

Louvain School of Management

Board Diversity and ESG Performance: Gender, Independence and Tenure effects on ESG scores and Market Reaction

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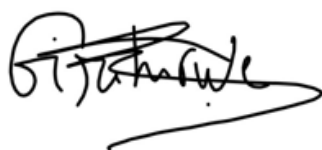
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Abstract:

This thesis examines the effect of multidimensional board diversity, combining gender, board independence and average tenure, on both ESG performance and market reaction around ESG report publication dates. Using a sample of 416 S&P 500 firms over the 2007 to 2020 period, representing 1,667 firm-year observations, the study employs two-way fixed effects panel regressions for the ESG performance hypotheses and cross-sectional OLS regressions for the market reaction hypotheses. The study uses cumulative abnormal returns (CAR) computed using the Fama-French three-factor model across four event windows.

The results indicate that none of the three dimensions of board diversity have a significant effect on ESG performance or cumulative abnormal returns in the main specifications. One exception stands out: over the 60-day window, greater female representation on the board is associated with less pronounced market reactions around ESG report publication dates, suggesting that these firms communicate in a more readable and predictable way for investors.

These findings are interpreted in light of the fact that board diversity changes slowly over time and is largely absorbed by firm fixed effects, which means its effect on ESG outcomes shows up more clearly when comparing firms with different governance profiles than when tracking changes within the same firm. This study adds to the existing literature by looking at board diversity through multiple dimensions at once and by connecting governance characteristics to both ESG performance and investor reaction.

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1. Introduction

In a context of increasing pressure from investors and regulators, dimensions such as Environmental, Social and Governance (ESG) have taken a central role in investment strategies and regulation systems. Today, assets with ESG standards constitute a significant share of worldwide financial markets, showing an increase in the importance of those standards in investing decisions. In 2022, they reached USD 30 trillion and are on track to exceed USD 40 trillion by 2030, representing more than 25% of projected global assets under management (Bloomberg Intelligence, 2022).

Additionally, the progressive adoption of the Corporate Sustainability Reporting Directive (CSRD), Starting from the 2024 fiscal year, reinforces the transparency requirements in terms of sustainability. In this context, ESG performance is likely to influence investors' perception, the value of the firm and capital access (European Commission, 2022).

In the meantime, the term diversity of the board of directors has become a major governance concern. The literature acknowledges that this diversity is inherently multidimensional and should cover multiple characteristics, such as board independence and directors' tenure (CFA Institute, 2025). However, gender often stands out the most when empirical works talk about diversity. It is mostly because of its visibility and the availability of data, compared to other dimensions, that stay relatively less explored (Byron & Post, 2016).

The reliability of ESG indicators is subject to growing criticism. Greenwashing and inconsistencies in ESG ratings among providers, with average correlations of 0.54 (Berg et al., 2022), are questioning their comparability and credibility. These limits are reducing investors' trust and highlighting the importance of governance mechanisms capable of strengthening the quality and credibility of the ESG reporting system. Furthermore, the CFA Institute confirms that there is a lack of uniformity in large firms' disclosures, which has been a persisting issue (CFA Institute, 2025).

In this context, the role of directors is crucial. Drawing on stakeholder theory (Freeman, 2010), resource dependence theory (Pfeffer & Salancik, 2003) and upper echelon theory (Hambrick & Mason, 1984), a diverse board can be interpreted as a factor fostering better decision-making, enhanced supervision and a more efficient integration of ESG challenges. From a signalling perspective, greater diversity is likely to strengthen the credibility of ESG information and impact investors' perception.

Nevertheless, the existing literature outlines two major limitations. On one hand, it often analyses diversity dimensions independently, mostly gender diversity, rather than adopting a multidimensional approach (Byron & Post, 2016). On the other hand, it mainly focuses on ESG performance, which is an internal point of view of the issue, overlooking the way financial markets react to governance characteristics, which is external to the firm (Raimo et al. 2021).

This thesis addresses this gap by asking:

How does multidimensional board diversity, such as gender, board independence and average tenure, affect ESG performance and market reaction around ESG report publication dates?

To do so, the study separates the internal dimension, by examining how board diversity influences ESG outcomes, from the external dimension, by testing how shareholders perceive ESG disclosures depending on board diversity.

This paper contributes to the literature in two ways. First, it adopts a multidimensional approach to board diversity, combining gender, board independence and tenure, whereas most existing frameworks focus on only one dimension, mostly gender. Second, it links board diversity not only to ESG performance, but also to market reaction, shedding light on the perceived credibility of ESG information.

To answer this question, the study relies on a sample of 416 S&P 500 firms over the 2007 to 2020 period, employing two-way fixed effects panel regressions for the ESG performance hypotheses and cross-sectional OLS regressions for the market reaction hypotheses.

The remainder of the thesis is structured as follows. Section 2 presents the literature review and research hypotheses. Section 3 describes the data and methodology. Section 4 presents the empirical results. Section 5 discusses the implications and Section 6 concludes the thesis.

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2. Literature Review

2.1. ESG credibility and measurement issues

This part of the thesis aims to address issues by explaining why trustworthy information on Environmental, Social, and Governance factors is important for investors, and how the construction of a company's board might just be the key to solving this problem.

ESG criteria, standing for Environmental, Social and Governance, were built to overcome a one-sided view, which is a strictly financial vision of a company. Over the years, analyses on companies have more seriously targeted earnings performance, business growth and accounting results. This approach has shown its limits by not incorporating a clear integration of long-term risks that may appear, such as social tensions, environmental harms, governance failures or behaviours that could affect enterprise value, as the world is constantly evolving (Berg et al., 2022; Buttigieg & Pulis, 2024).

The idea of investing in a more sustainable way is not new. The first forms of ethical exclusions appeared in previous centuries, then became more structured in the 20th century with funds called "ethical". In 1970, socially responsible investment began taking a more organized form, before environmental, social and governance issues were progressively integrated into investment decision-making from the 1990s and mostly in the early 2000s. The adoption of this concept strongly accelerated with the release of the United Nations Principles for Responsible Investment in 2006, which contributed to building ESG as an international guiding framework for investors, enterprises and regulators (UN PRI, 2006; Berg et al., 2022). Since then, ESG has become important in corporate governance and finance. First, investors are becoming more sensitive to extra-financial risks, because of risks that can affect future performance, cash-flow stability and company reputation. On the other hand, consumers, non-governmental actors and public authorities are putting rising pressure on companies to demonstrate their contributions to the environmental transition and social responsibility. Lastly, the rise of regulatory and transparency requirements has reinforced the use of ESG data in capital allocation decisions (Buttigieg & Pulis, 2024).

We can now observe an important market expansion of ESG data and ratings. The number of rating providers has increased, companies are increasingly publishing sustainability information, and assets are more widely integrating these variables in their investment strategies. In this regard, ESG has become a common language between companies, investors and regulators, so they can follow the evolution of the company. It signals that a firm goes beyond short-term financial performance and considers long-term issues related to its environmental impact, its relationships with stakeholders and the quality of its governance (Berg et al., 2022).

However, this evolution has shown a significant limitation: ESG scores often differ from one provider to another. Berg, Kölbel and Rigobon (2022) have shown that depending on the ESG rating provider firms are using, the same firm can receive different evaluations and different

scores, due to variations in the scope of analysis, the methodology used and the weighting assigned to different criteria. The correlations computed in their work indicate that ESG scores from different rating agencies are not strongly correlated with one another. This divergence is particularly problematic because it makes scores harder to interpret, may send wrong signals to the market, which can lead investors to make wrong decisions and makes true sustainable performance hard to identify.

Beyond this difference, concerns about the reliability of ESG criteria are growing. On one side, ESG information is often characterised by strong information asymmetry, where firms control what data they disclose, leaving investors reliant on sometimes difficult-to-verify data. On the other side, the greenwashing risk is still present. Some board members can be tempted to prioritize their sustainability image rather than changing their operations or business model. This reaction can be driven by the pressures they face to demonstrate good ESG performance. Buttigieg & Pulis (2024) highlight that greenwashing does not only stem from opportunistic behaviour, but also from an environment marked by varying interpretations of ESG, imperfect information and insufficient supervision of sustainability-related claims. This limit creates a strong gap between shareholders and directors.

These issues are why governance and the corporate board play a key role in defining ESG strategies, monitoring reporting and building the trustworthiness of published information. The literature shows that governance mechanisms put in place in some companies, such as audit committees, which are often independent from management, can improve the reliability of sustainability reports and reduce the risk of false or misleading claims (Al-Shaer & Zaman, 2018). This suggests that board characteristics may not only impact the quality of reports, but also the way markets react to this information.

It is in this perspective that this thesis is positioning itself. If ESG dimensions are unavoidable and crucial to the development of firms, their value heavily depends on the quality of the information disclosed. It becomes relevant to examine whether board composition can strengthen this reliability, particularly through gender, board independence and tenure. In the next section, theoretical frameworks will help us understand why governance diversity can act as a tool for reinforcing these standards, whether on the effective ESG performance, or on the reaction of the market around the date of the released ESG reports (Berg et al., 2022; Buttigieg & Pulis, 2024; Al-Shaer & Zaman, 2018).

2.2. Role of the board in ESG performance

In the continuity of the credibility issues identified in the previous section, the board appears as the internal governance mechanism best positioned to address them. As the ultimate decision-maker and strategic body, the board oversees the decisions that shape and determine the quality, coherence and reliability of ESG practices. This is explained through three distinct, but complementary functions identified in the literature: a strategic function, a supervision function and a signalling function (Freeman, 2010; Jensen & Meckling, 1976; Spence, 1973)

The first function of the board is to define the long-term strategic orientations of a company, in which ESG plays an increasingly important role. Stakeholder theory (Freeman, 2010) argues that corporations whose governance bodies actively involve all their stakeholders, such as shareholders, workers, local communities and the natural environment, are better inclined to develop credible and sustainable strategies because the different parties' expectations are considered.

Therefore, the board is the entity that translates external pressures from stakeholders into organisational choices. Liu et al. (2022) confirm that the adoption of ESG strategies is largely conducted by the board, by assessing the alignment of sustainability objectives with available resources and prioritising the ESG dimensions that are most material to the company's activity. The board must fully understand the social and environmental impacts of corporate activities and set strategic goals in accordance with stakeholder standards, allowing for the direct integration of ESG into governance and long-term strategies.

Resource dependence theory aligns with this perspective by emphasising that the board not only acts as an internal controller but also as a bridge with the external environment. Directors with diverse backgrounds bring different experiences, networks and perspectives that strengthen the company's capacity to engage with the complex demands of ESG reporting. They also help maintain relationships with stakeholders such as regulatory authorities, capital providers and non-governmental organisations, providing access to the experience, knowledge and external connections that firms need to build effective ESG strategies (Pfeffer & Salancik, 2003).

The second function of the board is the supervision of managerial decisions, which is at the core of agency theory (Jensen & Meckling, 1976). In the scope of ESG, this monitoring responsibility is crucial to curb opportunistic behaviours such as greenwashing, which involves demonstrating ESG performance without real transformation of practices. The board plays a key role in overseeing management and can thereby improve the quality of non-financial information disclosed by the firm. Independent members, concerned about protecting their reputation, tend to prioritise greater transparency in disclosure practices, which can reduce opportunistic behaviours at the expense of shareholders.

A large part of the empirical literature confirms that structural characteristics of the board of directors have a significant impact on ESG performance. Independent directors and specialised committees, such as audit or sustainability committees, are among the factors most frequently associated with better reporting quality. Recent studies document a positive and significant

relationship between board independence, sustainability committees and ESG performance, underlining the importance of separating the roles of Chairman and CEO to enhance ESG investment. Al-Shaer & Zaman (2018) further demonstrate that audit committees play a specific role in strengthening the trustworthiness of sustainability reports, reducing the risk of misleading communication and improving the reliability of published information.

The third function, less often formalised but theoretically important, is the signalling function. Spence (1973) states that, in an environment of information asymmetry, investors cannot directly observe the real ESG practices that directors have implemented. They can only rely on observable features of the firm, referred to as "signals", to evaluate the quality of corporate governance. In the ESG context, board composition and characteristics can serve as signals for investors regarding the quality of governance and the sincerity of sustainability commitments. Board characteristics such as independence, gender diversity and tenure not only function as governance instruments, but also as strategic drivers through which firms signal their ESG commitment in an environment that calls for strong external scrutiny. In this way, a well-composed board can influence not only the intrinsic quality of ESG practices, but also the market's perception of that quality, establishing an indirect bridge between governance, reporting and investor reaction.

These three functions, namely strategic, supervision and signalling, converge toward the same conclusion: the effectiveness of the board in terms of ESG does not only depend on its existence or its size, but also on the quality of its composition. Group dynamics and decision-making change according to the profiles of individuals sitting on the board. A group of directors from diverse backgrounds brings together a wider range of knowledge, experiences and perspectives, which strengthens the board's capacity to identify stakeholder needs and interests, ultimately contributing to ESG performance. It is this fundamental intuition that motivates the transition from understanding the role of the board to analysing its diversity, discussed in the next section.

2.3. Board diversity and ESG performance

In the continuity of the central role that the board fulfils in ESG governance, previous research has progressively turned its attention to the composition of the board. The main idea is as follows: if the board influences ESG performance, then the characteristics of its members, particularly their diversity, determine the quality and orientation of these decisions. This perspective is anchored in upper echelons theory (Hambrick & Mason, 1984), according to which the strategic decisions of an organization reflect the values, experiences and cognitive frames of those who lead it. In this regard, board diversity appears to be a factor capable of widening the spectrum of mobilized perspectives, reducing collective biases and improving the integration of sustainability issues into long-term strategic decisions. In this section, each diversity dimension will be studied before formulating the corresponding hypothesis.

2.3.1. Gender diversity

Gender diversity is the most documented dimension in the literature on board composition, due to its visibility and data availability. Multiple theoretical mechanisms explain why the presence of women on boards is associated with better ESG performance.

On one side, stakeholder theory (Freeman, 2010) argues that firms with more representative governance bodies tend to consider the interests of all their stakeholders, including employees, local communities and the environment, when making decisions. Empirical work generally shows that female board representation is positively associated with ESG disclosure, though results vary across industries and sustainability levels (Khemakhem et al., 2023; EmadEldeen et al., 2025). On the other side, resource dependence theory (Pfeffer & Salancik, 2003) underlines that women bring competencies, networks and complementary perspectives that reinforce the board's capacity to identify and manage non-financial risks.

The empirical literature largely validates this positive relationship. Recent studies indicate that companies with at least three female directors display stronger involvement in ESG disclosures, although a symbolic representation of only one or two women can have a negative effect on disclosure scores. This result connects to critical mass theory, according to which the influence of a minority within a group becomes significant only beyond a certain level of representation. Below this level, women can find themselves in a "token" position, included for conformity reasons rather than as true and valuable decision-making actors, which limits their real influence on strategic trajectories (Kanter, 1987; Torchia et al. 2011).

It is also important to note that the literature is not fully consistent. While multiple studies report a positive correlation between gender diversity and ESG practices, others find negative or non-significant results, with divergences explained by differences in governance structures, empirical methodologies, analysis periods and omitted variables. This heterogeneity of results highlights the need for robust econometric methods and the control of potential endogeneity, questioning reverse causality, as companies with well-established ESG practices may also be more inclined to adopt diverse board structures (Gavana et al., 2024). Based on the theoretical evidence developed above, this thesis introduces the following hypotheses:

- *H1a: Higher female board representation is positively associated with ESG performance.*
- *H1b: Higher female board representation is positively associated with market reaction around ESG report publication.*

2.3.2. Board independence

Compared to gender diversity, board independence has received considerable academic attention, both from a theoretical and empirical standpoint. Independent directors are defined as those who have no significant financial, professional or family connections with the firm's management. They are considered one of the most studied governance mechanisms in the corporate finance literature.

Agency theory (Jensen & Meckling, 1976) forms the theoretical foundation for such members. A director with no significant connection with the company's executives has no reason to ignore decisions that would go against shareholders' interests. Unlike internal or affiliated members, whose judgement can be influenced by relational or personal motives, they are supposed to evaluate managerial choices with a less compromised look. This distance from the firm naturally makes them question practices put in place, ask for clarity and transparency, and lead the board toward long-term strategies, including questions on sustainability.

Resource dependence theory (Pfeffer & Salancik, 2003) adds another layer to this reading. These directors do not only check on the company's leadership; they also bring resources that the organization does not have internally such as networks, sector-specific expertise, or experience across different geographical contexts. It is particularly this diversity of profiles that allows the board to address ESG challenges from multiple angles at once and to build relationships with a wider range of stakeholders. A partial correlation can therefore exist between independence and international diversity, as they are frequently recruited beyond national boundaries precisely because of their absence of ties with the firm (Masulis, Wang & Xie, 2012).

On the empirical side, the literature establishes a strong and positive link between the proportion of independent directors and the quality of ESG reporting. Al-Shaer & Zaman (2018) show that audit committees composed of independent directors significantly improve the credibility of sustainability reports, reducing the risk of misleading communication and strengthening the reliability of published information. Liu et al. (2022) also confirm that a board with a higher proportion of independent directors is better able to define ESG strategies and focus on the dimensions that are most material to the firm.

EmadEldeen et al. (2025), who studied United Kingdom companies, identified a positive relationship between ESG report quality among UK firms and board independence, which may confirm that the same governance mechanism can be relevant even if it does not apply to US firms.

Beyond these direct effects on ESG quality, independent directors can also be seen as a signal of credibility to shareholders. As mentioned in section 2.2 earlier, the features of a board are important for governance within an organization, but they can also send a message to shareholders about how committed the organization is to the firm's goals. A larger proportion of independent directors on the board signals to the market that ESG reporting is subject to rigorous and impartial oversight, which can improve investor confidence and reduce the information asymmetry identified in section 2.1 (Spence, 1973; CFA Institute, 2025).

To analyse this section, the following hypotheses are going to be tested:

- *H2a: A greater proportion of independent directors on the board is positively associated with ESG performance.*
- *H2b: A greater proportion of independent directors on the board is positively associated with market reaction around ESG report publication.*

2.3.3. Board tenure

The third dimension leads us toward the average tenure of board members. It is less studied than gender or independence but remains theoretically relevant and has a solid justification. It is based on the idea that directors who have worked longer accumulate a deeper knowledge of the firm's strategic challenges, institutional environment and stakeholder relationships, which may improve their capacity to oversee ESG commitments effectively (Huang & Hilary, 2018).

A first argument in favour of a positive effect of tenure on ESG holds in the continuity of strategy. When listed firms are obligated to adopt new ESG policies, it can take some time to define long-term objectives, build reliable reporting systems and engage in sustainable relationships with stakeholders. Directors with longer tenure accumulate a deeper knowledge of the firm's strategic challenges and institutional environment, which may better equip them to resist short-term pressures and defend long-term commitments whose effects are not immediately visible in financial results (Huang & Hilary, 2018). This is explained by the fact that they already know the firms well. From an institutional perspective, longer tenure may also strengthen familiarity with national governance norms, reporting requirements and cultural expectations, which improves the capacity to align ESG disclosures with currently applicable institutional standards.

However, prior research identifies a risk of excessive tenure, known as entrenchment. From an agency perspective, when members stay on the board for too long, it can lead to entrenchment and reduce supervisory capacity, as long-tenured directors may remain in place due to their connections with the executive team or family shareholders. Directors with overly long tenure can become less receptive to new ESG practices, regulatory changes and investor pressures, which can lead to a form of organizational stagnation in reporting frameworks (CFA Institute, 2025). Excessive tenure can have contradictory effects on the adoption of new sustainability frameworks. The interaction between ESG performance and tenure may potentially be non-linear, increasing positively as experience increases before decreasing beyond a particular level of tenure. (Huang & Hilary, 2018).

On the market reaction side, the signalling value is an important matter to consider. If investors observe the board in terms of its balanced tenure profile, considering the experience accumulated, they might interpret this as a sign of governance stability associated with openness to change, which may strengthen the credibility investors place in ESG reports.

We will study this section by suggesting the following hypotheses:

- *H3a: A longer average board tenure is positively associated with ESG performance.*
- *H3b: Average board tenure is positively associated with market reaction around ESG report publication.*

2.4. From ESG performance to market reaction

The focus of diversity effects on ESG performance cannot be complete without questioning ourselves on how this information is received by financial markets. Indeed, if diverse board members can improve the quality of ESG practices and reporting, a fundamental question remains: do investors indeed perceive and value these signals? This section develops the mechanisms through which ESG performance influences market reaction, identifying the conditions under which this effect is positive, ambiguous or non-existent.

It is important to consider this point of view for a simple reason. If financial markets do not recognise and respond to firms that have an improved ESG performance, the reasoning of this thesis becomes less relevant. The characteristics of the board would impact the ESG performance, but in return, the ESG quality would not have measurable impact on the firm valuation. Therefore, it is necessary to build this relationship so that this study can show that governance quality has a real financial impact, rather than just an internal impact on firm practices (Friede, Busch & Bassen, 2015).

The first link between ESG performance and the market reaction revolves around reduced information asymmetry. This represents the main mechanism underlying this relationship. In an environment where investors can be surrounded by incomplete information about management quality and firms' long-term risks, ESG reports can constitute a non-financial source of information, likely to improve risk assessment. The literature generally maintains that improved ESG transparency can reduce a company's cost of capital, by reducing information asymmetry and investor uncertainty (Raimo et al., 2021).

The more credible and reliable the ESG information is, the more it can allow investors to adjust their expectations of future cash flows and risk premium, which translates into better firm valuation (Raimo et al., 2021).

The empirical research on market reactions to ESG events is rich but heterogeneous in its conclusions (Galema & Gerritsen, 2025). Flammer (2015), in a study of 270 environmental announcements, realized between 1980 and 2009, highlights that communication on ecological initiatives is associated with significant and positive cumulative abnormal returns in the order of 0.84%. These results may indicate that the market reaction is in favour to sustainable involvements, interpreting them as improvement signals of improved future performances and long-term risk reduction.

In a more modern perspective, an analysis on 2,841 MSCI rated securities between 2017 and 2021, demonstrates that downward revisions of ESG ratings are associated with negative buy-and-hold abnormal returns ranging from 2.5% to 3% on an annualized basis, with larger downgrades reaching up to 4.5% per year (Galema & Gerritsen, 2025).

However, other research papers are nuancing this picture. Some works are underlining a lack of significant short-term market reaction, attributing this to the growing and slow integration of ESG information by the market instead of an immediate reaction of the market (Glück, Hübel & Scholz, 2021).

These mixed results are partly explained by a key factor highlighted in section 2.1: the perceived credibility of ESG information. When shareholders question the reliability of a score or suspect greenwashing, their reaction to ESG reporting is logically attenuated or non-existent.

The literature also shows that corporate disclosures can generate strong market reactions even when investors do not all react in the same direction. Beaver (1968) argues that the informational content of a report can be measured through the intensity of market reactions, regardless of whether they are positive or negative. In the ESG context, Glück et al. (2021) confirm that ESG reports trigger heterogeneous investor responses, making the absolute market reaction a relevant complement to the standard directional CAR.

This observation establishes the central link of this study: market reactions to ESG information is not only determined by the score itself, but also by the credibility that investors assign to it, a credibility that is depending, among other factors, on governance quality (i.e., the effectiveness of the board's monitoring, the accountability mechanism and transparency) and the board composition. In this way, board diversity can act as a governance signal, leading to a more positive market reaction to ESG announcements beyond the direct effect of the score itself. (Spence, 1973).

3. Methodology

3.1. Data collection

This study focuses on S&P 500 firms over the 2007–2020 period. The merged dataset gathers four different data sources. ESG scores come from MSCI ESG Ratings, which provide aggregated scores on a 0 to 10 scale for a large base of listed companies (MSCI, 2023). Data on board composition, including the proportion of women directors, board independence, and the average tenure of board members, were retrieved from Bloomberg. Independence data were obtained using annual observations in December, while women-on-board data were collected in October. Financial data and firm identifiers came from COMPUSTAT Fundamentals Annual, and stock return data were sourced from CRSP, based on the PERMNO identifier. The study also includes the disclosure dates of ESG reports (*Creation_Date*), which is used as event dates for the market reaction analysis.

Cumulative abnormal returns, based on the three-factor Fama and French model calibrated over the estimation window starting 315 days before the announcement and ending 62 days before the release date, were also provided in the database along with the other financial variables. CAR is thus already calculated.

A limitation must be taken into account in the sample structure. Bloomberg data on board independence and board tenure were not reliably available before 2015. Therefore, H1a and H1b, the hypotheses testing the gender dimension, are estimated over the full 2007–2020 period. H2a, H2b, H3a, and H3b, on the other hand, are estimated over the 2015–2020 sub-period. The sample contains 416 firms and 1,667 firm-year observations, resulting in an unbalanced panel, reflecting the entry and exit of listed companies and the year-to-year availability of Bloomberg data. The number of observations differs across the different dimensions because of missing values and limited availability of Bloomberg variables.

All continuous variables are winsorized at the 1st and 99th percentiles to limit the influence of extreme observations on the estimates (Wooldridge, 2010).

3.2. Variables

A descriptive table of the variables, which can be found in Appendix Table A, presents the full set of variables, their definitions, and the sources used in this thesis. The following subsections explain in detail the choice of each variable and the rationale behind it.

3.2.1. Dependent Variables

ESG performance

The first dependent variable is the aggregated MSCI ESG score, expressed on a 0 to 10 scale. The score represents a firm's capacity to manage ESG risks and opportunities that are financially material in its sector relative to its peers. MSCI builds these scores through a predefined rules-based methodology that explicitly considers sectoral materiality, making it suitable for cross-sectional comparisons over a long period (MSCI, 2023; Khan et al., 2016).

Berg, Kölbel, and Rigobon (2022) identify significant divergences among rating agencies and show that the agencies have a correlation of only 0.54. This finding justifies the need for a consistent single provider throughout the entire analysis period.

Market reaction

The second dependent variable is cumulative abnormal returns (CAR), calculated over four event windows, namely CAR[-1,+1], CAR[-2,+2], CAR[-5,+5], and CAR[-60,+60] around the ESG report publication date. The shorter windows capture the immediate reaction of investors after the release of ESG disclosures, while the longer window allows for a more gradual integration of ESG information, consistent with evidence that price adjustments to ESG rating revisions may occur only several months after the publication date (Glück, Hübel, & Scholz, 2021).

3.2.2. Independent Variables

Gender diversity (H1)

The first independent variable is gender diversity. This variable is measured as the proportion of female directors on the board of directors. The use of a continuous indicator (the percentage) rather than a binary indicator allows the detection of potential effects associated with critical mass theory (Kanter, 1987; Torchia et al. 2011), which predicts that minority representation does not influence board decisions before a minimum level of representation is reached.

Board Independence (H2)

Board independence is measured on a 0–10 scale as provided by Bloomberg, where a score of 10 indicates that all board members are independent. The sample average of 9.33 corresponds to approximately 93% independent directors, consistent with governance standards among large S&P 500 firms. Independent directors are normally defined as members who do not have any financial, professional, or familial connections with the firm or its management. From an agency theory perspective, the absence of such ties allows a more rigorous and impartial oversight of managerial decisions, which can be expected to improve the credibility and quality of ESG disclosures (Jensen & Meckling, 1976; Al-Shaer & Zaman, 2018). As explained by

resource dependence theory in the previous sections, independent directors also bring external networks, diverse expertise, and complementary viewpoints that reinforce the board's capacity to handle ESG challenges from different angles and maintain relationships with global stakeholders (Pfeffer & Salancik, 2003).

Average board tenure (H3)

The third independent variable, average board tenure, is measured as the average tenure of current board members. This data is provided by Bloomberg as an annual snapshot, meaning that the value corresponding to a given year is linked to the board composition at a specific point in time, rather than representing an average over the entire financial year. The relationship between tenure and ESG performance remains theoretically ambiguous. At moderate levels, longer tenure may indicate accumulated experience and a commitment to long-term sustainability objectives, reducing the board's reactivity to changes in ESG standards (Huang & Hilary, 2018). However, beyond a certain level, excessive tenure may lead to entrenchment, meaning that directors may respond less effectively to new ESG practices, regulatory changes, and investor pressure (Huang & Hilary, 2018; CFA Institute, 2025).

3.2.3. Control Variables

A standard set of firm-level control variables is included to isolate the effect of board diversity from other characteristics that could influence ESG performance and market reaction. Two separate sets of control variables are used: one for the ESG performance regressions and one for the market reaction regressions, reflecting the different nature of the two dependent variables.

For the ESG performance regressions (H1a, H2a, H3a), considered control variables are included. Firm size is determined as the natural logarithm of total assets. Larger firms face greater attention from stakeholders and normally have more resources to invest in ESG practices (Berg et al., 2022; EmadEldeen et al., 2025).

Financial performance is measured by return on assets and Tobin's Q. Firms with stronger financial profiles may show greater engagement in ESG activities (Raimo et al., 2021). Financing constraints are corresponds to financial leverage, calculated as total debt divided by total assets, since high debt can reduce a firm's capacity to allocate resources to sustainability investments (Raimo et al., 2021).

To address information asymmetry, analyst coverage is measured as the natural logarithm of one plus the number of financial analysts following the firm (Raimo et al., 2021).

The firm's innovation orientation is captured by the intensity of research and development expenses, defined as R&D expenditures divided by sales. More innovative firms may display a higher propensity to engage in ESG practices.

Finally, earnings volatility (VOLAT), measured as the standard deviation of return on assets over a five-year period, is expected to be negatively associated with ESG engagement, because

financially unstable firms are likely to lack both the resources and the incentives to invest in long-term sustainability commitments (Galema & Gerritsen, 2025).

For the market reaction regressions (H1b, H2b, H3b), the control variables capture the determinants of stock price movements around ESG report publication dates. In addition to firm size, return on assets, financial leverage, and Tobin's Q, two market-specific variables are included. Momentum, described as the one-year cumulative abnormal return over the trading window [-375, -10] days before the ESG report publication date, is included as a control for the pre-existing trend in stock returns that may independently influence the market reaction to ESG disclosures (MacKinlay, 1997; Flammer, 2015).

Earnings surprise, defined as the spread between the analysts' consensus earnings per share forecast and the actual earnings per share, divided by the stock price at the end of the previous year, controls for concurrent earnings announcements that may contaminate the market reaction around ESG publication dates (Galema & Gerritsen, 2025). Liquidity, measured as the number of shares traded divided by the total number of shares outstanding, is also included because it affects the speed and magnitude of price adjustments to new information (Galema & Gerritsen, 2025).

Year and firm fixed effects are included in the ESG performance to absorb time-invariant sectoral characteristics and common macroeconomic shocks affecting all firms (Berg et al., 2022). Accordingly, the analysis examines whether, within the same firm, a year in which the proportion of women on the board is higher than average is also a year in which the ESG score is stronger, once common time trends and firm-specific heterogeneity are controlled for.

3.3. ESG performance regressions (H1a, H2a, H3a)

To test H1a to H2a and H3a, the following two-way fixed effects panel regression is estimated:

$$ESGscore_{it} = \alpha + \beta_1 BoardDiversity_{it-1} + \beta_2 Controls_{it-1} + \mu_i + \lambda_t + \varepsilon_{it}$$

where i represents the firm and t the year. μ_i denotes firm fixed effects and λ_t year fixed effects. The board diversity variable is successively replaced by the proportion of female directors for H1a, board independence for H2a, and average tenure for H3a.

The board diversity measures and control variables are lagged by one year to limit the risk of reverse causality, ensuring that the independent variables precede the dependent variable. Standard errors are clustered at the firm level, to make sure that observations from the same firm are not independent across years, consistent with Petersen (2009).

Reverse causality is the main econometric concern of this thesis. Firms with a stronger ESG culture may be more likely to appoint diverse directors, as diversity may already be embedded in the organizational culture, which would bias OLS estimates upward (Gavana et al., 2024).

Two strategies are implemented to address this issue. First, all board diversity measures are lagged by one year relative to the ESG score. Second, alternative lag structures are estimated as robustness tests to control for unobserved firm characteristics that remain constant over time.

Prior to estimation, variance inflation factors are computed to verify the absence of severe multicollinearity among the regressors. All VIF values remain well below 5, confirming that multicollinearity does not represent a concern for the reliability of the estimates or the results (Hair et al., 2010; Wooldridge, 2010).

3.4. Market reaction regressions (H1b, H2b, H3b)

To test H1b, H2b, and H3b, an event study methodology is used to isolate the stock market reaction around ESG report publication dates from normal market movements (MacKinlay, 1997; Flammer, 2015; Galema & Gerritsen, 2025).

For cumulative abnormal returns (CAR), four event windows are considered: $[-1, +1]$, $[-2, +2]$, $[-5, +5]$, and $[-60, +60]$, to capture both the immediate market reaction and the gradual price adjustment documented by Glück, Hübel, and Scholz (2021). This multi-window approach is standard in ESG event studies (Flammer, 2015; Galema & Gerritsen, 2025).

The CARs are then regressed on the board diversity measures and control variables in a cross-sectional OLS regression:

$$CAR_i[\tau_1, \tau_2] = \alpha + \beta_1 \text{BoardDiversity}_i + \beta_2 \text{Controls}_i + \varepsilon_i$$

The coefficient β_1 represents the relationship between board diversity and the market reaction around ESG disclosures, after controlling for firm characteristics that may affect governance quality and stock price movements. Heteroskedasticity-robust standard errors are used in this cross-sectional regression.

To complete the standard CAR analysis, absolute cumulative abnormal returns $|CAR|$ are computed as complementary variables:

$$|CAR|_{[T1, T2]} = \sum AR_{it}$$

Unlike standard CAR, which captures the direction of the market reaction, $|CAR|$ measures its intensity regardless of sign. The following regression is estimated:

$$|CAR_i[\tau_1, \tau_2]| = \alpha + \beta_1 \text{BoardDiversity}_{i, t-1} + \beta_2 \text{Controls}_i + \varepsilon_i$$

A significant correlation between board diversity and $|CAR|$ would mean that a more diversified board triggers a stronger market reaction to ESG disclosures, regardless of whether investors interpret this information positively or negatively (Beaver, 1968).

3.5. Robustness tests

Two robustness tests are conducted to assess the stability of the main results.

First, a Hausman test is conducted to explain the use of firm fixed effects over random effects. It assesses whether the assumption $\text{Cov}(X_{it}, \alpha_i) = 0$ holds. The null hypothesis assumes that firm-specific effects are uncorrelated with the explanatory variables, making random effects both consistent and efficient.

If the null hypothesis is rejected, this assumption is violated and fixed effects become more appropriate for this thesis (Hausman, 1978). The Hausman test is carried out on H1a as the reference specification, as it covers the longest period and offers the greatest statistical power for comparing the two estimators.

Second, the board diversity variables, such as independence, tenure, and gender, are lagged by two years instead of one year to test whether the effect of governance dimensions on ESG performance operates over a longer period. If the results remain stable under the alternative specification, this provides evidence that the findings are not sensitive to the choice of lag length (Wooldridge, 2010; Gavana et al., 2024)

4. Results

4.1. Descriptive statistics

The final sample is composed of 416 S&P 500 firms on the 2007-2020 period, representing up to 1667 year-firms' observations. The used panel is unbalanced, reflecting the progressive entry and exit of companies in the index and the availability of Bloomberg data across the years. Descriptive statistics for all variables are reported in Appendix A. To test H2a and H3a, sub-periods are used, covering 2015 to 2020, containing 934 and 990 observations respectively.

The average of the MSCI ESG score over the entire period is 5.30 out of 10, with sectional dispersion, consistent with heterogeneity in ESG performance talked by Berg et al. (2022). We can observe a low average percentage of female directors of 22.23%, which can reflect and confirm the well-documented underrepresentation of women in the corporate governance within this period. If we look at the Board independence figures, we can see that it averages around 93 %, which corresponds to what the governance standards typically say among large S&P 500 firms. The average tenure in the board is approximatively 8 years and a half, which suggests that most of directors are composed of experienced members with more recently appointed directors.

Cumulative abnormal returns across the four event windows are all near zero on average, which is expected for abnormal returns in an efficient market. However, dispersion increases with the length of the event window, particularly for CAR ± 60 days, indicating heterogeneous market reactions to ESG report disclosures.

Lastly, the Variance Inflation Factors (VIF) shows no evidence of important multicollinearity between the independent and control variables, whether it is for the ESG performance or for the market reaction. All VIF stays well below the threshold of 5, which is recommended by Hair et al. (2010) and Wooldridge (2010), confirming that multicollinearity is not a threat to the estimates and the results. (see appendix B and C).

4.2. ESG performance results (H1a, H2a and H3a)

The table 1 shows the results on the two-way fixed effects panel regressions for H1a, H2a and H3a, with the MSCI ESG scores, described as the dependent variables.

For the H1a, coefficient on the proportion of women directors is positive but not statistically significant, with $\beta = 0.003$ and a standard error of 0.012. This result is not in line with the hypothesis, arguing that an increase in gender diversity within the firm is related to an improvement in its ESG score over time.

The second hypothesis (H2a), concerning the board independence, also has a positive coefficient, but is not statistically significant ($\beta = 0.081$, $SE = 0.069$) therefore, it is not confirmed by the data.

For the third hypothesis (H3a), the average tenure of the board shows a positive but non-significant coefficient ($\beta = 0.033$, $SE = 0.044$), which does not give the support needed for the within-firm effect of the tenure on ESG performance.

Across all three specifications, the models are jointly significant, based on the F-statistic.

However, the adjusted R^2 values stay low, indicating that the diversity variables explain only a limited share of the within-firm variation in ESG scores over time (Wooldridge, 2010). Analyst coverage shows a positive and marginally significant association with ESG performance in H2a and H3a ($\beta = 0.031$, $p < 0.1$ and $\beta = 0.030$, $p < 0.1$ respectively), suggesting that firms with greater analyst following tend to have higher ESG scores. In addition, volatility displays a negative and statistically significant coefficient across all specifications, suggesting that financially unstable firms tend to exhibit lower ESG performance.

These non-significant results are further discussed in the discussion section considering the structural nature of board diversity, which grow slowly within firms over time and is therefore largely absorbed by firm fixed effects.

Table 1 — ESG Performance Regressions			
Dependent variable: ESG Score (MSCI, 0–10)			
Variable	H1a: (1)	Gender H2a: Independence (2)	H3a: Tenure (3)
Independent variables			
pct_women_lag	0.003		
	(0.012)		
board_indep_lag		0.081	
		(0.069)	
avg_tenure_lag			0.032
			(0.044)
Control variables			
ROA_lag	0.026*	0.002	0.002
	(0.016)	(0.011)	(0.011)
LEV_lag	-0.012	-0.010	-0.010
	(0.012)	(0.008)	(0.008)
Tobin_lag	-0.060	0.118	0.128
	(0.123)	(0.091)	(0.090)
ln_size_lag	0.288	-0.154	-0.131
	(0.362)	(0.406)	(0.386)
NoA_lag	0.022	0.031*	0.030*
	(0.021)	(0.018)	(0.017)
RD_lag	0.009	0.035	0.032
	(0.044)	(0.031)	(0.031)
VOLAT_lag	-0.021**	-0.020***	-0.019***
	(0.008)	(0.005)	(0.004)
Model statistics			
Observations	1,606	934	990
R ²	0.018	0.039	0.038
Adjusted R ²	-0.329	-0.524	-0.563
F Statistic	2.763***	3.004***	2.977***
Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Two-way fixed effects (firm + year). Clustered SE at firm level. All variables lagged one year.			

4.3. Market reaction results (H1b, H2b, H3b)

The tables 2, 3 and 4 show the cross-sectional OLS regression results for H1b, H2b and H3b, with cumulative abnormal returns over four event windows, represented as the dependent variables.

H1b Hypothesis

Across all four event windows, the proportion of female directors (H1b) has a positive coefficient but bears no significant relationship with abnormal returns around ESG report publication dates. H1b is rejected.

Table 2 — Gender Diversity and Market Reaction (H1b)				
Dependent variable: Cumulative Abnormal Return (CAR)				
Variable	±1 (1)	day ±2 (2)	days ±5 (3)	days ±60 (4)
Independent variable				
pct_women_lag	0.0001	0.0001	-0.00005	-0.00001
	(0.0001)	(0.0002)	(0.0002)	(0.0004)
Control variables				
ROA_w	0.0007**	0.0006	0.0013**	0.0017
	(0.0003)	(0.0004)	(0.0005)	(0.0011)
LEV_w	-0.0001	-0.00003	-0.00004	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Tobin_w	-0.0018*	-0.0021	-0.0047**	-0.0049
	(0.0010)	(0.0014)	(0.0019)	(0.0039)
ln_size_w	-0.0018*	-0.0018	0.0008	0.0075**
	(0.0009)	(0.0012)	(0.0017)	(0.0035)
NoA	0.0001	-0.0001	-0.0004	-0.0009
	(0.0002)	(0.0003)	(0.0004)	(0.0008)
MOMENTUM	0.0014	-0.0047	-0.0115*	-0.0773***
	(0.0038)	(0.0050)	(0.0068)	(0.0141)
SURPRISE	0.0079*	0.0026	0.0205**	0.0106
	(0.0047)	(0.0063)	(0.0085)	(0.0178)
LIQUID	-0.0010	0.0001	0.0009	-0.0021
	(0.0008)	(0.0011)	(0.0015)	(0.0030)
Constant	0.0155*	0.0165	-0.0041	-0.0552
	(0.0090)	(0.0119)	(0.0161)	(0.0336)
Model statistics				
Observations	399	399	399	399
R ²	0.0330	0.0219	0.0404	0.1120
Adjusted R ²	0.0107	-0.0007	0.0182	0.0914
F Statistic	1.4765	0.9673	1.8177*	5.4510***
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Cross-sectional OLS. Board diversity variable lagged one year.				

H2b hypothesis

For H2b, the coefficient on the board independence is positive, but stays non-significant across all windows. Which suggests that having more independent directors is not significantly associated with stronger market reactions around ESG report publication dates.

Table 3 — Board Independence and Market Reaction (H2b)				
Dependent variable: Cumulative Abnormal Return (CAR)				
Variable	±1 day (1)	±2 days (2)	±5 days (3)	±60 days (4)
Independent variable				
board_indep_lag	0.0008 (0.0010)	0.0003 (0.0012)	0.0002 (0.0018)	-0.0002 (0.0032)
Control variables				
ROA_w	0.0006** (0.0003)	0.0007* (0.0004)	0.0013** (0.0006)	0.0010 (0.0010)
LEV_w	-0.0001 (0.0001)	-0.00003 (0.0001)	-0.00003 (0.0001)	-0.0002 (0.0002)
Tobin_w	-0.0018 (0.0011)	-0.0021 (0.0013)	-0.0045** (0.0020)	-0.0026 (0.0035)
ln_size_w	-0.0016 (0.0010)	-0.0009 (0.0013)	0.0013 (0.0019)	0.0087*** (0.0033)
NoA	-0.00002 (0.0002)	-0.0002 (0.0003)	-0.0005 (0.0004)	-0.0007 (0.0007)
MOMENTUM	0.0009 (0.0046)	-0.0021 (0.0056)	-0.0107 (0.0082)	-0.1024*** (0.0144)
SURPRISE	0.0084 (0.0052)	0.0064 (0.0064)	0.0220** (0.0094)	-0.0044 (0.0165)
LIQUID	-0.0009 (0.0009)	-0.0001 (0.0011)	0.0010 (0.0016)	0.0004 (0.0027)
Constant	0.0110 (0.0135)	0.0087 (0.0165)	-0.0126 (0.0244)	-0.0767* (0.0427)
Model statistics				
Observations	333	333	333	333
R ²	0.0354	0.0211	0.0409	0.1795
Adjusted R ²	0.0085	-0.0062	0.0142	0.1566
F Statistic	1.3163	0.7719	1.5313	7.8504***
*p<0.1; **p<0.05; ***p<0.01. Cross-sectional OLS. Board diversity variable lagged one year.				

H3b Hypothesis

For H3b, average board tenure has negative coefficients over the short windows and a positive coefficient over the sixty-day window, but none of these estimates reach statistical significance. H3b is therefore not supported in this thesis.

In terms of the control variables, firm size is negatively significant, which means there is a negative association with short-term CAR and a significant positive association with the sixty-day CAR, suggesting that bigger firms experience more gradual market adjustments following ESG disclosures. Returns on assets are positively significant and associated with short-term CARs in all three specifications, consistent with the fact that financial performance partially conditions investors reactions to ESG information.

Table 4 — Board Tenure and Market Reaction (H3b)				
Dependent variable: Cumulative Abnormal Return (CAR)				
Variable	±1 day (1)	±2 days (2)	±5 days (3)	±60 days (4)
Independent variable				
avg_tenure_lag	-0.0003	-0.0006	-0.0005	0.0014
	(0.0004)	(0.0005)	(0.0007)	(0.0013)
Control variables				
ROA_w	0.0006**	0.0006	0.0013**	0.0017*
	(0.0003)	(0.0004)	(0.0005)	(0.0010)
LEV_w	-0.0001	-0.00004	-0.0001	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Tobin_w	-0.0017	-0.0020	-0.0046**	-0.0045
	(0.0010)	(0.0014)	(0.0019)	(0.0038)
ln_size_w	-0.0012	-0.0009	0.0010	0.0068*
	(0.0009)	(0.0012)	(0.0017)	(0.0035)
NoA	0.00002	-0.0002	-0.0005	-0.0007
	(0.0002)	(0.0003)	(0.0004)	(0.0008)
MOMENTUM	-0.0016	-0.0095*	-0.0150**	-0.0755***
	(0.0039)	(0.0051)	(0.0070)	(0.0143)
SURPRISE	0.0077	0.0038	0.0213**	0.0091
	(0.0047)	(0.0062)	(0.0086)	(0.0175)
LIQUID	-0.0008	0.0002	0.0008	-0.0019
	(0.0008)	(0.0011)	(0.0015)	(0.0030)
Constant	0.0145	0.0168	-0.0026	-0.0659*
	(0.0100)	(0.0133)	(0.0182)	(0.0373)
Model statistics				
Observations	385	385	385	385
R ²	0.0281	0.0292	0.0476	0.1100
Adjusted R ²	0.0048	0.0059	0.0248	0.0886
F Statistic	1.2050	1.2523	2.0830**	5.1481***
* <i>p</i> <0.1; ** <i>p</i> <0.05; *** <i>p</i> <0.01. Cross-sectional OLS. Board diversity variable lagged one year.				

Absolute CAR

The following tables 5,6 and 7, present the results using the absolute CAR as the dependent variable. Gender diversity shows a negative and significant association with $|CAR|_{\pm 60d}$ ($\beta = -0.0008$, $p < 0.05$), suggesting that firms with greater female board representation may generate more predictable ESG disclosures, leading to lower investor surprise and less pronounced long-term market reactions.

For the remaining two dimensions, which are Board independence and average tenure, their results stay non-significant in all absolute CAR windows, consistent with directional CAR results.

Table 5 — Gender Diversity and Absolute Market Reaction (H1b — $ CAR $)				
Dependent variable: Absolute Cumulative Abnormal Return $ CAR $				
Variable	± 1 day (1)	± 2 days (2)	± 5 days (3)	± 60 days (4)
Independent variable				
pct_women_lag	0.00002 (0.0001)	0.0001 (0.0001)	0.0002 (0.0002)	-0.0008** (0.0004)
Control variables				
ROA_w	-0.00001 (0.0002)	-0.0002 (0.0003)	-0.0001 (0.0004)	-0.0009 (0.0010)
LEV_w	-0.00002 (0.0001)	0.00001 (0.0001)	0.00002 (0.0001)	-0.0001 (0.0002)
Tobin_w	-0.0003 (0.0009)	-0.0008 (0.0011)	-0.0005 (0.0015)	-0.0009 (0.0036)
ln_size_w	0.0008 (0.0008)	-0.0005 (0.0010)	-0.0014 (0.0013)	-0.0079** (0.0032)
NoA	-0.0001 (0.0002)	0.0002 (0.0002)	0.0002 (0.0003)	0.0011 (0.0007)
MOMENTUM	-0.0041 (0.0031)	-0.0111*** (0.0040)	-0.0059 (0.0053)	0.0376*** (0.0131)
SURPRISE	-0.0009 (0.0039)	-0.0028 (0.0051)	-0.0003 (0.0067)	0.0122 (0.0165)
LIQUID	0.0004 (0.0007)	0.0001 (0.0009)	-0.00002 (0.0011)	-0.0030 (0.0028)
Constant	0.0056 (0.0073)	0.0176* (0.0096)	0.0312** (0.0126)	0.1285*** (0.0311)
Model statistics				
Observations	399	399	399	399
R ²	0.0112	0.0257	0.0097	0.0699
Adjusted R ²	-0.0117	0.0031	-0.0132	0.0484
F Statistic	0.4895	1.1391	0.4255	3.2489***
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Cross-sectional OLS. Dependent variable is absolute CAR. Board diversity variable lagged one year.				

Table 6 — Board Independence and Absolute Market Reaction (H2b — CAR)				
Dependent variable: Absolute Cumulative Abnormal Return CAR				
Variable	±1 day (1)	±2 days (2)	±5 days (3)	±60 days (4)
Independent variable				
board_indep_lag	0.0007	0.0008	0.0023	-0.0003
	(0.0008)	(0.0010)	(0.0014)	(0.0031)
Control variables				
ROA_w	-0.0001	-0.0002	-0.0003	-0.0014
	(0.0003)	(0.0003)	(0.0004)	(0.0009)
LEV_w	-0.00004	-0.000001	-0.000001	0.00003
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Tobin_w	-0.0002	-0.0006	-0.0003	-0.0004
	(0.0009)	(0.0011)	(0.0016)	(0.0034)
ln_size_w	0.00005	-0.0014	-0.0022	-0.0098***
	(0.0009)	(0.0010)	(0.0015)	(0.0032)
NoA	-0.00003	0.0003	0.0002	0.0015**
	(0.0002)	(0.0002)	(0.0003)	(0.0007)
MOMENTUM	-0.0031	-0.0063	-0.0065	0.0607***
	(0.0038)	(0.0044)	(0.0065)	(0.0140)
SURPRISE	-0.0034	-0.0044	-0.0019	-0.0058
	(0.0043)	(0.0050)	(0.0074)	(0.0160)
LIQUID	0.0003	-0.0001	-0.0006	-0.0029
	(0.0007)	(0.0008)	(0.0012)	(0.0026)
Constant	0.0077	0.0214	0.0254	0.1209***
	(0.0111)	(0.0130)	(0.0192)	(0.0414)
Model statistics				
Observations	333	333	333	333
R ²	0.0098	0.0176	0.0181	0.0987
Adjusted R ²	-0.0178	-0.0097	-0.0093	0.0736
F Statistic	0.3566	0.6443	0.6615	3.9294***
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Cross-sectional OLS. Dependent variable is absolute CAR. Board diversity variable lagged one year.				

Table 7 — Board Tenure and Absolute Market Reaction (H3b — CAR)				
Dependent variable: Absolute Cumulative Abnormal Return CAR				
Variable	±1 day (1)	±2 days (2)	±5 days (3)	±60 days (4)
Independent variable				
avg_tenure_lag	-0.00002	-0.0001	-0.0001	-0.0001
	(0.0003)	(0.0004)	(0.0005)	(0.0012)
Control variables				
ROA_w	-0.00005	-0.0001	-0.0001	-0.0008
	(0.0002)	(0.0003)	(0.0004)	(0.0010)
LEV_w	-0.00002	0.00001	0.00004	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Tobin_w	-0.0002	-0.0006	-0.0004	-0.0015
	(0.0008)	(0.0011)	(0.0015)	(0.0035)
ln_size_w	0.0005	-0.0006	-0.0011	-0.0114***
	(0.0008)	(0.0010)	(0.0013)	(0.0032)
NoA	-0.00002	0.0002	0.0002	0.0017**
	(0.0002)	(0.0002)	(0.0003)	(0.0007)
MOMENTUM	-0.0026	-0.0095**	-0.0089	0.0441***
	(0.0031)	(0.0041)	(0.0056)	(0.0133)
SURPRISE	-0.0015	-0.0031	0.0003	0.0109
	(0.0038)	(0.0051)	(0.0068)	(0.0163)
LIQUID	0.0004	0.0003	-0.00001	-0.0039
	(0.0007)	(0.0009)	(0.0012)	(0.0028)
Constant	0.0085	0.0214**	0.0325**	0.1410***
	(0.0082)	(0.0108)	(0.0145)	(0.0347)
Model statistics				
Observations	385	385	385	385
R ²	0.0059	0.0195	0.0102	0.0776
Adjusted R ²	-0.0180	-0.0040	-0.0136	0.0554
F Statistic	0.2471	0.8292	0.4274	3.5047***
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Cross-sectional OLS. Dependent variable is absolute CAR. Board diversity variable lagged one year.				

4.4. Robustness tests

The Hausman test allows us to compare the fixed effects and random effects estimators for H1a. This test rejects the null hypothesis at the 5% level ($\chi^2 = 18.035$, $df = 8$, $p = 0.021$), confirming that fixed effects is the appropriate specification. Full results are reported in Appendix D. We can therefore assume that unobserved firm-specific characteristics, such as company's culture and history, can be correlated with the board diversity variables. (Hausman, 1978; Wooldridge, 2010).

Table 8 presents the results of the two-year lag robustness test. When board diversity variables are lagged by two years instead of one, the coefficients remain virtually unchanged across all three dimensions of diversity, with values and standard errors that almost are identical to those of the main specification. Gender diversity, board independence and average tenure stay non-significant at conventional levels, confirming that the results are not sensitive to the choice of lag length and that the absence of a significant within-firm effect holds over a longer time horizon.

Table 8 — Robustness: Two-Year Lag			
Dependent variable: ESG Score (MSCI, 0–10)			
Variable	H1a lag2: Gender (1)	H2a lag2: Independence (2)	H3a lag2: Tenure (3)
Independent variables (2-year lag)			
pct_women_lag2	0.007 (0.010)		
board_indep_lag2		0.081 (0.069)	
avg_tenure_lag2			0.032 (0.044)
Control variables (1-year lag)			
ROA_lag	0.001 (0.011)	0.002 (0.011)	0.002 (0.011)
LEV_lag	-0.010 (0.008)	-0.010 (0.008)	-0.010 (0.008)
Tobin_lag	0.131 (0.090)	0.118 (0.091)	0.128 (0.090)
ln_size_lag	-0.158 (0.398)	-0.154 (0.406)	-0.131 (0.386)
NoA_lag	0.032* (0.018)	0.031* (0.018)	0.030* (0.017)
RD_lag	0.033 (0.031)	0.035 (0.031)	0.032 (0.031)
VOLAT_lag	-0.019*** (0.004)	-0.020*** (0.005)	-0.019*** (0.004)
Model statistics			
Observations	989	934	990
R ²	0.037	0.039	0.038
Adjusted R ²	-0.567	-0.524	-0.563
F Statistic	2.932***	3.004***	2.977***
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Two-way fixed effects (firm + year). Clustered SE at firm level. Board diversity lagged two years.			

5. Discussion

5.1. Interpretation of the results

The aim of this study is to examine how board diversity, covering gender, independence, and tenure, relates to both ESG performance and market reaction around ESG report publication dates. Across all main specifications, none of the three dimensions shows significant results. The following paragraphs discuss what these findings mean.

A lack of significance does not mean that board diversity has no effect on ESG performance. It rather suggests that diversity effects are more visible when comparing firms with different board compositions than when looking at changes within the same firm over time. A company that has maintained a diverse board over time is likely to do better on ESG than a similar firm with a less diverse one, but this difference is absorbed by the firm fixed effect and therefore cannot be detected in a within-firm analysis. Upper echelons theory (Hambrick & Mason, 1984) supports this: board characteristics tend to reflect stable organizational values that change slowly rather than from one year to the next.

The non-significant results for H1b, H2b, and H3b follow the same logic. If board diversity has no visible effect on within-firm ESG performance, it is hard to expect it to produce a clear market signal around report publication dates. When investors react to an ESG report, they are responding to new information about sustainability performance, not to board features that have been stable and publicly known for years. Board characteristics such as gender diversity, independence and tenure may still play an indirect role, however, influencing how shareholders read ESG disclosures rather than driving immediate price movements. This is consistent with Galema & Gerritsen (2025), who found that the impact of ESG rating changes unfolds gradually over several months rather than immediately, and with the mixed evidence on ESG market reactions discussed in section 2.4.

Among the control variables, the positive and significant relationship between analyst coverage and ESG performance in H2a and H3a suggests that firms under closer external scrutiny tend to invest more in ESG, likely because analyst attention raises the cost of poor sustainability practices. The significant association between firm size and cumulative abnormal returns across event windows reflects the fact that larger firms already operate in a well-documented information environment, leaving less room for a single ESG report to move the market.

The only significant finding in the market reaction analysis concerns the absolute CAR. The negative coefficient on gender diversity in the $|CAR|_{\pm 60d}$ specification shows that firms with more women on the board tend to generate smaller market reactions to ESG disclosures over a 60-day window. This is consistent with signalling theory (Spence, 1973): gender-diverse boards may produce ESG reports that investors see as more credible and predictable, which reduces surprise and lowers the size of the market reaction over time.

Two broader factors may also help explain the overall absence of significant results. The first is timing. Before 2015, ESG reporting was largely voluntary and uneven, which made it harder for investors to get clear signals from disclosures Berg et al. (2022). The rise of frameworks such as the PRI and the TCFD, pushed forward by the Paris Agreement, has since made ESG reporting more standardized and relevant to investment decisions (Berg et al., 2022). The link between board diversity and ESG outcomes may therefore have become stronger in recent years, beyond what our sample period covers.

The second factor is sector. ESG topics do not matter equally across industries. In sectors like energy, utilities, and basic materials, where regulatory and reputational risks are high, board governance is more likely to affect both ESG scores and investor reactions (Khan et al., 2016). In sectors where ESG is less central to day-to-day operations, like technology or financial services, these effects tend to be weaker. By grouping all S&P 500 firms together without accounting for sector differences, the analysis may hide patterns that a more focused approach would capture.

5.2. Limitations

Despite the rigour of the approach adopted in this study, several limitations must be considered to interpret the results with appropriate nuance.

The first and most significant limitation is the use of firm fixed effects, which, while methodologically appropriate to control for unobserved heterogeneity, absorbs most of the variation in board diversity variables, due to their structural and slowly evolving nature. This design choice limits the ability to detect between-firm effects, which may be where the true influence of board diversity on ESG performance may be most visible. Future research could use between-firm or cross-sectional analyses to better capture the structural dimension of governance diversity.

The second limitation concerns the sample composition. The study focuses solely on S&P 500 firms, composed of the largest and most visible companies in the United States. These firms are subject to particularly strong governance pressures and have generally adopted more diverse board structures than smaller firms. This selection bias may reduce the variance in board diversity within the sample and limit the generalizability of the findings to smaller firms or firms operating in different institutional contexts. As such, the sample is less likely to be representative of the broader population of firms, as smaller or less visible companies are systematically excluded, potentially skewing the results toward firms with already well-established ESG and governance practices.

The third limitation relates to the measurement of board diversity variables. Bloomberg data on board independence and average tenure are only reliably available from 2015 onwards, which restricts H2a, H2b, H3a and H3b to a six-year sub-period. This shorter period reduces the statistical power of the estimates and may limit the capacity to detect effects that operate over longer horizons. Additionally, average tenure captures the central tendency of the tenure distribution but does not reflect its dispersion. A board where some members have served for

decades while others were just appointed may show the same average tenure as a board where everyone has served for a similar length of time. However, these two boards are likely to function very differently in practice.

The fourth limitation concerns the ESG scores used as the main dependent variable. MSCI ESG scores are proprietary and subject to an access fee, which restricts the replicability of the study to researchers with access to this database. Moreover, as shown by Berg et al. (2022), ESG scores differ considerably across rating providers, with an average cross-provider correlation of only 0.54. The results of this study are therefore specific to the MSCI methodology and may not hold when using alternative providers such as Sustainalytics. Future research could test the robustness of these findings using alternative ESG rating sources.

The fifth limitation concerns the time period covered in this thesis. Bloomberg diversity data is only available from 2015, which reduces our analysis to six years (2015-2020) instead of seventeen years. This short window may be insufficient to capture the gradual evolution of how firms integrate ESG in investment decisions, given that shareholders' sensitivity to ESG disclosures has increased significantly in recent years. At the same time, the study does not take into account the sector heterogeneity in ESG materiality, which may mask sector-specific dynamics that a more targeted analysis would have revealed.

A further limitation may be potential endogeneity concerns that cannot be fully resolved in this thesis. Even though the use of firm fixed effects and lagged variables help to manage issues of reverse causality, it does not entirely reduce them. Unobserved time-varying factors, such as modifications in corporate strategy or external governance pressures, may still simultaneously impact both board composition and ESG outcomes. As a result, the estimated coefficients should be interpreted as associative rather than causal (Wooldridge, 2010).

Finally, this study does not formally test for sectoral heterogeneity in the effects of board diversity. The materiality of ESG issues varies substantially across industries, and the effect of board diversity on ESG performance and market reaction may be more pronounced in sectors where ESG challenges are financially material, such as energy or financial services (Khan et al., 2016; CFA Institute, 2025). This may constitute a promising avenue for future research.

5.3. Recommendations for future research

The results of this study open several areas for future research. First, future studies could adopt a between-firm design or a cross-sectional approach to capture the structural dimension of board diversity, which is not detectable in a within-firm fixed effects framework. Comparing firms with persistently diverse boards to firms with persistently homogeneous boards over long periods would provide a more direct test of the governance diversity hypothesis.

Second, the extension of the analysis to a mandatory ESG reporting context, such as the European regulatory framework introduced by the Corporate Sustainability Reporting Directive, would allow researchers to assess whether the legal obligation to disclose ESG information amplifies the role of board governance in determining reporting quality and investor reactions.

Third, future research could examine the interaction effects between different dimensions of board diversity, exploring whether specific combinations of gender diversity, independence and tenure produce governance dynamics that are qualitatively different from what each dimension achieves individually. This would require larger samples and longer time series than those available in the present thesis.

Lastly, future studies could investigate whether the relationship between board diversity, ESG performance and market reaction varies across time periods and industries. Focusing on the post-2015 period could reveal whether investor sensitivity to board governance has strengthened over time. Similarly, sector-specific analyses in high-materiality industries could uncover heterogeneous effects that are obscured in cross-sector samples.

Finally, future studies could also test if board diversity impacts market reaction not in a direct way, but through the quality and credibility of ESG disclosures, meaning that shareholders react to the content of the report instead of the board characteristics themselves.

6. Conclusion

This thesis analysed the effect of a multidimensional approach to board diversity, combining gender, board independence and average tenure, on both ESG performance and market reaction around ESG report publication dates. Based on a sample of 416 S&P 500 firms and 1,667 firm-year observations over the 2007 to 2020 period, the thesis used two-way fixed effects panel regressions for the ESG performance hypotheses and cross-sectional OLS regressions for the market reaction hypotheses.

The results indicate that none of the three board diversity dimensions has a significant effect on ESG performance or on cumulative abnormal returns, regardless of the event window retained. The absence of significant within-firm effects should be interpreted as evidence that board diversity is a structural characteristic of the firm, evolving slowly over time and largely absorbed by firm fixed effects.

However, one notable exception emerges from the absolute CAR analysis, where gender diversity displays a negative and significant association with absolute cumulative abnormal returns over the 60-day window, suggesting that firms with greater female board representation may produce more predictable ESG disclosures, thereby reducing informational surprise for investors over longer horizons.

This does not directly mean that diversity has no impact on ESG outcomes, but rather that this effect might be better captured by comparing firms with different governance profiles than by monitoring changes within the same firm year after year.

This result interpretation contributes to the literature on the structural dimension of corporate governance and its relationship with sustainability performance.

This study also contributes to the academic literature in two ways. First, it adopts a multidimensional approach to board diversity, analysing gender, independence and tenure as distinct governance dimensions, whereas most existing papers focus on a single dimension. Second, it links board diversity not only to ESG performance but also to market reaction, creating a separation between the internal effects on sustainability outcomes and external effects on investor perception.

From a practical perspective, these findings suggest that regulators and investors should be careful about using observable board characteristics as direct measures for ESG commitment or reporting quality. The structural nature of diversity within the board suggests that its effects on ESG outcomes are more likely to emerge over the long run and across firms, rather than through short-run within-firm changes. As mandatory reporting frameworks such as the CSRD are now progressively implemented and adopted, future research will be better positioned to assess whether standardized disclosure requirements strengthen the observable link between board governance and ESG performance.

These results therefore raise wider research questions about the conditions under which the governance of the board is linked with measurable ESG improvements and market signals. Future research should examine the between-firm dimension of governance diversity, explore mandatory reporting contexts such as the CSRD framework, and investigate potential interaction effects between diversity dimensions that go beyond what individual measures can capture.

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8. Appendix

Appendix A: Descriptive Statistics

Appendix A — Descriptive Statistics (Sub-period 2015–2020)					
Variable	N	Mean	Std. Dev.	Min	Max
Dependent Variables					
ESG Score (0–10)	1,667	5.297	2.228	0.000	10.000
CAR ±1d	1,667	0.000	0.022	−0.195	0.145
CAR ±2d	1,667	0.001	0.029	−0.185	0.227
CAR ±5d	1,667	0.000	0.041	−0.235	0.225
CAR ±60d	1,667	−0.001	0.117	−0.611	0.641
Board Diversity Variables					
Female Directors (%)	1,606	22.230	9.034	0.000	58.333
Board Independence (0–10)	934	9.326	1.178	3.930	10.000
Average Tenure (years)	1,247	8.594	3.063	0.430	22.690
Control Variables					
ROA (%)	1,667	6.605	6.281	−29.575	34.931
Leverage (%)	1,667	27.401	16.127	0.000	100.095
Tobin's Q	1,667	2.160	1.352	0.597	13.586
Number of Analysts	1,667	15.711	7.182	3.000	47.000
Size	1,667	72,455,912	237,729,300	218,832	2,687,379,000
R&D	1,667	4.289	7.112	0.000	40.060
Volatility	1,667	3.530	14.753	0.029	553.029
Momentum	1,667	−0.011	0.484	−3.365	2.281
Surprise	1,667	0.062	0.242	0.000	1.000
Liquidity	1,667	2.213	1.536	0.067	20.477
Notes: All continuous variables are winsorized at the 1st and 99th percentiles. Sub-period covers 2015–2020.					

Appendix B: VIF (ESG Regressions)

Appendix B — Variance Inflation Factors: ESG Performance Regressions	
Variable	VIF
Female Directors (%)	1,131
Board Independence (%)	1,287
Average Tenure (years)	1,228
ROA	1,696
Leverage	1,088
Tobin's Q	2,231
Size (ln)	1,534
Number of Analysts	1,375
R&D	1,302
Volatility	1,06
Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. All VIF values are well below the conventional threshold of 5, confirming the absence of multicollinearity.	

Appendix C: VIF (Market Reaction Regression)

Appendix C — Variance Inflation Factors: Market Reaction Regressions	
Variable	VIF
Female Directors (%)	1,086
ROA	2,807
Leverage	1,048
Tobin's Q	2,13
Size (ln)	1,875
Number of Analysts	1,785
Momentum	1,039
Surprise	1,819
Liquidity	1,412
Notes: All VIF values are well below the conventional threshold of 5, confirming the absence of multicollinearity in the market reaction models.	

Appendix D: Hausman Test

Appendix D — Hausman Test: Fixed Effects vs Random Effects	
	Value
Chi-squared	18.035
Degrees of freedom	8
p-value	0.0210
Conclusion	Fixed effects preferred ($p < 0.05$)
<i>Note: H_0: Random effects are consistent. Rejection of H_0 ($p < 0.05$) supports the use of fixed effects (firm + year two-way FE).</i>	

Appendix E: R-Code

```
# =====
# MASTER THESIS - R SCRIPT
# Gender, Independence, and Tenure Effects on ESG Scores and CAR
# =====

library(tidyverse)
library(plm)
library(lmtest)
library(sandwich)
library(DescTools)
library(stargazer)
library(car)

setwd("C:/Users/adeli/OneDrive/Documents/Thesis guidance")
panel <- read.csv("panel_final (2).csv", stringsAsFactors = FALSE)

cat("Obs:", nrow(panel), "\n")
cat("Firms:", n_distinct(panel$ticker), "\n")
cat("Period:", min(panel$year), "to", max(panel$year), "\n")

# Winsorize
panel <- panel %>%
  mutate(
    pct_women_w = Winsorize(pct_women, probs = c(.01, .99), na.rm = TRUE),
    board_independence_w = Winsorize(board_independence, probs = c(.01, .99), na.rm =
TRUE),
    avg_tenure_w = Winsorize(avg_tenure, probs = c(.01, .99), na.rm = TRUE),
    ROA_w = Winsorize(ROA, probs = c(.01, .99), na.rm = TRUE),
```

```

LEV_w = Winsorize(LEV, probs = c(.01, .99), na.rm = TRUE),
Tobin_w = Winsorize(Tobin, probs = c(.01, .99), na.rm = TRUE),
ln_size_w = Winsorize(log(SIZE), probs = c(.01, .99), na.rm = TRUE)
)

# Lags
panel <- panel %>%
  arrange(ticker, year) %>%
  group_by(ticker) %>%
  mutate(
    ROA_lag = lag(ROA_w),
    LEV_lag = lag(LEV_w),
    Tobin_lag = lag(Tobin_w),
    ln_size_lag = lag(ln_size_w),
    NoA_lag = lag(NoA),
    RD_lag = lag(RD),
    VOLAT_lag = lag(VOLAT),
    pct_women_lag = lag(pct_women_w),
    board_indep_lag = lag(board_independence_w),
    avg_tenure_lag = lag(avg_tenure_w)
  ) %>%
  ungroup()

panel_full <- panel
panel_sub <- filter(panel, year >= 2015)

pdata_full <- pdata.frame(panel_full, index = c("ticker", "year"))
pdata_sub <- pdata.frame(panel_sub, index = c("ticker", "year"))

# ESG regressions
controls_esg <- "ROA_lag + LEV_lag + Tobin_lag + ln_size_lag + NoA_lag + RD_lag +
VOLAT_lag"

h1a <- plm(as.formula(paste("ESGscore ~ pct_women_lag +", controls_esg)),
  data = pdata_full, model = "within", effect = "twoways")

h2a <- plm(as.formula(paste("ESGscore ~ board_indep_lag +", controls_esg)),
  data = pdata_sub, model = "within", effect = "twoways")

h3a <- plm(as.formula(paste("ESGscore ~ avg_tenure_lag +", controls_esg)),
  data = pdata_sub, model = "within", effect = "twoways")

se_h1a <- sqrt(diag(vcovHC(h1a, type = "HC1", cluster = "group")))
se_h2a <- sqrt(diag(vcovHC(h2a, type = "HC1", cluster = "group")))

```

```

se_h3a <- sqrt(diag(vcovHC(h3a, type = "HC1", cluster = "group")))

stargazer(h1a, h2a, h3a, type = "text", se = list(se_h1a, se_h2a, se_h3a),
  column.labels = c("H1a", "H2a", "H3a"),
  dep.var.labels = "ESG Score",
  title = "ESG Performance Regressions")

# Event sample
panel_event <- panel %>%
  filter(!is.na(CAR1) & !is.na(pct_women_lag)) %>%
  arrange(ticker, desc(year)) %>%
  distinct(ticker, .keep_all = TRUE) %>%
  mutate(
    absCAR1 = abs(CAR1),
    absCAR2 = abs(CAR2),
    absCAR5 = abs(CAR5),
    absCAR60 = abs(CAR60)
  )

controls_car <- "ROA_w + LEV_w + Tobin_w + ln_size_w + NoA + MOMENTUM +
SURPRISE + LIQUID"

# CAR regressions
h1b_car1 <- lm(as.formula(paste("CAR1 ~ pct_women_lag +", controls_car)), data =
panel_event)
h1b_car2 <- lm(as.formula(paste("CAR2 ~ pct_women_lag +", controls_car)), data =
panel_event)
h1b_car5 <- lm(as.formula(paste("CAR5 ~ pct_women_lag +", controls_car)), data =
panel_event)
h1b_car60 <- lm(as.formula(paste("CAR60 ~ pct_women_lag +", controls_car)), data =
panel_event)

stargazer(h1b_car1, h1b_car2, h1b_car5, h1b_car60, type = "text",
  column.labels = c("CAR1", "CAR2", "CAR5", "CAR60"),
  title = "Gender Diversity and Market Reaction")

# Absolute CAR regressions
h1b_abscar1 <- lm(as.formula(paste("absCAR1 ~ pct_women_lag +", controls_car)), data =
panel_event)
h1b_abscar2 <- lm(as.formula(paste("absCAR2 ~ pct_women_lag +", controls_car)), data =
panel_event)
h1b_abscar5 <- lm(as.formula(paste("absCAR5 ~ pct_women_lag +", controls_car)), data =
panel_event)

```

```

h1b_abscar60 <- lm(as.formula(paste("absCAR60 ~ pct_women_lag +", controls_car)), data
= panel_event)

stargazer(h1b_abscar1, h1b_abscar2, h1b_abscar5, h1b_abscar60, type = "text",
  column.labels = c("|CAR1|", "|CAR2|", "|CAR5|", "|CAR60|"),
  title = "Gender Diversity and Absolute Market Reaction")

# Robustness: 2-year lag
panel_lag2 <- panel_sub %>%
  arrange(ticker, year) %>%
  group_by(ticker) %>%
  mutate(
    pct_women_lag2 = lag(pct_women_w, 2),
    board_indep_lag2 = lag(board_independence_w, 2),
    avg_tenure_lag2 = lag(avg_tenure_w, 2)
  ) %>%
  ungroup()

pdata_lag2 <- pdata.frame(panel_lag2, index = c("ticker", "year"))

rc2_h1 <- plm(as.formula(paste("ESGscore ~ pct_women_lag2 +", controls_esg)),
  data = pdata_lag2, model = "within", effect = "twoways")

rc2_h2 <- plm(as.formula(paste("ESGscore ~ board_indep_lag2 +", controls_esg)),
  data = pdata_lag2, model = "within", effect = "twoways")

rc2_h3 <- plm(as.formula(paste("ESGscore ~ avg_tenure_lag2 +", controls_esg)),
  data = pdata_lag2, model = "within", effect = "twoways")

stargazer(rc2_h1, rc2_h2, rc2_h3, type = "text",
  column.labels = c("Lag2 H1a", "Lag2 H2a", "Lag2 H3a"),
  title = "Robustness: Two-Year Lag")

cat("Done.\n")

```

This thesis examines the effect of multidimensional board diversity, combining gender, board independence and average tenure, on both ESG performance and market reaction around ESG report publication dates. Using a sample of 416 S&P 500 firms over the 2007 to 2020 period, representing 1,667 firm-year observations, the study employs two-way fixed effects panel regressions for the ESG performance hypotheses and cross-sectional OLS regressions for the market reaction hypotheses. The study uses cumulative abnormal returns (CAR) computed using the Fama-French three-factor model across four event windows.

The results indicate that none of the three dimensions of board diversity have a significant effect on ESG performance or cumulative abnormal returns in the main specifications. One exception stands out: over the 60-day window, greater female representation on the board is associated with less pronounced market reactions around ESG report publication dates, suggesting that these firms communicate in a more readable and predictable way for investors.

These findings are interpreted in light of the fact that board diversity changes slowly over time and is largely absorbed by firm fixed effects, which means its effect on ESG outcomes shows up more clearly when comparing firms with different governance profiles than when tracking changes within the same firm. This study adds to the existing literature by looking at board diversity through multiple dimensions at once and by connecting governance characteristics to both ESG performance and investor reaction.

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