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# Does the EU "Women on Boards" Directive affect the financial performance of STOXX 600 Firms? A quantitative analysis.

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Academic year 2025-2026.
Dissertation for the master of Corporate Finance.
26th of May 2026

# DECLARATION

Supervisor's name: Kim Van de Velden

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## Abstract:

This thesis examines whether Directive (EU) 2022/2381 on gender balance in corporate boards has produced measurable effects on the financial performance and governance structure of European listed companies. The analysis uses a Difference-in-Differences (DiD) design applied to a two-period panel (2021–2025) of 245 STOXX Europe 600 firms. Treatment companies belong to nine EU member states without prior binding gender quota legislation. Control companies come from France, Italy, and Portugal, which had adopted binding legislation before 2022. Belgium serves as a placebo group. Four outcome variables are examined: return on equity (ROE), the price-to-book ratio (P/B), the percentage of women on the Board of Directors (CG627), and the percentage of women among Key Executives (CG631). The headline estimator is OLS with firm-clustered standard errors (CR2). Seven complementary methods test the robustness of the results: firm fixed effects, Wilcoxon non-parametric tests, Propensity Score Matching, Doubly Robust (AIPW) estimation, permutation inference, cluster bootstrap, and an individual firm-level DiD. The DiD estimates for ROE, P/B, and Key Executive representation are statistically non-significant across all methods. The estimate for board representation is non-significant in the headline specification and most robustness checks, with one matched-sample exception that the Doubly Robust estimator contradicts. The Belgian placebo group progresses as much as the Treatment group on board diversity despite facing no new regulation, indicating that the observed governance improvements reflect a broader pan-European trend rather than a direct compliance response to the Directive. These findings are consistent with the meta-analytic literature and do not support the hypothesis that mandatory gender diversity legislation imposes short-term financial costs.

# Glossary

| Acronym | Definition |
|---|---|
| **AIPW** | Augmented Inverse Probability Weighting |
| **BDH** | Bloomberg Data History |
| **BDP** | Bloomberg Data Point |
| **CEO** | Chief Executive Officer |
| **CFO** | Chief Financial Officer |
| **CG627** | Bloomberg field code — Percentage of women on the Board of Directors |
| **CG631** | Bloomberg field code — Percentage of women among Key Executives |
| **CI** | Confidence Interval |
| **CMT** | Critical Mass Theory |
| **CR2** | Cluster-Robust standard error type 2 (Bell–McCaffrey small-sample correction) |
| **DiD** | Difference-in-Differences |
| **DR** | Doubly Robust |
| **EBITDA** | Earnings Before Interest, Taxes, Depreciation and Amortisation |
| **EEA** | European Economic Area |
| **ESG** | Environmental, Social, and Governance |
| **GMM** | Generalized Method of Moments |
| **HC2** | Heteroskedasticity-Consistent standard error type 2 (White correction) |
| **NA** | Not Available / Not Applicable |
| **OLS** | Ordinary Least Squares |
| **P/B** | Price-to-Book ratio |
| **PSM** | Propensity Score Matching |
| **RDT** | Resource Dependence Theory |
| **ROE** | Return on Equity |
| **SE** | Standard Error |
| **STEM** | Science, Technology, Engineering, and Mathematics |
| **STOXX 600** | STOXX Europe 600 — European blue-chip index of 600 leading listed companies |

# Table of contents

*Abstract:* ..... *III*

*Glossary* ..... *IV*

*1. Introduction: the new paradigm of European corporate governance* ..... *1*

*2. Literature review: theoretical foundations and empirical evidence* ..... *3*

**2.1. Theoretical frameworks of gender diversity** ..... **3**
2.1.1. Agency theory: the board as a shield against managerial opportunism ..... 3
2.1.2. Resource dependence theory: the board as a strategic link ..... 6
2.1.3. Critical mass theory: dynamics of social change within the group ..... 7
2.1.4. Integrated synthesis: the Hillman and Dalziel (2003) model ..... 9
2.1.5. Justification for using these theories in the thesis ..... 10

**2.2. Mixed empirical outcomes on financial performance** ..... **11**

**2.3. Sector-specific dynamics** ..... **14**

**2.4. The literature gap and research positioning** ..... **16**
2.4.1. Gap A: the separation between board-level and executive-level diversity ..... 16
2.4.2. Gap B: The disconnect between accounting returns and market valuation ..... 16
2.4.3. Gap C: The absence of post-2022 cross-national analysis at the STOXX 600 level ..... 17
2.4.4. Research positioning ..... 17

*3. Methodology* ..... *18*

**3.1. Research design** ..... **18**

**3.2. Data collection** ..... **19**
3.2.1. Bloomberg Terminal ..... 19
3.2.2. Completeness filter ..... 19
3.2.3. Data cleaning ..... 19

**3.3. Sample construction and group classification** ..... **20**
3.3.1. Excluded countries ..... 20
3.3.2. STOXX 600 working sample (245 companies) ..... 20
3.3.3. Group classification and national legislation ..... 21

**3.4. Variables** ..... **21**

**3.5. Analytical strategy** ..... **22**
3.5.1. Descriptive statistics ..... 22
3.5.2. Main estimation: DiD with firm-clustered standard errors ..... 22
3.5.3. Robustness checks ..... 23
3.5.4. Placebo test using Belgium ..... 25
3.5.5. Software ..... 26

*4. Results* ..... *26*

**4.1. Descriptive statistics** ..... **26**

**4.2. Main DiD results** ..... **27**

**4.3. Robustness checks** ..... **28**
4.3.1. Firm fixed effects ..... 28
4.3.2. Propensity Score Matching ..... 28
4.3.3. Doubly Robust (AIPW) ..... 29
4.3.4. Permutation inference ..... 29
4.3.5. Cluster bootstrap ..... 29
4.3.6. Group-level Wilcoxon tests ..... 29
4.3.7. Individual DiD distribution ..... 29

**4.4. Placebo test (Belgium)** ..... **30**

*5. Discussion* ..... *31*
**5.1. No financial impact across methods** ..... **31**
**5.2. Mixed evidence on board representation** ..... **31**
**5.3. Governance progress: a broader European trend** ..... **32**
*6. Limitations* ..... *32*
*Bibliography* ..... *34*
*Appendix* ..... *39*

## 1. Introduction: the new paradigm of European corporate governance

The adoption of Directive (EU) 2022/2381 on November 23, 2022, represents a definitive shift in the regulatory landscape of corporate governance within the European Union. This legislation, which reached a political consensus after nearly a decade of deadlock, mandates that listed companies achieve a minimum of 40% representation of the underrepresented gender among non-executive directors, or 33% among all board positions, by June 2026 [1]. While the social imperatives for gender equality are well established, the economic consequences of such mandatory convergence remain a subject of intense academic debate.

For companies listed on the STOXX Europe 600, this Directive acts as an exogenous shock, particularly for firms in Member States that previously relied on voluntary soft measures rather than binding quotas [2]. The central question this raises is not only normative. It is economic. Does increasing gender diversity at the leadership level improve firm performance? The academic literature does not offer a straightforward answer. Some studies report positive effects [3], others find no significant relationship [4], and others still document short-term performance declines following quota-driven appointments [5]. These contradictions suggest that the relationship between diversity and performance is complex, non-linear, and highly context dependent.

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[1] European Parliament and Council of the European Union. (2022). 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. Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022L2381

[2] Terjesen, S., Sealy, R., & Singh, V. (2009). Women directors on corporate boards: A review and research agenda. Corporate Governance: An International Review, 17(3), 320–337. https://doi.org/10.1111/j.1467-8683.2009.00742.xPost ;
C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. Academy of Management Journal, 58(5), 1546–1571. https://doi.org/10.5465/amj.2013.0319

[3] Pletzer, J. L., Nikolova, R., Kedzior, K. K., & Voelpel, S. C. (2015). Does gender matter? Female representation on corporate boards and firm financial performance — A meta-analysis. PLOS ONE, 10(6), e0130005. https://doi.org/10.1371/journal.pone.0130005

[4] Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. The Quarterly Journal of Economics, 127(1), 137–197.

[5] Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X ;
Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007

Three theoretical frameworks help to structure these mixed findings. Agency Theory argues that diverse boards monitor management more effectively and reduce agency costs [6]. Resource Dependence Theory suggests that female directors bring distinct skills, networks, and legitimacy that strengthen the firm's access to external resources [7]. Critical Mass Theory adds that diversity benefits only materialize once women represent approximately 30% of board seats, as below this threshold, minority members face tokenism and their influence remains limited [8].

Existing research, however, leaves several gaps. Most studies examine either board-level or executive-level diversity, but rarely both simultaneously. Most rely on a single performance indicator, either accounting returns or market valuation, rather than both together. Most also draw on pre-2020 data, before the current European regulatory shift came into effect [9].

This study aims to address these gaps. Using a sample of 245 companies listed on the STOXX Europe 600, it examines whether gender diversity, measured at both the Board of Directors and Key Executive levels, correlates with two distinct performance indicators: Return on Equity (ROE) as an accounting-based measure of internal profitability, and the Price-to-Book (P/B) ratio as a market-based indicator of investor confidence. The period of study is centered around the adoption of Directive 2022/2381.

The objective is not to establish causality. The endogeneity challenges inherent in this field are well-documented and cannot be fully resolved through observational data alone [10]. Rather, this research seeks to provide a timely and multidimensional assessment of the business case for gender diversity in the current European governance context.

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[6] Pfeffer, J., & Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. Harper & Row.;
Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. Academy of Management Review, 28(3), 383–396. https://doi.org/10.5465/amr.2003.10196729

[7] Kanter, R. M. (1977). Men and women of the corporation. Basic Books.;
Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1546-8

[8] Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007 ;
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[10] Ibid. (Adams & Ferreira, 2009) ;
Brahma, S., Nwafor, C., & Boateng, A. (2021). Board gender diversity and firm performance: The UK evidence. International Journal of Finance & Economics, 26(4), 5704–5719. https://doi.org/10.1002/ijfe.2089

# 2. Literature review: theoretical foundations and empirical evidence

## *2.1. Theoretical frameworks of gender diversity*

The integration of gender diversity into corporate governance has emerged as both an ethical imperative and a key performance driver [11]. Academic literature relies on three main theoretical frameworks to explain how female directors influence firm outcomes. First, Agency Theory argues that diverse boards provide more rigorous oversight and reduce agency costs. Female directors have notably been associated with lower absenteeism and stronger ethical conduct, which in turn improves financial reporting quality. Second, Resource Dependence Theory (RDT) views boards as critical links to external resources, suggesting that women bring distinct cognitive perspectives, professional networks, and legitimacy that enhance strategic decision-making [12]. Third, Critical Mass Theory holds that diversity benefits only materialize once women reach a threshold of approximately 30 to 35% of board seats, shifting from token representation to genuine organizational influence [13].

### *2.1.1. Agency theory: the board as a shield against managerial opportunism*

Agency Theory, founded by Jensen and Meckling (1976)[14], is the standard framework for corporate governance. It addresses the structural conflict of interest between shareholders (principals) and managers (agents). This separation of ownership and control creates information asymmetry and agency costs that must be reduced through monitoring [15].

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[11] Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. Academy of Management Review, 28(3), 383–396. https://doi.org/10.5465/amr.2003.10196729 ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga, J. (2017). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350.

[12] Ibid. (Hillman & Dalziel, 2003) ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga, J. (2017). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350.

[13] Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1546-8 ;
Ibid. (Hillman & Dalziel, 2003)

[14] Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

[15] Wahid, A. S. (2019). The effects and the mechanisms of board gender diversity: Evidence from financial manipulation. Journal of Business Ethics, 159(3), 705–725. [p. 707]

#### *2.1.1.1. Board monitoring and the role of diversity*

The primary mission of the board is to monitor management and protect shareholder interests. Gender diversity strengthens this monitoring function[16]. Diverse boards tend to be more independent and to provide stronger monitoring of management[17].

Female directors are often less embedded in traditional networks, which may enhance their independence and objectivity[18]. This heterogeneity helps prevent groupthink by introducing diverse perspectives and encouraging more critical evaluation[19]. Overall, gender diversity strengthens board monitoring and leads to more effective oversight and decision-making[20].

#### *2.1.1.2. Disciplinary mechanisms: absenteeism and compensation*

The monitoring efficiency of female directors is visible in specific governance behaviors. Adams and Ferreira (2009)[21] find that female directors have better attendance records than their male colleagues. Their presence also has an indirect disciplinary effect: male directors are less likely to be absent when the board is gender-diverse [22].

Agency Theory also predicts that stricter oversight moderates executive pay. Evidence suggests that gender diversity is associated with a higher sensitivity of CEO turnover to firm performance. However, Adams and Ferreira (2009)[23] find no statistically significant effect of board gender diversity on CEO pay, precisely because women are under-represented on compensation committees and therefore have limited influence over executive remuneration design [24].

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[16] Wahid, A. S. (2019). The effects and the mechanisms of board gender diversity: Evidence from financial manipulation. Journal of Business Ethics, 159(3), 705–725. [p. 707]

[17] Carter, D. A., D'Souza, F., Simkins, B. J., & Simpson, W. G. (2010). The gender and ethnic diversity of US boards and board committees and firm financial performance. Corporate Governance: An International Review, 18(5), 396–414. [pp. 396–398] ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga, J. (2017). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350. [pp. 141–143]
Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007 [p. 292]

[18] Arvanitis, S. E., Varouchas , E. G., & Agiomirgianakis , G. M. (2022). Does board gender diversity really improve firm performance? Evidence from Greek listed firms. Journal of Risk and Financial Management, 15(7), 306.
https://doi.org/10.3390/jrfm15070306

[19] Ibid. (Arvanitis et al., 2022)

[20] Ibid. (Adams & Ferreira, 2009.) ;
Brahma, S., Nwafor, C., & Boateng, A. (2021). Board gender diversity and firm performance: The UK evidence. International Journal of Finance & Economics, 26(4), 5704–5719.
https://doi.org/10.1002/ijfe.2089

[21] Ibid. (Adams & Ferreira, 2009)

[22] Ibid. (Adams & Ferreira, 2009)

[23] Ibid. (Adams & Ferreira, 2009)

[24] Ibid. (Adams & Ferreira, 2009)

#### *2.1.1.3. Impact on financial reporting quality and ethics*

Gender diversity reduces information asymmetry by improving financial reporting quality[25]. Srinidhi et al. (2011)[26] find a positive relationship between female board participation and earnings quality, while Wahid (2019)[27] shows that gender-diverse boards are associated with fewer financial reporting mistakes and less fraud. When present on audit committees, female directors have been shown to exercise more rigorous control over accounting processes and reduce the likelihood of financial reporting errors [28]. This vigilance is associated with lower levels of earnings management [29]. Diverse boards also favor greater transparency in financial reporting [30] Through stronger monitoring, such boards contribute to limiting fraud and opportunistic behavior, which can indirectly support firm reputation [31].

#### *2.1.1.4. The limits of over-monitoring*

Agency Theory also highlights an important caveat. The impact of gender diversity is not always positive. Adams and Ferreira (2009)[32] show that increased monitoring by gender-diverse boards can be harmful in firms that already have strong governance mechanisms (pp. 306–308). In such contexts, excessive monitoring may reduce managerial flexibility and negatively affect firm performance. Conversely, the benefits of gender diversity are more pronounced in firms with weaker governance, where it serves as an effective additional control mechanism[33].

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[25] Barua, A., Davidson, L. F., Rama, D. V., & Thiruvadi , S. (2010). CFO gender and accruals quality. Accounting Horizons, 24(1), 25–39. https://doi.org/10.2308/acch.2010.24.1.25

[26] Srinidhi, B., Gul, F. A., & Tsui, J. (2011). Female directors and earnings quality. Contemporary Accounting Research, 28(5), 1610–1644.

[27] Ibid. (Wahid, 2019.)

[28] Pucheta-Martínez, M. C., Bel-Oms, I., & Olcina-Sempere, G. (2016). Corporate governance, female directors and quality of financial information. Business Ethics: A European Review, 25(4), 363–385. https://doi.org/10.1111/beer.12123 [pp. 367–369]

[29] Srinidhi, B., Gul, F. A., & Tsui, J. (2011). Female directors and earnings quality. Contemporary Accounting Research, 28(5), 1610–1644.
Ibid. (Wahid, 2019)

[30] Pucheta-Martínez, M. C., Bel-Oms, I., & Olcina-Sempere, G. (2016). Corporate governance, female directors and quality of financial information. Business Ethics: A European Review, 25(4), 363–385. https://doi.org/10.1111/beer.12123 [pp. 365–369]

[31] Ibid. (Wahid, 2019)

[32] Ibid. (Adams & Ferreira, 2009.)

[33] Ibid. (Adams & Ferreira, 2009) ;
Gul, F. A., Srinidhi, B., & Ng, A. C. (2011). Does board gender diversity improve the informativeness of stock prices? Journal of Accounting and Economics, 51(3), 314–338. https://doi.org/10.1016/j.jacceco.2011.01.005 [pp. 329–331]

### *2.1.2. Resource dependence theory: the board as a strategic link*

While Agency Theory focuses on internal control, Resource Dependence Theory (RDT) takes an external perspective [34]and views the firm as an open system that must acquire resources from its environment to survive[35]). Within this framework, the board serves as a key bridge to external organizations and resources [36].

#### *2.1.2.1. The four strategic functions of the board*

According to Hillman, Cannella, and Paetzold (2000)[37], directors contribute value to the firm through four interrelated channels. First, they provide advice and expertise by bringing specialized knowledge and unique cognitive frameworks to board deliberations. Second, they serve as information channels, establishing critical links with external constituents such as suppliers, clients, and regulators. Third, they facilitate resource access by enabling the firm to acquire capital, secure contracts, or adopt new technologies. Finally, they enhance organizational legitimacy by strengthening the brand image and credibility of the firm in the eyes of external stakeholders[38].

#### *2.1.2.2. Human capital and cognitive diversity*

The presence of women enhances the firm's human capital. Due to their diverse professional and life experiences, female directors bring different perspectives to the boardroom[39]. They often contribute complementary skills and backgrounds, which increases the overall diversity of expertise within the board [40].

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[34] Pfeffer, J., & Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. Harper & Row. ;
Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. Academy of Management Review, 28(3), 383–396. https://doi.org/10.5465/amr.2003.10196729 [pp. 384–386]

[35] Pfeffer, J., & Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. Harper & Row. [pp. 2–3]

[36] Ibid. (Pfeffer & Salancik, 1978) ;
Hillman, A. J., Cannella, A. A., Jr., & Paetzold, R. L. (2000). The resource dependence role of corporate directors: Strategic adaptation of board composition in response to environmental change. Journal of Management Studies, 37(2), 235–256. [pp. 236–238]

[37] Ibid. (Hillman et al., 2000)

[38] Ibid. (Hillman et al., 2000)

[39] Hillman, A. J., Shropshire, C., & Cannella, A. A., Jr. (2007). Organizational predictors of women on corporate boards. Academy of Management Journal, 50(4), 941–952. https://doi.org/10.5465/amj.2007.26279222 [pp. 943–945] ;
Terjesen, S., Sealy, R., & Singh, V. (2009). Women directors on corporate boards: A review and research agenda. Corporate Governance: An International Review, 17(3), 320–337. https://doi.org/10.1111/j.1467-8683.2009.00742.x [pp. 326–329]

[40] Bear, S., Rahman, N., & Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. Journal of Business Ethics, 97(2), 207–221. [pp. 210–213] ;
Hillman, A. J., Cannella, A. A., Jr., & Harris, I. C. (2002). Women and racial minorities in the boardroom: How do directors differ? Journal of Management, 28(6), 747–763. [pp. 749–752]

This diversity of perspectives can improve problem-solving and decision-making by broadening the range of viewpoints considered. By expanding the board's cognitive base, firms may become more adaptable and better equipped to respond to changing market conditions.

#### *2.1.2.3. Social capital, networks, and market connection*

RDT emphasizes that boards play a critical role in linking the firm to its external environment and securing essential resources[41]. In this view, greater board diversity can expand the range of external connections and perspectives available to the firm[42].

Diverse boards may therefore improve access to strategic information, external financing, and business opportunities. They can also help firms better respond to environmental uncertainty[43].

#### *2.1.2.4. Institutional legitimacy and stakeholder engagement*

Finally, RDT highlights the importance of legitimacy. The nomination of female directors sends a positive signal to stakeholders by demonstrating alignment with societal expectations and good governance practices [44]. Enhanced legitimacy and governance are, in turn, often associated with improved firm performance and greater stakeholder confidence [45].

### *2.1.3. Critical mass theory: dynamics of social change within the group*

Agency Theory and RDT explain the potential benefits of diversity, but Critical Mass Theory (CMT) explains the structural and psychological conditions required for these benefits to occur.

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[41] Pfeffer, J., & Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. Harper & Row. [pp. 2–3, 163–169] ;
Hillman, A. J., Cannella, A. A., Jr., & Paetzold, R. L. (2000). The resource dependence role of corporate directors: Strategic adaptation of board composition in response to environmental change. Journal of Management Studies, 37(2), 235–256. [pp. 236–238]

[42] Hillman, A. J., Shropshire, C., & Cannella, A. A., Jr. (2007). Organizational predictors of women on corporate boards. Academy of Management Journal, 50(4), 941–952. https://doi.org/10.5465/amj.2007.26279222 ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga, J. (2015). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350. https://doi.org/10.1007/s10551-015-2735-9 [pp. 142–144]

[43] Ibid. (Hillman et al., 2000) ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga , J. (2015). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350. https://doi.org/10.1007/s10551-015-2735-9

[44] Isidro, H., & Sobral, M. (2015). The effects of women on corporate boards on firm value, financial performance, and ethical and social compliance. Journal of Business Ethics, 132(1), 1–19. https://www.jstor.org/stable/24703649 ;
Ibid. (Hillman et al., 2007)

[45] Ibid. (Isidro & Sobral, 2015) ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga , J. (2017). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350.

Based on the work of Rosabeth Moss Kanter (1977)[46], CMT argues that the influence of a minority depends on its numerical proportion within the group [47].

#### *2.1.3.1. The traps of tokenism*

Kanter (1977)[48] identified that in groups where a category represents less than approximately 15 to 20%, members are treated as "tokens" (pp. 206–210). Tokenism creates three negative dynamics that undermine the contribution of minority members. First, tokens face heightened visibility: they are scrutinized more severely than their peers, which creates disproportionate performance pressure [49]Second, their presence triggers polarization, whereby the dominant group reinforces its own boundaries and excludes token members [50]Third, tokens experience assimilation pressure: they are expected to conform to majority stereotypes, which stifles their authentic professional contribution[51]. As long as women remain tokens on corporate boards, their influence on strategic decisions stays symbolic and limited [52].

#### *2.1.3.2. The threshold: 30% to 35% or three women*

The central concept of CMT is the critical mass tipping point[53] Academic research generally identifies this threshold at 30 to 35% of the board, or at least three women for smaller boards [54].

At this stage, group interactions change qualitatively. Women are no longer seen as a single voice but as individuals with specific expertise[55]. They are more likely to actively participate in and influence board discussions[56]. The group focus also shifts from gender to competence, which allows the board to make better use of diverse human and social capital [57].

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[46] Kanter, R. M. (1977). Men and women of the corporation. Basic Books.
[47] Ibid. (Kanter, 1977)
[48] Ibid. (Kanter, 1977.)
[49] Ibid. (Kanter, 1977)
[50] Ibid. (Kanter, 1977)
[51] Ibid. (Kanter, 1977)
[52] Ibid. (Kanter, 1977)
[53] Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6 [pp. 67–69] ;
Konrad, A. M., Kramer, V., & Erkut, S. (2008). Critical mass: The impact of three or more women on corporate boards. Organizational Dynamics, 37(2), 145–164.
[54] Ibid. (Joecks et al., 2013) ;
Ibid. (Konrad et al., 2008) ;
Wiley, C., & Monllor -Tormos, M. (2018). Board gender diversity in the STEM&F sectors: The critical mass required to drive firm performance. Journal of Leadership & Organizational Studies, 25(3), 290–308. [pp. 5–8]
[55] Ibid. (Joecks et al., 2013) ;
Ibid. (Konrad et al., 2008)
[56] Konrad, A. M., Kramer, V., & Erkut, S. (2008). Critical mass: The impact of three or more women on corporate boards. Organizational Dynamics, 37(2), 145–164.
[57] Lefley, F., & Janeček, V. (2024). Board gender diversity, quotas, and critical mass theory. Corporate Communications: An International Journal, 29(2), 139–151.

#### *2.1.3.3. The U-shaped relationship and financial performance*

Joecks, Pull, and Vetter (2013)[58] applied CMT to corporate finance and showed that the relationship between board gender diversity and financial performance follows a U-shaped curve [59].

Initially, appointing a small number of women (tokenism) may decrease firm performance. The friction costs associated with heterogeneity, such as conflict, communication barriers, and social categorization, outweigh the immediate benefits. However, once female representation reaches the critical mass of 30%, the performance curve reverses. Financial performance becomes significantly higher than that of entirely male-dominated boards [60]This non-linear relationship shows that gender diversity only produces measurable financial benefits when it is substantial enough to overcome the structural barriers of tokenism.

### *2.1.4. Integrated synthesis: the Hillman and Dalziel (2003) model*

Modern research moves beyond opposing these frameworks to propose integrated models. Hillman and Dalziel (2003)[61] unified Agency Theory and RDT through the concept of "Board Capital" [62].

#### *2.1.4.1. Board capital as an antecedent*

In the Hillman and Dalziel (2003)[63] model, board capital (defined as the sum of directors' human and social capital) is the key driver of the two vital board functions. On one hand, higher board capital in terms of expertise and knowledge enables the board to better detect managerial inefficiencies, strengthening its monitoring function as described by Agency Theory. On the other hand, broader board capital in terms of networks and reputation allows the board to secure critical external resources for the firm, fulfilling its resource provision function as described by RDT ([64]. Building on this framework, Haynes and Hillman (2010)[65] show that board capital can be expanded through both broader heterogeneity (breadth) and deeper industry ties (depth). Gender diversity contributes to both dimensions by introducing varied professional experiences

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[58] Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a “critical mass”? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1546-8

[59] Ibid. (Joecks et al., 2013) ;
Reguera-Alvarado, N., de Fuentes, P., & Laffarga , J. (2017). Does board gender diversity influence financial performance? Evidence from Spain. Journal of Business Ethics, 141(2), 337–350.

[60] Ibid. (Joecks et al., 2013)

[61] Ibid. (Hillman & Dalziel, 2003.)

[62] Ibid. (Hillman & Dalziel, 2003)

[63] Ibid. (Hillman & Dalziel, 2003.)

[64] Ibid. (Hillman & Dalziel, 2003)

[65] Haynes, K. T., & Hillman, A. (2010). The effect of board capital and CEO power on strategic change. Strategic Management Journal, 31(11), 1145–1163.

and expanding the board's network connections. By including women, the organization diversifies its stock of board capital and simultaneously strengthens both its monitoring and resource provision capabilities.

### *2.1.5. Justification for using these theories in the thesis*

Mobilizing these three theories is essential for several reasons.

First, it moves the discussion beyond purely normative or ethical arguments. By using Agency Theory and RDT, researchers ground their arguments in economic rationality and organizational efficiency [66]. Diversity is framed as a competitive advantage rather than a mere social obligation.

Second, these theories provide a multidimensional analytical framework. Firm performance is a multidimensional concept. Agency Theory explains improvements in financial metrics through cost reduction, while RDT explains growth through resource acquisition and legitimacy[67].

Finally, Critical Mass Theory is essential for explaining empirical paradoxes. Without it, researchers might be confused by studies showing negative or neutral effects of diversity. CMT helps explain these mixed findings: diversity does not automatically improve performance. Its effects depend on a sufficient level of female presence to break down the sociological barriers of exclusion[68].

In conclusion, Agency Theory, RDT, and CMT form a coherent and complementary theoretical framework. They provide the tools to understand that performance from diversity results from a combination of rigorous control (Agency Theory), strategic resource access (RDT), and effective group dynamics and decision-making (CMT) [69].

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[66] Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007 ;
Ibid. (Hillman & Dalziel, 2003)

[67] Hillman, A. J., Cannella, A. A., Jr., & Paetzold, R. L. (2000). The resource dependence role of corporate directors: Strategic adaptation of board composition in response to environmental change. Journal of Management Studies, 37(2), 235–256. ;
Ibid. (Hillman & Dalziel, 2003)

[68] Kanter, R. M. (1977). Men and women of the corporation. Basic Books. ; Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a “critical mass”? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6

[69] Ibid. (Joecks et al., 2013) ;
Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. Academy of Management Review, 28(3), 383–396. https://doi.org/10.5465/amr.2003.10196729

## *2.2. Mixed empirical outcomes on financial performance*

Empirical research on board gender diversity and financial performance has produced heterogeneous and sometimes contradictory results. Industry reports tend to be optimistic. McKinsey & Company (2020)[70], for instance, reports that firms in the top quartile of gender diversity are 25% more likely to outperform financially. However, this is an industry report, not a peer-reviewed study. Academic evidence is more nuanced.

Meta-analytical evidence further complicates the picture. Post and Byron (2015)[71] aggregate the results of 140 studies and find that female board representation is positively linked to accounting returns. However, the effect is small, and it is stronger in countries with robust shareholder protections. This suggests that institutional context, not diversity alone, drives the relationship. Pletzer et al. (2015)[72] reach an even more cautious conclusion. Analyzing 20 peer-reviewed studies on 3,097 companies, they find that the overall relationship between female board representation and financial performance is consistently small and non-significant. Both meta-analyses converge on the same point: diversity does not automatically translate into better financial outcomes. Its effects depend on moderating factors.

Several individual studies also report insignificant or negative effects. Joecks et al. (2013)[73] show that the diversity-performance relationship follows a non-linear, U-shaped pattern. Low levels of female representation may initially harm performance due to coordination and communication costs [74]. Ahern and Dittmar (2012) [75] reach a similar conclusion in the Norwegian context. Analyzing the mandatory quota reform, they find a short-term decline in firm value following the mandated increase in female board representation[76]. These findings highlight the need to distinguish between short-term adjustment costs and long-term performance outcomes.

A central methodological challenge is endogeneity. Adams and Ferreira (2009)[77] point out that it is difficult to establish causality. It is unclear whether diversity improves performance, or

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[70] McKinsey & Company. (2020). Diversity wins: How inclusion matters. McKinsey & Company. https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters

[71] Post, C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. Academy of Management Journal, 58(5), 1546–1571. https://doi.org/10.5465/amj.2013.0319

[72] Pletzer, J. L., Nikolova, R., Kedzior, K. K., & Voelpel, S. C. (2015). Does gender matter? Female representation on corporate boards and firm financial performance — A meta-analysis. PLOS ONE, 10(6), e0130005. https://doi.org/10.1371/journal.pone.0130005

[73] Ibid. (Joecks et al., 2013.)

[74] Ibid. (Joecks et al., 2013)

[75] Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. The Quarterly Journal of Economics, 127(1), 137–197.

[76] Ibid. (Ahern & Dittmar, 2012)

[77] Ibid. (Adams & Ferreira, 2009.)

whether better-performing firms are simply more likely to appoint female directors [78]. Unobserved firm characteristics, such as governance quality, corporate culture, or managerial competence, may simultaneously drive both board composition and financial outcomes, thereby biasing empirical estimates. This concern extends to related outcomes such as firm risk. Using a dynamic model that controls for reverse causality and unobserved firm-level heterogeneity, Sila et al. (2016)[79] find no causal evidence that female board representation reduces equity risk. They argue that earlier findings of a negative relationship are spurious and driven by between-firm heterogeneous factors[80].

Several studies have attempted to address the endogeneity problem directly. Arvanitis et al. (2022)[81] use a two-step system GMM estimator, which controls for both reverse causality and unobserved firm-level heterogeneity. Ahern and Dittmar (2012)[82] exploit the Norwegian quota reform as a natural experiment, applying a difference-in-differences approach that treats the policy change as an exogenous shock to board composition. These quasi-experimental designs are considered more credible than standard regression approaches, as they reduce the risk of confounding the effect of diversity with pre-existing firm characteristics. This reinforces the broader point that cross-sectional correlations between gender diversity and firm outcomes should be interpreted with considerable caution.

Methodological choices also explain much of the inconsistency across studies. Cross-sectional analyses often identify positive correlations, whereas panel data models with firm fixed effects tend to produce weaker or insignificant results [83]. Short-term event studies, such as those examining quota implementations, may capture transitional frictions rather than long-term benefits[84].

Institutional context plays a critical role in explaining divergent findings. Terjesen and Singh (2008)[85] show, in a 43-country study, that female board representation is strongly shaped by the broader social, political, and economic environment in which firms operate. Building on

[78] Ibid. (Adams & Ferreira, 2009)
[79] Sila, V., Gonzalez, A., & Hagendorff, J. (2016). Women on board: Does boardroom gender diversity affect firm risk? Journal of Corporate Finance, 36, 26–53. https://doi.org/10.1016/j.jcorpfin.2015.10.003
[80] Ibid. (Sila et al., 2016)
[81] Ibid. (Arvanitis et al., 2022.)
[82] Ibid. (Ahern & Dittmar, 2012)
[83] Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007 [pp. 291–293]
[84] Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. The Quarterly Journal of Economics, 127(1), 137–197. https://doi.org/10.1093/qje/qjr049 [pp. 142–144]
[85] Terjesen, S., & Singh, V. (2008). Female presence on corporate boards: A multi-country study of environmental context. Journal of Business Ethics, 83(1), 55–63.

this, Terjesen, Sealy, and Singh (2009)[86] identify three broad institutional configurations that produce distinct outcomes. First, in systems with binding mandatory quotas, such as Norway or France, diversity increases rapidly but at a cost. Firms are forced to appoint female directors within a constrained timeframe, which limits access to experienced candidates and disrupts established board dynamics. Ahern and Dittmar (2012)[87] document precisely this pattern in Norway: mandated diversity was followed by a short-term decline in firm value (pp. 140–144). Second, in systems with soft "comply or explain" codes, such as the United Kingdom or Germany, diversity increases more gradually. Adjustment costs are lower and firms retain discretion over the pace of change, which tends to produce smoother transitions. Third, in market-driven environments such as the United States, diversity emerges organically from firm-level decisions. In these contexts, female directors tend to be appointed when they are expected to add value, which may explain why studies from these settings more often report positive performance effects[88]. Importantly, Post and Byron (2015)[89] confirm this institutional logic at the meta-analytical level: the positive relationship between female board representation and accounting returns is significantly stronger in countries with more robust shareholder protection frameworks. This suggests that institutional conditions do not simply moderate the pace of change. They shape the very mechanisms through which diversity affects performance.

The non-linear nature of the diversity-performance relationship offers another explanatory lens. As Critical Mass Theory suggests, low levels of female representation generate coordination costs without delivering the associated cognitive and governance benefits. Once representation reaches approximately 30%, these benefits become more pronounced and performance improve[90].

Finally, the glass cliff phenomenon introduces an additional source of bias. Ryan and Haslam (2005)[91] show that women are disproportionately appointed to leadership positions during periods of organizational distress [92]. Their appointments thus tend to coincide with pre-existing poor performance, which may cause empirical studies to underestimate the true positive impact of female directors.

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[86] Terjesen, S., Sealy, R., & Singh, V. (2009). Women directors on corporate boards: A review and research agenda. Corporate Governance: An International Review, 17(3), 320–337. https://doi.org/10.1111/j.1467-8683.2009.00742.x

[87] Ibid. (Ahern & Dittmar, 2012)

[88] Ibid. (Joecks et al., 2013.) [pp. 68–69]

[89] Ibid. (Post & Byron, 2015.)

[90] Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6 [pp. 63–68]

[91] Ryan, M. K., & Haslam, S. A. (2005). The glass cliff: Evidence that women are over-represented in precarious leadership positions. British Journal of Management, 16(2), 81–90.

[92] Ibid. (Ryan & Haslam, 2005)

Overall, the relationship between gender diversity and financial performance is complex and context dependent. It is sensitive to methodological choices, institutional environments, and the level of diversity achieved.

### *2.3. Sector-specific dynamics*

The impact of gender diversity on firm performance is not uniform across sectors. Industry-specific characteristics, such as regulatory environments, consumer bases, and innovation pressures, shape the mechanisms through which diversity translates into value. These sector-level differences can be understood through the theoretical frameworks presented in section 2.1. Agency Theory, RDT, and Critical Mass Theory do not operate with equal force in all industries. Their relative explanatory power shifts depending on the competitive and institutional environment of each sector.

In the financial sector, Agency Theory provides the dominant explanatory lens. Banks operate under complex regulatory frameworks that impose strict accountability requirements. In this context, the monitoring function of the board is particularly critical. García-Meca, García-Sánchez, and Martínez-Ferrero (2015)[93] analyze 159 banks across nine countries and find that gender diversity increases bank performance, with effects that are stronger in environments with weaker investor protection, precisely where additional monitoring is most needed [94]. This is consistent with Adams and Ferreira's (2009)[95] argument that diverse boards add most value where governance mechanisms are otherwise insufficient. Farag and Mallin (2017)[96] and Cardillo et al. (2020) [97] further document a negative association between female board representation and bank-specific credit risk among European listed banks, suggesting that diverse boards exercise more prudent oversight. Owen and Temesvary (2018)[98] complement these findings by showing that efficiency gains become significant once female representation reaches approximately 17% of the board, a threshold consistent with Critical Mass Theory.

In the consumer goods sector, the relevant theoretical mechanism shifts toward RDT. Women on the board provide legitimacy and market intelligence that is directly aligned with the firm's

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[93] García-Meca, E., García-Sánchez, I.-M., & Martínez-Ferrero, J. (2015). Board diversity and its effects on bank performance: An international analysis. Journal of Banking & Finance, 53, 202–214.
[94] García-Meca, E., García-Sánchez, I.-M., & Martínez-Ferrero, J. (2015). Board diversity and its effects on bank performance: An international analysis. Journal of Banking & Finance, 53, 202–213. https://doi.org/10.1016/j.jbankfin.2014.12.002 [pp. 202–207]
[95] Ibid. (Adams & Ferreira, 2009.)
[96] Farag, H., & Mallin, C. (2017). Board diversity and financial fragility: Evidence from European banks. International Review of Financial Analysis, 49, 98–112.
[97] Cardillo, G., Onali, E., & Torluccio, G. (2020). Does gender diversity on banks' boards matter? Evidence from public bailouts. Journal of Corporate Finance, 71, Article 101560.
[98] Owen, A. L., & Temesvary , J. (2018). The performance effects of gender diversity on bank boards. Journal of Banking & Finance, 90, 50–63.
https://doi.org/10.1016/j.jbankfin.2018.02.015

consumer base. Chapple and Humphrey (2014)[99] find that in basic materials and consumer goods sectors, the presence of at least one female director is associated with higher returns. This is consistent with Hillman et al.'s (2002)[100] argument that female directors enhance the firm's connection to female consumers and workers, who represent a strategically important external constituency. In this sector, diversity is less about monitoring and more about securing relevant market information and stakeholder legitimacy, which is the core contribution of RDT.

Regarding crisis resilience, the evidence is mixed and context dependent. Chen et al. (2019)[101] and Papangkorn et al. (2021) [102] find that gender-diverse boards helped firms reduce performance declines during the 2008 financial crisis. From a theoretical perspective, this is consistent with both Agency Theory (diverse boards may limit excessive risk-taking) and RDT (broader networks provide access to alternative resources during periods of stress). However, Azeem et al. (2023)[103] show that during the COVID-19 pandemic, high gender diversity was associated with longer share price recovery times in some institutional contexts. This suggests that the coordination costs identified by Critical Mass Theory may be amplified during crises, particularly when diversity has not yet reached a meaningful threshold.

In industry and technology, RDT and the human capital dimension are most relevant. These sectors are primarily driven by innovation rather than regulatory compliance. Griffin et al. (2021)[104] demonstrate that board gender diversity promotes firm-level innovation. Dezső and Ross (2012) [105] similarly find that female representation in top management improves performance specifically in innovation-intensive firms, where the cognitive diversity brought by women directors translates into measurable competitive advantage. At the same time, these sectors face structural supply-side constraints. Women represent only approximately 24% of the STEM workforce in the United States[106], which limits the available talent pipeline and raises the adjustment costs of increasing diversity, costs that are particularly visible in the short term.

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[99] Chapple, L., & Humphrey, J. E. (2014). Does board gender diversity have a financial impact? Evidence using stock portfolio performance. Journal of Business Ethics, 122(4), 709–723.
[100] Hillman, A. J., Cannella, A. A., Jr., & Harris, I. C. (2002). Women and racial minorities in the boardroom: How do directors differ? Journal of Management, 28(6), 747–763.
[101] Chen, L. H., Gramlich, J., & Houser, K. A. (2019). The effects of board gender diversity on a firm's risk strategies. Accounting & Finance, 59(4), 1271–1300.
[102] Papangkorn, S., Chatjuthamard, P., Jiraporn, P., & Chueykamhang, S. (2021). Female directors and firm performance: Evidence from the Great Recession. International Review of Finance, 21(2), 598–610.
[103] Azeem, N., Ullah, M., & Ullah, F. (2023). Board gender diversity and firms' financial resilience during the Covid-19 pandemic. Finance Research Letters, 58, Article 103398.
[104] Griffin, D., Li, K., & Xu, T. (2021). Board gender diversity and corporate innovation: International evidence. Journal of Financial and Quantitative Analysis, 56(1), 123–154. https://doi.org/10.1017/S002210901900098X
[105] Dezső, C. L., & Ross, D. G. (2012). Does female representation in top management improve firm performance? A panel data investigation. Strategic Management Journal, 33(9), 1072–1089.
[106] Pew Research Center. (2021). STEM jobs see uneven progress in increasing gender, racial and ethnic diversity.

Taken together, these sector-level findings reinforce a broader theoretical point. The diversity-performance relationship is not driven by a single mechanism. Its direction and magnitude depend on which theoretical channel (monitoring, resource access, or group dynamics) is most activated by the sector's structural characteristics. This underscores the need to account for sectoral context in both empirical research and corporate governance policy.

## *2.4. The literature gap and research positioning*

The existing literature on gender diversity and corporate performance is extensive. However, several recurring limitations reduce its direct relevance to the current European regulatory context. This study aims to address three specific gaps.

### *2.4.1. Gap A: the separation between board-level and executive-level diversity*

Most studies focus exclusively on the Board of Directors, largely because non-executive appointments are more visible and easier to measure[107]. A smaller body of research examines top management teams or the CEO-CFO dyad in isolation[108]. Very few studies, however, analyze the interaction between these two levels simultaneously. This is a meaningful omission. The mechanisms described by Agency Theory and Resource Dependence Theory operate at both the board and the executive level [109]. Since diversity at the board level does not extend to Key Executives, the governance benefits identified in the literature may not translate into actual financial outcomes. This study therefore evaluates whether diversity at both levels jointly predicts better performance, or whether one level is more determinant than the other.

### *2.4.2. Gap B: The disconnect between accounting returns and market valuation*

Empirical research has primarily used either accounting-based metrics or market-based metrics, rarely both together. Post and Byron (2015)[110] rely on accounting returns in their meta-analysis, while other studies focus on Tobin's Q or share price reaction. This distinction matters. Internal

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[107] Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007 ;
Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6

[108] Dezső, C. L., & Ross, D. G. (2012). Does female representation in top management improve firm performance? A panel data investigation. Strategic Management Journal, 33(9), 1072–1089. https://doi.org/10.1002/smj.1955

[109] Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. Academy of Management Review, 28(3), 383–396. https://doi.org/10.5465/amr.2003.10196729

[110] Ibid. (Post & Byron, 2015.)

profitability (ROE) and external market confidence (Price-to-Book ratio) capture different dimensions of performance. A firm can improve its governance and ESG signaling, which markets may reward through a higher P/B ratio, without immediately generating stronger net profits. The costs of restructuring boards, training new directors, or integrating diverse executives can depress short-term ROE even when long-term value creation is underway[111]. By measuring both indicators at two levels of diversity (Board and Key Executive), this study provides a more complete picture of where the financial benefits of diversity materialize.

### *2.4.3. Gap C: The absence of post-2022 cross-national analysis at the STOXX 600 level*

Most academic studies draw on pre-2020 data or rely on isolated national experiments, such as the Norwegian quota reform [112] or individual country-level panels [113]. The adoption of Directive (EU) 2022/2381 represents a structural break in the European governance landscape. It creates a natural treatment group of firms in countries that previously relied on voluntary codes, such as Germany, the Netherlands, or Luxembourg, and forces a transition to binding thresholds. This institutional shock is precisely the type of exogenous variation that Terjesen et al. (2009)[114] identify as valuable for isolating the effect of diversity from pre-existing firm characteristics. Yet no comparative study has yet examined how firms across the STOXX 600 respond to this new regulatory environment, particularly when they come from different starting points in terms of existing diversity levels.

### *2.4.4. Research positioning*

This study contributes to filling these three gaps. Using a sample of 245 STOXX Europe 600 firms, it tests the relationship between gender diversity and both ROE and Price-to-Book ratio, at both the Board and Key Executive levels, in the period surrounding the 2022 Directive. The theoretical framework relies on Agency Theory, Resource Dependence Theory, and Critical

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[111] Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6 ;
Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. The Quarterly Journal of Economics, 127(1), 137–197. https://doi.org/10.1093/qje/qjr049

[112] Ibid. (Ahern & Dittmar, 2012)

[113] García-Meca, E., García-Sánchez, I.-M., & Martínez-Ferrero, J. (2015). Board diversity and its effects on bank performance: An international analysis. Journal of Banking & Finance, 53, 202–214. https://www.sciencedirect.com/science/article/pii/S0378426614003811?via%3Dihub ;
Farag, H., & Mallin, C. (2017). Board diversity and financial fragility: Evidence from European banks. International Review of Financial Analysis, 49, 98–112. https://www.sciencedirect.com/science/article/pii/S1057521916301879?via%3Dihub

[114] Ibid. (Terjesen, Sealy & Singh, 2009.)

Mass Theory, each of which predicts different mechanisms and thresholds for the diversity-performance relationship[115]. The objective is not to establish causality, as the methodological challenges identified by Sila et al. (2016)[116] and Adams and Ferreira (2009)[117] are fully acknowledged, but to provide a timely and multidimensional assessment of the business case for the Directive.

# 3. Methodology

## *3.1. Research design*

This study employs a quantitative quasi-experimental design to evaluate whether Directive (EU) 2022/2381 produced measurable effects on the financial performance and governance structure of European listed companies. The causal identification strategy relies on a Difference-in-Differences (DiD) approach applied to a balanced two-period panel covering fiscal years 2021 (pre-treatment) and 2025 (post-treatment)[118].

The analysis is conducted on the full STOXX Europe 600 universe. After applying a completeness filter and removing one outlier, the working sample comprises 245 companies (147 Treatment, 87 Control, 11 Belgium). Belgian firms serve as a placebo group throughout. The Treatment cohort gathers EU member states without binding pre-2022 gender quota legislation. The Control cohort gathers France, Italy and Portugal, which had already adopted such legislation before 2022.

The main estimator is ordinary least squares (OLS) with cluster-robust standard errors at the firm level, using the Bell–McCaffrey (CR2) correction[119]. Several complementary methods test the robustness of the findings: standard errors clustered by country, firm fixed effects, non-parametric Wilcoxon tests, Propensity Score Matching, Doubly Robust (AIPW) estimation, permutation inference, and a cluster bootstrap. Each method addresses a distinct identification

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[115] Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007 ;
Ibid. (Hillman & Dalziel, 2003) ;
Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? Journal of Business Ethics, 118(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6

[116] Ibid. (Sila et al., 2016.)

[117] Ibid. (Adams & Ferreira, 2009)

[118] Angrist, J. D., & Pischke, J.-S. (2009). Mostly harmless econometrics: An empiricist's companion. Princeton University Press.

[119] Pustejovsky, J. E., & Tipton, E. (2018). Small-sample methods for cluster-robust variance estimation and hypothesis testing in fixed effects models. Journal of Business & Economic Statistics, 36(4), 672–683. https://doi.org/10.1080/07350015.2016.1247004

concern. Their convergence (or divergence) provides a strong stability check on the headline results.

## *3.2. Data collection*

### *3.2.1. Bloomberg Terminal*

Financial and governance data were retrieved from the Bloomberg Terminal. Historical data for fiscal year 2021 were extracted using the BDH function (Bloomberg Data History). Data for fiscal year 2025 were extracted using the BDP function (Bloomberg Data Point). Four fields were collected for the analyses: RETURN_COM_EQY (Return on Equity, ROE), PX_TO_BOOK_RATIO (Price-to-Book, P/B), CG627 (percentage of women on the Board of Directors), and CG631 (percentage of women among Key Executives). EV_TO_T12M_EBITDA was retrieved but excluded from all analyses, as financial institutions and holding companies do not report this metric.

### *3.2.2. Completeness filter*

The STOXX Europe 600 contains 612 constituents. After data extraction, only companies with complete Bloomberg data for all four analytical variables in both years were retained. This filter reduced the universe to 246 companies. One additional firm was subsequently removed on data-quality grounds (see Section 3.3.2), yielding a final working sample of 245 companies.

This filter results in unequal group sizes: 147 firms in the Treatment group versus 87 in the Control group. The imbalance reflects the country composition of each group rather than any sampling decision. The Treatment group spans nine countries, while the Control group covers three. Unequal group sizes do not invalidate the Difference-in-Differences estimator. The estimator remains unbiased as long as the parallel-trends assumption holds, and standard errors are corrected to account for within-firm correlation.

### *3.2.3. Data cleaning*

The raw Bloomberg exports contained five header rows and a reference legend spanning columns L through Q. These were removed to produce a clean, machine-readable file. Bloomberg missing-value indicators (shown as a dash in the raw export) were converted to NA. The cleaned files were imported into R using the readxl package[120].

[120] Wickham, H., & Bryan, J. (2023). readxl: Read Excel files [R package, version 1.4.3]. https://CRAN.R-project.org/package=readxl

## *3.3. Sample construction and group classification*

### *3.3.1. Excluded countries*

Three countries present in the STOXX Europe 600 were excluded from the analysis because they fall outside the legal scope of Directive (EU) 2022/2381.

The United Kingdom was excluded. The UK formally left the European Union on 31 January 2020. EU directives adopted after that date have no legal effect on UK-listed companies.

Switzerland was excluded. Switzerland is not an EU member state and has no obligation to implement EU legislation. Swiss corporate governance is governed by national law, which includes a comply-or-explain diversity recommendation but no binding quota.

Norway was excluded. Although Norway participates in the European Economic Area and applies many EU single-market rules, it is not an EU member state. Directive (EU) 2022/2381 has not been incorporated into the EEA Agreement as of the study date.

### *3.3.2. STOXX 600 working sample (245 companies)*

After applying the completeness filter to the full STOXX Europe 600, one additional company was removed: INPOST SA (Netherlands), which recorded a Price-to-Book ratio of 835 in 2021. InPost completed its initial public offering in January 2021 with a near-zero book value. This makes its P/B ratio structurally incomparable to established listed companies and would have distorted all group-level P/B statistics. After removal, the Treatment group P/B mean in 2021 was 3.72, comparable to the Control group mean of 3.55.

The final sample comprises 147 Treatment companies, 87 Control companies, and 11 Belgian companies. One additional missing ROE value in 2025 brings the panel to 489 observations. The country composition is reported in Table 1.

*Table 1. Sample composition by group and country*

| Group | Country | n 2021 | n 2025 |
|---|---|---|---|
| Treatment | Germany, Spain, Netherlands, Finland, Poland, Sweden, Denmark, Austria, Ireland | 147 | 147 |
| Control | France, Italy, Portugal | 87 | 87 |
| Belgium (placebo) | Belgium | 11 | 11 |
| Total | | 245 | 245 |

### *3.3.3. Group classification and national legislation*

Companies are assigned to one of three groups based on the regulatory environment of their country of incorporation.

The Control group comprises companies from countries that had adopted binding national gender quota legislation before Directive (EU) 2022/2381. France enacted the Copé-Zimmermann Law (Loi n. 2011-103) in 2011, requiring boards of large listed and unlisted companies to achieve 40% representation of each gender, with non-compliant appointments rendered legally void[121]. Italy passed the Golfo-Mosca Law (Legge n. 120/2011) in the same year, setting a minimum one-third representation threshold for listed and state-owned companies, with financial penalties for non-compliance[122]. Portugal adopted Law 62/2017, which imposes a binding 33% quota on listed companies and public sector entities, with graduated sanctions including formal warnings and public fines[123]. These three countries form the Control group because their companies had already faced the type of regulatory pressure that the Directive would impose on Treatment group firms after 2022.

The Treatment group comprises companies from EU member states with no equivalent binding national legislation before 2022. This includes Germany, Spain, the Netherlands, Finland, Poland, Sweden, Denmark, Austria, and Ireland.

The Belgian group serves as a placebo. Belgium adopted a national gender quota law on 28 July 2011[124], imposing a one-third representation threshold on listed companies. However, Belgium had not transposed Directive (EU) 2022/2381 into domestic law as of the study date. Belgian companies therefore face a pre-existing national constraint but no new regulatory obligation from the Directive during the study period.

## *3.4. Variables*

Four variables are used in the analysis. Their selection was guided by three criteria: theoretical relevance to the research question, accessibility across a large cross-national sample via Bloomberg, and coverage of both a financial and a governance dimension.

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[121] Assemblée Nationale. (2011). Loi n° 2011-103 du 27 janvier 2011 relative à la représentation équilibrée des femmes et des hommes au sein des conseils d'administration et de surveillance et à l'égalité professionnelle. Journal officiel de la République française.
[122] Gazzetta Ufficiale. (2011). Legge 12 luglio 2011, n. 120: Modifiche al testo unico delle disposizioni in materia di intermediazione finanziaria. Gazzetta Ufficiale della Repubblica Italiana.
[123] Diário da República. (2017). Lei n.º 62/2017, de 1 de agosto: Regime da representação equilibrada entre mulheres e homens nos órgãos de administração e de fiscalização.
[124] Moniteur Belge. (2011). Loi du 28 juillet 2011 visant à assurer la présence de femmes dans le conseil d'administration des entreprises autonomes publiques, des sociétés cotées et de la Loterie Nationale.

Return on Equity (ROE, %) measures net profit generated per unit of shareholders' equity. It is the most widely used accounting-based measure of firm profitability in the corporate governance literature and reflects the internal efficiency of the firm. Bloomberg provides this figure for nearly all STOXX Europe 600 constituents.

Price-to-Book ratio (P/B) measures market value relative to the book value of equity. Unlike ROE, P/B incorporates investor expectations about future performance and risk. Together, ROE and P/B cover both the internal profitability and the market-valuation dimensions of financial performance.

CG627 measures the percentage of women on the Board of Directors. It is the primary governance outcome variable, since it directly captures the object of the Directive's intervention. Changes in this variable between 2021 and 2025 reflect the degree to which companies adjusted their board composition in response to the Directive.

CG631 measures the percentage of women among Key Executives. The Directive targets non-executive board positions only. CG631 therefore serves as a test of potential spillover effects: does regulatory pressure on the board translate into changes at the executive level as well?

## *3.5. Analytical strategy*

### *3.5.1. Descriptive statistics*

Means, medians, and standard deviations are computed by group and year. The objective is to verify that the Treatment and Control groups are comparable at baseline in 2021. If pre-existing differences are large, the identifying assumption of the Difference-in-Differences method is weakened. Unconditional changes (2025 value minus 2021 value) are also reported to describe the raw evolution of each group before applying any statistical model.

### *3.5.2. Main estimation: DiD with firm-clustered standard errors*

Companies cannot be randomly assigned to regulatory environments. Group membership is determined by the country of incorporation. The Control group's evolution between 2021 and 2025 provides the counterfactual for what Treatment group firms would have done in the absence of the Directive. The DiD estimator removes the influence of any time-invariant differences between groups, as well as any factors that affected all firms equally over the period.

For each outcome variable Y, the following two-way model is estimated:

$$Y_{it} = \alpha_i + \beta_1 \, Post_t + \beta_2 \, Treated_i + \delta \, (Post_t \times Treated_i) + x_i'\beta + \varepsilon_{it}$$

where i indexes firms and $t \in \{2021, 2025\}$. Each coefficient has a precise interpretation: $\alpha_i$ is the firm-specific intercept, which absorbs all time-invariant firm characteristics (sector, country, governance culture); $\beta_1$ captures the time trend common to both groups between 2021 and 2025 (macroeconomic shocks, ESG trends, voluntary adoption); $\beta_2$ captures the pre-existing average Treatment–Control gap in 2021; $\delta$ is the coefficient of interest, namely the differential effect on the Treatment group in 2025 net of the common trend and of the initial gap; and $x_i$ denotes additional firm-level controls. Adding firm-specific intercepts $\alpha_i$ means that $\delta$ is identified from within-firm changes between 2021 and 2025. This neutralises the heterogeneity of the Control pool: each firm is, in effect, its own counterfactual benchmark.

Standard errors are clustered at the firm level using the CR2 small-sample correction[125]. With 234 firm clusters, this correction is the most reliable estimator under panel autocorrelation. Firm-level clustering accounts for the within-firm correlation between the two annual observations, which would otherwise lead to under-estimated standard errors[126]. The model is estimated separately for each of the four outcome variables.

### *3.5.3. Robustness checks*

Seven complementary methods test the robustness of the headline results.

#### *3.5.3.1. Firm fixed effects*

Adding firm fixed effects absorbs all time-invariant firm characteristics, including sector, country, governance culture, and pre-existing diversity. With T = 2, firm fixed effects identify the DiD coefficient purely from within-firm variation between 2021 and 2025. Since the treatment indicator does not vary over time, it is collinear with the firm dummies and dropped from the model. Only the interaction term Post × Treated is retained.

#### *3.5.3.2. Non-parametric tests (Wilcoxon)*

OLS regression assumes approximately normal residuals. Financial variables such as ROE are typically skewed and sensitive to extreme observations. The Wilcoxon–Mann–Whitney rank-sum test addresses this limitation. It compares the full distribution of firm-level changes between Treatment and Control groups using ranks rather than raw values. It makes no assumption about the shape of the distribution and is not distorted by outliers[127]. A signed-rank

[126] Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. Journal of Human Resources, 50(2), 317–372.
[127] Hollander, M., Wolfe, D. A., & Chicken, E. (2013). Nonparametric statistical methods (3rd ed.). Wiley.

version of the same test is also applied to the distribution of individual DiD effects within the Treatment group (see Section 3.5.3.7).

#### *3.5.3.3. Propensity Score Matching (PSM)*

Treatment and Control firms differ structurally at baseline. Control countries had already adopted gender quotas before 2021, so their boards entered the panel with significantly higher female representation than Treatment boards. Propensity Score Matching constructs an artificially balanced sample by pairing each Treatment firm with the most similar Control firm on observable pre-treatment characteristics[128]. The propensity score is estimated by a logistic regression of treatment status on the 2021 values of ROE, P/B, board female representation, key-executive female representation, and sector. Matching is performed using a one-to-one nearest-neighbor algorithm without replacement, implemented in the MatchIt R package[129]. The DiD model is then re-estimated on the matched sample, with observations weighted by the matching weights. The key identification assumption is conditional independence; given the matching covariates, treatment assignment is as good as random.

#### *3.5.3.4. Doubly Robust estimation (AIPW)*

PSM relies on a correctly specified propensity-score model. Standard regression relies on a correctly specified outcome model. The Augmented Inverse Probability Weighting (AIPW) estimator combines both[130]. It is consistent if at least one of the two models is correctly specified, hence the name "doubly robust". The estimator weights observations by the inverse of their estimated treatment probability (targeting the Average Treatment Effect on the Treated) and augments the DiD regression with the matching covariates. Standard errors are heteroskedasticity-robust (HC2). The estimator is implemented through the WeightIt R package[131].

#### *3.5.3.5. Permutation inference*

Permutation inference tests the null hypothesis of no treatment effect by randomly reassigning treatment status across firms 5,000 times[132]. For each permutation, the DiD coefficient is

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[128] Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. Biometrika, 70(1), 41–55. https://doi.org/10.1093/biomet/70.1.41

[129] Ho, D. E., Imai, K., King, G., & Stuart, E. A. (2011). MatchIt: Nonparametric preprocessing for parametric causal inference. Journal of Statistical Software, 42(8), 1–28. https://doi.org/10.18637/jss.v042.i08

[130] Robins, J. M., Rotnitzky, A., & Zhao, L. P. (1994). Estimation of regression coefficients when some regressors are not always observed. Journal of the American Statistical Association, 89(427), 846–866.

[131] Greifer, N. (2024). WeightIt: Weighting for covariate balance in observational studies [R package]. https://CRAN.R-project.org/package=WeightIt

[132] Fisher, R. A. (1935). The design of experiments. Oliver and Boyd.

recalculated. The empirical p-value is the proportion of permuted DiD estimates with absolute value at least as large as the observed one. The test makes no distributional assumption and is exact in finite samples. It provides a non-parametric benchmark for the OLS-based inference.

#### *3.5.3.6. Cluster bootstrap*

The cluster bootstrap resamples whole firms (each firm with its two annual observations) with replacement[133]. For each of B = 2,000 bootstrap samples, the DiD coefficient is recalculated. Percentile confidence intervals are derived from the empirical distribution of these bootstrap estimates. Two-sided bootstrap p-values are computed by reflection. Resampling at the firm level preserves the panel structure of the data[134].

#### *3.5.3.7. Individual firm-level DiD*

In addition to the aggregate DiD estimator, an individual DiD effect is computed for each Treatment firm. The individual effect is defined as the firm's observed change between 2021 and 2025 minus the mean change observed in the Control group. This decomposition reveals heterogeneity hidden under the aggregate average and identifies firms that drive the result. A Wilcoxon signed-rank test on the resulting distribution provides a non-parametric assessment of whether the median individual effect differs from zero.

### *3.5.4. Placebo test using Belgium*

Belgian companies are used as a placebo group. Belgium already had a national quota law before the study period and was not subject to any new regulatory constraint from the EU Directive during the study period. Under correct specification, the estimated DiD effect for Belgium versus Control should be statistically non-significant. A non-zero effect would suggest the existence of broader European trends that the main DiD estimator is incorrectly attributing to the Directive.

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[133] Efron, B. (1979). Bootstrap methods: Another look at the jackknife. The Annals of Statistics, 7(1), 1–26.
[134] Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2008). Bootstrap-based improvements for inference with clustered errors. Review of Economics and Statistics, 90(3), 414–427.

### *3.5.5. Software*

All analyses were conducted in R (version 4.4)[135] using the following packages: readxl, dplyr, tidyr, ggplot2, patchwork, broom, purrr, knitr, estimatr[136], MatchIt, WeightIt, lmtest, sandwich, and boot.

## 4. Results

### *4.1. Descriptive statistics*

Table 2 reports group-level means and standard deviations by year. In 2021, the Treatment and Control groups show closely aligned ROE means (14.52% versus 13.66%) and P/B means (3.72 versus 3.55). This baseline comparability supports the parallel-trends assumption for the financial variables.

The governance variables reveal a structural pre-existing gap. Control group companies entered 2021 at 41.95% female board representation, already well above the Directive's 33% threshold, reflecting years of prior national legislation. Treatment companies started at 34.44%, consistent with the absence of binding pre-2022 constraints. Belgium (33.62%) sat right at the Directive threshold. The Treatment–Control gap of 7.5 percentage points in 2021 is statistically significant.

*Table 2. Descriptive statistics (n = 245)*

| Group | Year | n | ROE (%) | P/B | Board F (%) | Exec F (%) |
|---|---|---|---|---|---|---|
| Control | 2021 | 87 | 13.66 | 3.55 | 41.95 | 19.92 |
| Control | 2025 | 87 | 12.69 | 2.73 | 44.48 | 26.20 |
| Treatment | 2021 | 147 | 14.52 | 3.72 | 34.44 | 20.08 |
| Treatment | 2025 | 147 | 15.14 | 3.44 | 38.90 | 24.49 |
| Belgium | 2021 | 11 | 12.13 | 1.87 | 33.62 | 17.75 |
| Belgium | 2025 | 11 | 10.08 | 2.31 | 40.35 | 28.59 |

Table 3 reports the raw changes between 2021 and 2025. The Treatment group ROE rose by +0.62 points (+4.2%) while the Control group declined by −0.97 points (−7.1%). Female board representation increased more in the Treatment group (+4.5 points) than in the Control group

[135] R Core Team. (2024). R: A language and environment for statistical computing. R Foundation for Statistical Computing.
https://www.R-project.org/
[136] Blair, G., Cooper, J., Coppock, A., Humphreys, M., & Sonnet, L. (2023). estimatr: Fast estimators for design-based inference [R package].
https://CRAN.R-project.org/package=estimatr

(+2.5 points). Belgium recorded the largest unconditional gain in both Board (+6.7 points) and Exec (+10.8 points), despite facing no new regulatory pressure.

*Table 3. Unconditional changes 2021 → 2025*

| Group | ROE (pts) | P/B | Board F (pts) | Exec F (pts) |
|---|---|---|---|---|
| Treatment | +0.62 | −0.28 | +4.5 | +4.4 |
| Control | −0.97 | −0.82 | +2.5 | +6.3 |
| Belgium | −2.05 | +0.45 | +6.7 | +10.8 |

Figure 1 plots these trends. Both groups show declining ROE and P/B between 2021 and 2025, reflecting common European business-cycle factors rather than divergent group dynamics. The board variable rises steeply in both groups. The Treatment line moves up faster than the Control line, but the gap remains: Control ends at 44.5%, Treatment at 38.9%.

*See Figure 1 in the Appendix. STOXX 600 — Evolution of financial and governance indicators (2021–2025) by group.*

## *4.2. Main DiD results*

Table 4 reports the headline DiD estimates with firm-clustered standard errors (CR2). All four estimates are statistically non-significant at the 5% level. The point estimates are positive for ROE (+1.59), P/B (+0.54), and Board (+1.92), and negative for Exec (−1.87). The 95% confidence intervals are wide and cross zero in all four cases.

*Table 4. DiD estimates with firm-clustered SE (CR2)*

| Outcome | δ | SE (firm) | 95% CI | p-value | Result |
|---|---|---|---|---|---|
| ROE (%) | +1.59 | 3.13 | [−4.59 ; +7.77] | .613 | ns |
| Price / Book | +0.54 | 0.48 | [−0.42 ; +1.49] | .267 | ns |
| % Women Board | +1.92 | 1.27 | [−0.59 ; +4.43] | .132 | ns |
| % Women Exec | −1.87 | 1.61 | [−5.04 ; +1.31] | .248 | ns |

The ROE estimate suggests that the Treatment group declined less than the Control group, but the confidence interval is very wide and crosses zero, so no conclusion can be drawn. The positive direction for female board representation is consistent with the expected compliance response to the Directive, but the effect is not statistically significant. The negative estimate for female executive representation is expected: the Directive targets board-level non-executive positions only and does not regulate executive committee composition.

Model fit is very weak for the financial variables ($R^2 = 0.003$ for ROE, 0.008 for P/B), which reflects the known difficulty of explaining cross-sectional financial performance variation through governance and time variables alone in short panels. The board representation model

has an $R^2$ of 0.127, driven mainly by the large and statistically significant pre-existing gap between Treatment and Control in 2021.

*See Figure 2 in the Appendix. STOXX 600 — Main DiD estimator δ with 95% CI (firm-clustered SE).*

## *4.3. Robustness checks*

Seven complementary methods are applied. Their estimates are summarised in Table 5 and discussed in turn below.

*Table 5. Synthesis of robustness checks (Treatment vs Control, n = 245)*

| Method | ROE δ (p) | P/B δ (p) | Board δ (p) | Exec δ (p) |
|---|---|---|---|---|
| OLS — firm cluster (main) | +1.59 (.613) | +0.54 (.267) | +1.92 (.132) | −1.87 (.248) |
| Firm fixed effects | +1.64 (.598) | +0.58 (.247) | +1.91 (.171) | −1.40 (.405) |
| PSM (matched DiD) | +0.72 (.850) | +0.68 (.430) | +5.35 (.007)** | −1.90 (.507) |
| Doubly Robust (AIPW) | +0.33 (.907) | +0.21 (.764) | −2.69 (.554) | +1.53 (.685) |
| Permutation (5,000) | +1.40 (.663) | +0.51 (.309) | +1.86 (.177) | −1.71 (.298) |
| Bootstrap (2,000) | +1.59 (.605) | +0.54 (.274) | +1.92 (.130) | −1.87 (.245) |
| Wilcoxon (group) | (p=.679) | (p=.392) | (p=.216) | (p=.310) |

### *4.3.1. Firm fixed effects*

Adding firm fixed effects produces virtually identical estimates: δ = +1.64 for ROE, +0.58 for P/B, +1.91 for Board, and −1.40 for Exec. None of the four coefficients is statistically significant. This is expected with T = 2: firm fixed effects identify the DiD coefficient from the same within-firm variation already captured by the main specification.

### *4.3.2. Propensity Score Matching*

PSM produces three non-significant estimates (ROE, P/B, Exec) and one significant estimate (Board, δ = +5.35, p = .007). On the face of it, this is the only specification that detects a Directive effect. However, two caveats apply.

First, the matching does not achieve good balance on the most relevant covariate. The standardised mean difference on board female representation remains −1.13 after matching (well above the conventional 0.25 threshold for acceptable balance). The Control pool is structurally too small and too different to find good counterfactuals for the Treatment firms with low baseline diversity.

Second, the Doubly Robust estimator (which corrects for misspecification of the propensity model) produces the opposite sign on the same variable (δ = −2.69), suggesting that the PSM

result is sensitive to specification choices. The PSM coefficient is therefore reported but interpreted with caution.

### *4.3.3. Doubly Robust (AIPW)*

The Doubly Robust estimator yields four non-significant estimates close to zero. The Board coefficient flips sign relative to PSM (−2.69 vs +5.35), reflecting the sensitivity of these estimators to the model specification when the matched sample is poorly balanced. The financial-outcome estimates (ROE +0.33, P/B +0.21) are smaller in magnitude than the OLS estimates, consistent with the interpretation that the structural Treatment–Control gap inflates the OLS point estimate.

### *4.3.4. Permutation inference*

Permutation inference with 5,000 random reassignments of treatment status produces p-values that align closely with the OLS-based p-values: .663 for ROE, .309 for P/B, .177 for Board, and .298 for Exec. The non-parametric test confirms the headline conclusion: under the null of no treatment effect, the observed DiD estimates would arise frequently by chance.

### *4.3.5. Cluster bootstrap*

The cluster bootstrap (B = 2,000) reproduces the OLS point estimates almost exactly and provides 95% percentile confidence intervals consistent with the firm-clustered standard errors. The bootstrap distributions are approximately symmetric around the observed point estimates and contain zero in all four cases. Bootstrap p-values match the parametric inference: .605, .274, .130, .245.

*See Figure 3 in the Appendix. STOXX 600 — Bootstrap distributions of the DiD estimator (B = 2,000) with 95% percentile intervals.*

### *4.3.6. Group-level Wilcoxon tests*

The Wilcoxon–Mann–Whitney rank-sum tests applied to firm-level changes confirm the absence of a significant Treatment–Control difference: p = .679 for ROE, .392 for P/B, .216 for Board, and .310 for Exec. The non-parametric inference is fully consistent with the OLS-based results and rules out an explanation based on residual non-normality.

### *4.3.7. Individual DiD distribution*

Decomposing the aggregate DiD into firm-level effects reveals informative heterogeneity. The counterfactual change in the Control group is −1.04 percentage points for ROE, −0.86 for P/B, +2.5 points for Board, and +6.0 points for Exec. Within the Treatment group, 79 firms have a

positive individual DiD on ROE (median +1.16) and 82 firms have a positive individual DiD on Board (median +1.97). The distribution is approximately symmetric for ROE but skewed positive for Board and P/B.

Wilcoxon signed-rank tests applied to these distributions yield mixed results: the median individual DiD is not significantly different from zero for ROE ($p = .685$), but it is significantly positive for P/B ($p < .001$), Board ($p = .043$), and marginally for Exec ($p = .097$). The contrast with the aggregate DiD reflects a subtle pattern: at the individual level, Treatment firms outperform the Control counterfactual on P/B and Board, but the cross-firm dispersion is too wide for the average effect to reach significance.

*See Figure 4 in the Appendix. STOXX 600 — Distribution of individual DiD effects for Treatment firms by sector.*

## *4.4. Placebo test (Belgium)*

Table 6 reports the DiD estimates using Belgium as a placebo treatment group, with Control as the reference. None of the four coefficients is statistically significant. The point estimate for board representation (+4.19) is even larger than the main Treatment estimate (+1.92), despite Belgium facing no new regulatory constraint during the period. The point estimate for executive representation (+4.56) is also larger than the main Treatment estimate (−1.87).

*Table 6. Placebo DiD estimates (Belgium vs Control)*

| Outcome | δ | SE | 95% CI | p-value | Result |
|---|---|---|---|---|---|
| ROE (%) | −1.07 | 7.74 | [−16.33 ; +14.19] | .890 | ns |
| Price / Book | +1.27 | 1.46 | [−1.62 ; +4.15] | .387 | ns |
| % Women Board | +4.19 | 3.51 | [−2.73 ; +11.12] | .234 | ns |
| % Women Exec | +4.56 | 6.00 | [−7.27 ; +16.38] | .448 | ns |

This placebo result is highly informative. If the Directive itself had driven the increase in female board representation observed in the Treatment group, Belgian firms (untreated by the Directive) should not show a comparable increase. They do. The Belgian gain is in fact larger than the Treatment gain. This indicates that the board diversity trend observed in the Treatment group is not specifically attributable to the Directive. It is more consistent with a broader voluntary trend in European corporate governance.

*See Figure 5 in the Appendix. STOXX 600 — Comparison of the main DiD estimator (Treatment vs Control) with the placebo DiD estimator (Belgium vs Control).*

# 5. Discussion

## *5.1. No financial impact across methods*

No specification produces a statistically significant effect of the Directive on ROE or P/B. The DiD point estimates are consistently positive for ROE (+1.59 OLS, +0.72 PSM, +0.33 DR, +1.40 permutation) and for P/B (+0.54 across methods). They never cross the conventional significance threshold. The cluster bootstrap, the permutation test, and the Wilcoxon rank-sum test all confirm the null. Scaling the sample to 245 firms provides enough power to detect effects of approximately 0.18 standard deviations, but no such effect emerges.

This is consistent with the meta-analytic literature, which finds no robust relationship between board gender diversity and firm financial performance[137]. Equally important is the absence of any negative effect. The Treatment group maintained its ROE better than the Control group across all specifications. This finding contradicts the argument that mandatory diversity legislation imposes short-term financial costs[138].

## *5.2. Mixed evidence on board representation*

The picture is more nuanced for board representation. The OLS, fixed-effects, bootstrap, and permutation estimators all point to a small positive effect (δ between +1.86 and +1.92) that is not statistically significant. The PSM estimator is the only specification to detect a significant effect (δ = +5.35, p = .007). However, the Doubly Robust estimator produces the opposite sign on the same variable (δ = −2.69). This divergence indicates that no single estimator is reliable for the board outcome under the current data structure.

Two methodological factors explain the divergence. First, the Treatment and Control groups have very different baseline levels of female board representation (34.4% versus 41.95%), which mechanically biases simple comparisons. Second, the Control pool is small (87 firms) and contains no firms with low baseline diversity. Matched comparisons therefore rely on imperfect counterfactuals, and the residual imbalance on the Board variable remains large

[137] Pletzer, J. L., Nikolova, R., Kedzior, K. K., & Voelpel, S. C. (2015). Does gender matter? Female representation on corporate boards and firm financial performance — A meta-analysis. PLOS ONE, 10(6), e0130005.
https://doi.org/10.1371/journal.pone.0130005 ;
Post, C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. Academy of Management Journal, 58(5), 1546–1571.
https://doi.org/10.5465/amj.2013.0319

[138] Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. The Quarterly Journal of Economics, 127(1), 137–197.

(standardized mean difference −1.13 after matching). The PSM significance must therefore be interpreted as suggestive rather than conclusive.

The individual-level Wilcoxon signed-rank test offers a useful complement. It rejects the null of zero median DiD for Board ($p = .043$) and for P/B ($p < .001$). Together with the OLS point estimate, this suggests that Treatment firms have on average moved slightly faster on-board diversity than their Control counterparts, but the magnitude of the differential is too small relative to the cross-firm dispersion for any single aggregate test to detect it confidently.

### *5.3. Governance progress: a broader European trend*

The Belgian placebo result is the most informative finding in the governance analysis. Belgian firms progressed as much as, or more than, Treatment firms on board female representation between 2021 and 2025, despite facing no new regulatory constraint. This suggests that the governance improvements observed in the Treatment group are not a direct response to the Directive but reflect a wider pan-European movement toward more gender-diverse boards, driven by investor expectations, ESG frameworks, and voluntary adoption[139].

The absence of any effect on female executive representation is consistent across all specifications. Since the Directive explicitly targets non-executive board appointments, this result is theoretically expected. It provides an additional validation of the specificity of the regulatory mechanism: the Directive moved board composition (modestly), but it has not yet spilled over into executive committees.

## 6. Limitations

Several limitations apply to the analysis.

The two-period structure (2021 and 2025 only) is the most fundamental constraint. With a single pre-treatment observation, the parallel-trends assumption cannot be tested statistically. Verifying this assumption would require at least one additional year of pre-Directive data (e.g., 2018 or 2019). The same constraint prevents the use of dynamic-effects estimators that would have allowed the identification of an event-study response profile.

The study period ends in 2025, one year before the Directive's June 2026 compliance deadline. Many Treatment-group firms may still be in transition. Financial effects of board restructuring, if they materialize, may only become visible once the full compliance process is complete.

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[139] Seierstad, C., Gabaldon, P., & Mensi-Klarbach, H. (2017). Gender diversity in the boardroom: Volume 1: The use of different quota regulations. Palgrave Macmillan.

Group classification uses a binary distinction between countries with and without binding pre-existing legislation. In practice, regulatory intensity varies within groups. Germany, for example, had a 30% supervisory-board quota since 2015, but it applied only to the largest co-determined firms, not to all listed companies. This within-group heterogeneity attenuates the contrast between Treatment and Control.

The completeness filter retains only companies with full Bloomberg data. Companies with incomplete data were excluded rather than completed. This introduces a potential selection effect if data availability is correlated with governance quality or country-level reporting practices.

The Belgian placebo group is small (11 firms). Confidence intervals for Belgian estimates are very wide, limiting the precision of the placebo test. The result remains informative about the direction of the effect but should not be over-interpreted in magnitude.

The Propensity Score Matching specification suffers from poor common support. The Control pool contains no firms with low baseline board diversity, so the Treatment–Control match cannot be balanced on the most relevant covariate. The residual standardized mean difference on board female representation remains −1.13 after matching. The PSM significance on the Board outcome must therefore be read with caution. The divergence between the PSM estimate (+5.35) and the Doubly Robust estimate (−2.69) for the same outcome confirms that no causal claim about Board representation can be drawn from this specification alone.

All causal-inference methods used in this thesis rely on the Conditional Independence Assumption: that, given the observable pre-treatment covariates, treatment assignment is as good as random. This assumption is not testable from the data. Unobserved firm characteristics (governance culture, ownership structure, internal compliance practices) may simultaneously drive both group membership and the outcome trajectory and bias the estimates.

Finally, the analysis uses only two financial metrics, ROE and Price-to-Book. These do not capture risk-adjusted returns, total shareholder return, or sustainability-related performance dimensions that are increasingly relevant in the context of ESG regulation.

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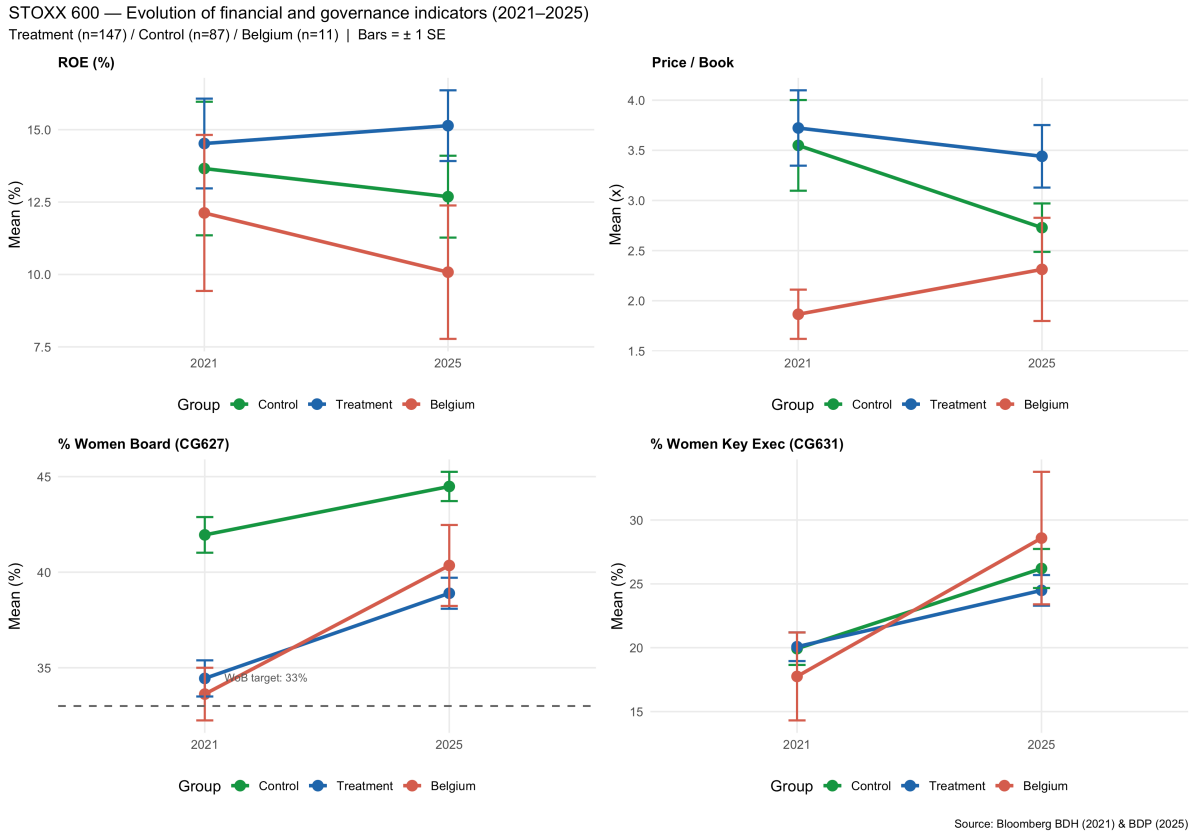
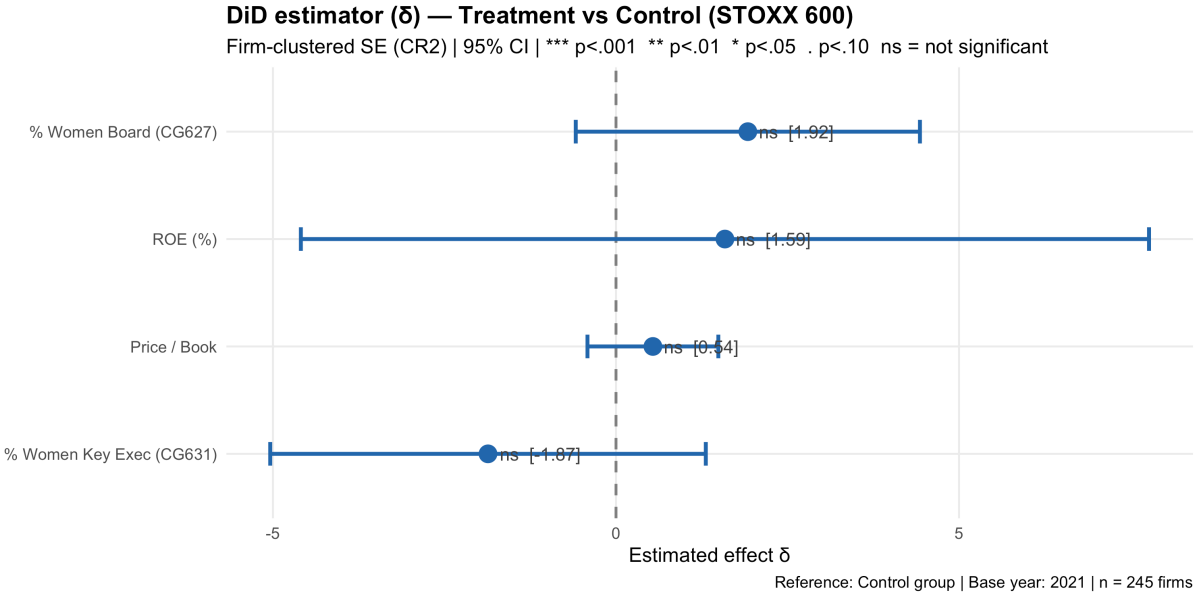
# Appendix

Figure A.1. *STOXX 600 — Evolution of financial and governance indicators (2021–2025) by group.*



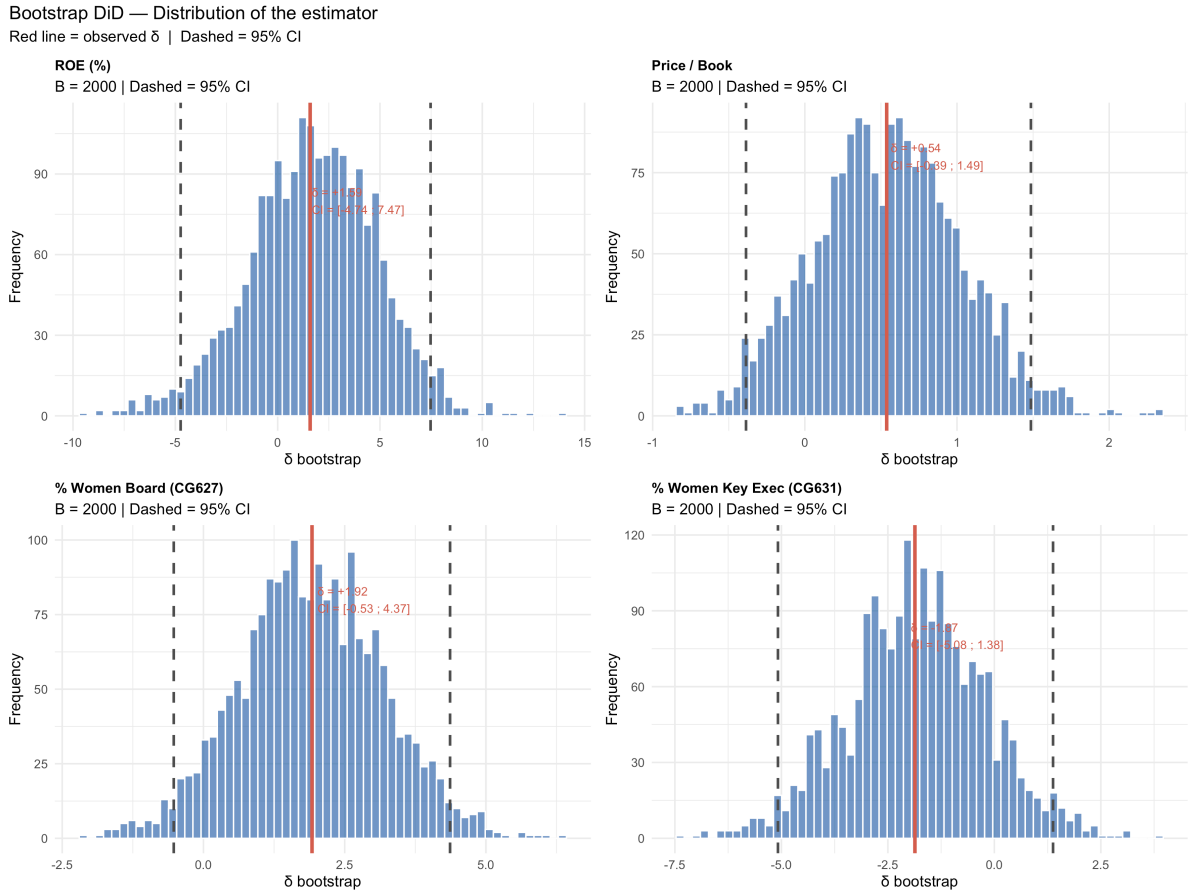

*Note. Treatment (n = 147) / Control (n = 87) / Belgium (n = 11). Error bars = ± 1 SE. Source: Bloomberg BDH (2021) and BDP (2025).*

Figure A.2. *STOXX 600 — Main DiD estimator δ with 95% CI.*



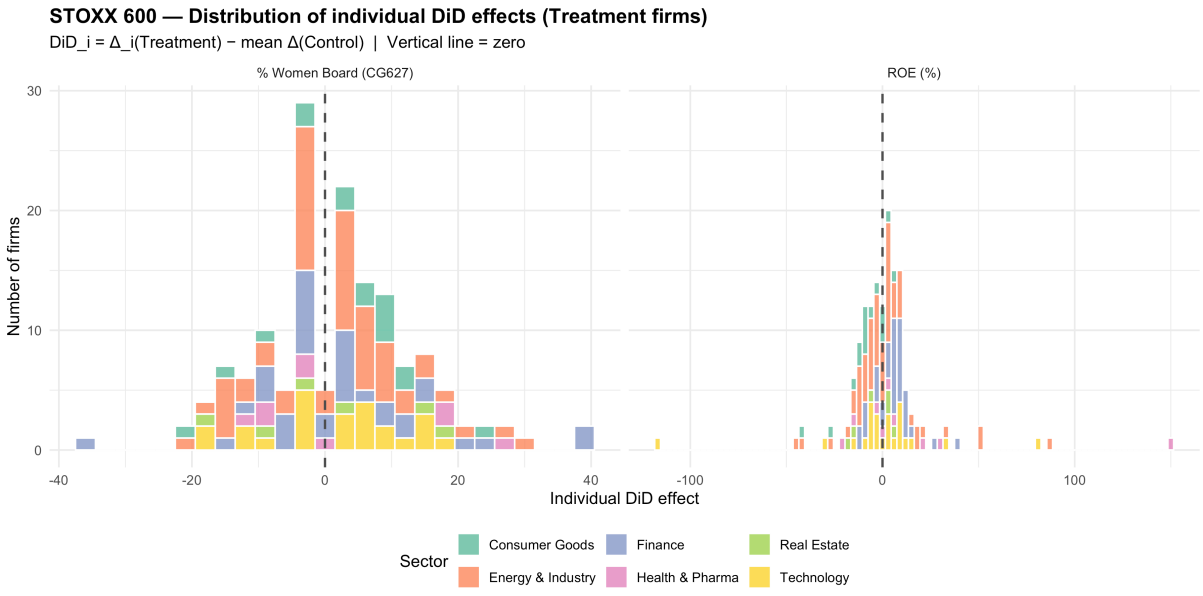
*Note. Firm-clustered standard errors (CR2 Bell–McCaffrey correction). Reference: Control group; base year: 2021; n = 245 firms. *** p < .001, ** p < .01, * p < .05, . p < .10, ns = not significant.*

Figure A.3. *Bootstrap distributions of the DiD estimator.*



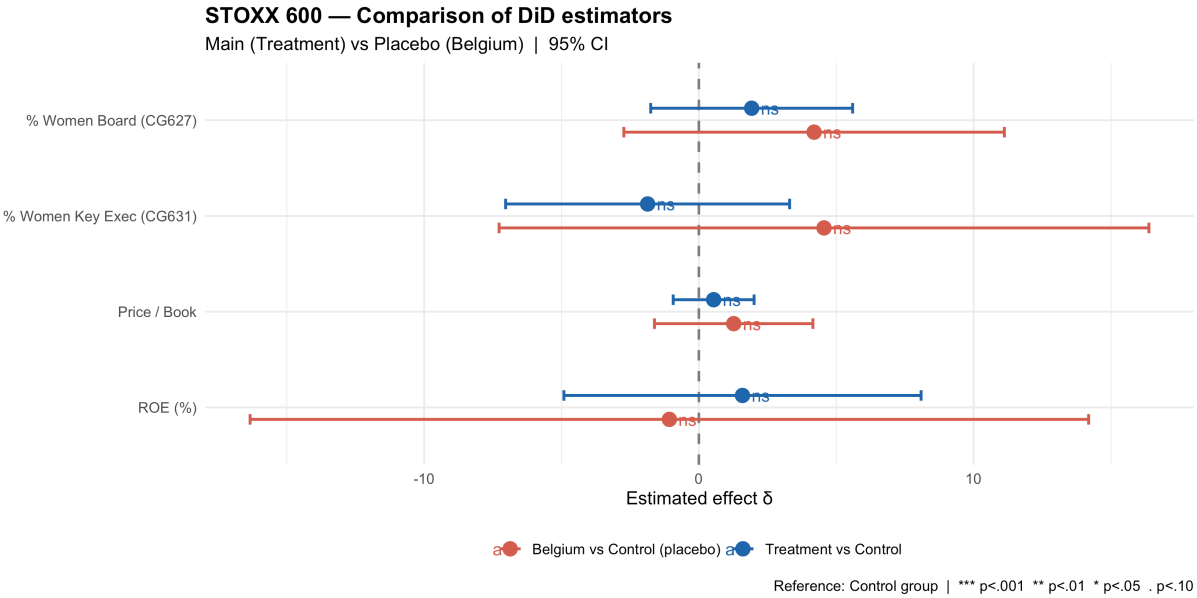

*Note. B = 2,000 firm-cluster bootstrap replications per outcome. Red line = observed δ; dashed lines = 95% percentile interval.*

Figure A.4. *Distribution of individual DiD effects for Treatment firms, by sector.*



*Note. DiD_i = ΔY_i (Treatment) − mean ΔY (Control). Vertical line = zero. Sample: 147 Treatment firms.*

Figure A.5. *Comparison of the main DiD estimator (Treatment vs Control) with the placebo DiD estimator (Belgium vs Control).*




*Note. 95% CI. Reference: Control group. Belgium serves as a placebo group: it was subject to a national gender quota before 2021 but not affected by the new Directive during the study period.*