



Research article

Substitutes or complements? The role of the board in moderating the relationship between board diversity and earnings management

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Abstract: The influence of board diversity on earnings quality has received growing attention from scholars and regulators, yet findings remain inconclusive. Much of this uncertainty stems from a narrow focus on visible diversity traits such as gender and age, while overlooking deeper characteristics like education, tenure, and experience. Additionally, limited research has examined how board functions, specifically their monitoring and advisory roles, moderate the relationship between diversity and financial reporting outcomes. This study addresses these gaps by integrating insights from agency theory, human capital theory, and resource dependence theory to evaluate how diversity influences board effectiveness. The research examines publicly listed companies with single-tier board structures across six developed economies: Australia, Singapore, Hong Kong, Canada, the United Kingdom, and the United States. The analysis excludes financial and utility sectors and covers the period from 2016 to 2020. Using a composite diversity index based on surface- and deep-level attributes, the study tests three hypotheses regarding the impact of board diversity and the moderating role of board functions. Statistical analyses employ panel regression models with firm, industry, country, and year fixed effects, alongside two-stage least squares estimation to address endogeneity. The results show that board diversity is associated with reduced accrual-based earnings manipulation but increased real activity-based earnings management, indicating a substitution effect. However, boards with strong monitoring and advisory roles can counteract both forms of manipulation. The most effective governance configuration includes three monitoring committees and one advisory committee, with monitoring roles exerting a greater influence. These findings

highlight the importance of integrating structural diversity with functional board design to enhance earnings quality. The study advocates for governance frameworks that go beyond symbolic diversity, emphasizing the need for strategic role alignment and robust non-financial disclosures to improve transparency and corporate accountability.

Keywords: corporate governance; board diversity; board roles; earnings management; substitutes; complements

JEL Codes: C33, G32, G34, M14, M4

1. Introduction

The prominence of corporate governance (CG) in academic discourse has grown significantly in recent decades, largely in response to a series of corporate failures and financial scandals (Banbhan et al., 2018). These events have not only destabilized markets but also eroded investor confidence, leading to substantial financial losses (Chen, 2014). Consequently, stakeholders—particularly shareholders and institutional investors—have become more attentive to governance practices, expecting transparency, accountability, and effective oversight mechanisms (Mertzanis et al., 2019). Given that the implementation of CG is predominantly driven by the Board of Directors (the board), its composition and effectiveness have become focal points in governance research (Wagana & Nzulwa, 2016).

There have been multiple studies exploring independently the various dimensions of board diversity in which we are interested. For example, Harahap (2025) found that representation by female CEOs on the board has a negative impact on earnings management. Likewise, they found that CEO tenure has a negative effect on earnings management. Further, Tessema & Abou-El-Sood (2025) found that gender diversity on the board is negatively associated with earnings management. Similar results were reported by Ajina et al. (2025), Muhhamad et al. (2025), and Primacintya & Kusma (2025), inter alia. In addition, others have explored the impact of education level (Zouari & Khilfi, 2025; Chi & Gooda, 2004), age (Davidson et al., 2007; Komal et al., 2023), and professional experience (Jian et al., 2013; Ege et al., 2022) on earnings management.

From a theoretical standpoint, as individuals on the board of directors have multiple backgrounds and experiences, we would anticipate different impacts on performance and the level of earnings management. For example, we might expect gender diversity to have a negative impact on earnings management; women have been seen to strengthen the quality of the earnings information presented in a company's financial statements (Harahap, 2025) because they tend to constrain opportunistic reporting (Tessema & Abou-El-Sood, 2025). Likewise, we expect longer-tenured directors to be less aggressive in reporting earnings (Harahap, 2025). Previous work finds inconsistencies in the explanatory power of board member characteristics, for example, on educational background, e.g., “the CEO having a Top-25 undergraduate degree negatively affects ROA, [but] the CEO having a Top-10 graduate degree has a positive effect on ROA” (Qi et al., 2018, p.146).

Considering foreign investments, the overseas investor is subject to information asymmetry, which might cause them to be more cautious and to undertake earnings management (cf. Han et al., 2022). Ashraf & Qian (2021) summarized the advantages that overseas investors can impart as a knowledge of foreign corporate governance, a better understanding of international capital markets, and the ability to take an independent stance in critically scrutinizing the managers' behavior. Alqatan (2024) found that the presence of foreigners does not affect earnings management, so there is no requirement to have them on the board. Conflicts in findings amongst researchers are partially explained by Qi et al. (2018) as being due to the focus on individual rather than group characteristics, but more work needs to be done.

Among the various elements of board structure, diversity has received increasing attention: it is thought to enhance decision-making quality by integrating varied perspectives, experiences, and problem-solving approaches (Milliken & Martins, 1996). While prior studies have linked board diversity to various corporate outcomes, the findings remain inconsistent (Alhossini et al., 2020). One reason may be the prevailing focus on surface-level diversity attributes (e.g., gender, age, ethnicity) at the expense of deep-level traits (e.g., education, expertise, professional experience) (Almutairi & Quttainah, 2019; Hillman, 2015). A more comprehensive view that integrates both dimensions may yield more robust insights into the relationship between board diversity and corporate outcomes.

Of particular interest is the influence of board characteristics on earnings quality. Financial reporting plays a critical role in stakeholders' decision-making processes, from investment valuation to regulatory compliance (Menicucci, 2020). The manipulation of earnings emerged as a salient topic following increased scrutiny by the US Securities and Exchange Commission (SEC) in the 1990s. Subsequent corporate scandals prompted CG reforms across jurisdictions, such as the Cadbury Report (UK, 1992), SOX (US, 2002), ASX (Australia, 2007), and NZX (New Zealand, 2007) (Banbhan et al., 2018).

In line with agency and resource dependence theories, boards perform two primary roles: monitoring management to reduce agency costs and advising executives to support strategic decision-making (Forbes & Milliken, 1999). Emerging research suggests that board diversity can enhance both functions. Gender diversity, for instance, may foster greater scrutiny and richer strategic input (Nielsen & Huse, 2010), while age and educational diversity can promote balanced perspectives and access to broader resource networks (Kim & Lim, 2010). Hence, board roles may moderate the impact of diversity on earnings quality.

This study posits that CG mechanisms operate not in isolation but as part of an integrated governance system. Drawing on the complementarity perspective (Aguilera et al., 2008; Tosi, 2008), we argue that the interplay between board diversity and board roles influences earnings quality more effectively than either mechanism alone. The central research question is the following: Do board roles moderate the relationship between board diversity and earnings quality? The study makes four key contributions:

1. it extends diversity analysis to deep-level attributes,
2. constructs a composite board diversity index,
3. examines board roles as moderators, and
4. analyzes multiple forms of earnings management.

Through this integrative framework, we aim to deepen the understanding of governance effectiveness in enhancing financial reporting quality.

1.1. Theoretical underpinnings of corporate governance and board diversity

Corporate governance (CG) has long been a focal point of scholarly investigation due to its critical role in shaping corporate behavior, performance, and accountability. Despite this, no singular theoretical lens offers a fully comprehensive understanding of how CG mechanisms affect corporate outcomes (Carpenter & Feroz, 1992). Historically, agency theory has dominated the discourse, serving as the primary framework for interpreting boardroom dynamics and managerial behavior (Filatotchev & Boyd, 2009; Gull et al., 2018; Zona & Zattoni, 2007). Nonetheless, while agency theory has offered valuable insights, it has significant limitations in providing a holistic view of governance systems (Eisenhardt, 1989). To develop a more robust and comprehensive understanding, this study adopts an integrative theoretical approach by incorporating agency theory, human capital theory, and resource dependence theory, which facilitates a deeper examination of the role of Board diversity in influencing earnings management.

Human capital theory, initially advanced by Becker (1962), conceptualizes human capital as the knowledge, skills, experience, and education embedded within individuals, which are accumulated over time and can contribute to productivity and organizational performance. The incomparable human capital of directors serves as a strategic asset, enhancing organizational competitiveness (Nguyen et al., 2017). Literature suggests that such attributes, when manifested through board diversity, can positively influence various corporate outcomes, including financial reporting quality, corporate disclosure, and firm performance (Alhossini et al., 2020; Terjesen et al., 2009).

Nonetheless, despite its theoretical promise, the application of human capital theory in corporate governance studies remains relatively limited. Empirical evidence has not yet reached a consensus as to the extent to which individual human capital attributes of board members translate into improved governance outcomes (Nguyen et al., 2020). Thus, this study contributes to the literature by extending the application of human capital theory within the context of board diversity and earnings management, particularly focusing on the cumulative effect of directors' demographic and cognitive attributes.

Agency theory, grounded in the seminal work of Jensen and Meckling (1976), is based on the inherent conflict between principals (shareholders) and agents (managers). The separation of ownership and control creates potential for managerial opportunism, wherein agents may act in their own interest at the expense of shareholders. This divergence underscores the importance of the Board of Directors as a monitoring mechanism. However, in widely held corporations, dispersed shareholding often limits the ability of shareholders to exert direct control, thus amplifying the board's role in ensuring managerial accountability.

Empirical findings on the relationship between board diversity and earnings quality under agency theory have been inconclusive. Several studies report positive associations between diverse boards and higher earnings quality (e.g., Alexeyeva, 2024; Almutairi & Quttainah, 2019; García-Sánchez et al., 2017; Mustafa et al., 2018; Nguyen et al., 2020), while others highlight adverse outcomes (Carter et al., 2010; Sharifah, 2012). Such contradictory evidence suggests that board diversity may exert complex and context-specific influences on governance outcomes, warranting a more nuanced investigation.

Resource dependence theory further enriches this analysis by viewing the firm as an open system that relies on external resources for its survival and growth (Pfeffer & Salancik, 1978). This theory suggests that the board serves not only a monitoring function but also plays a resource-providing role,

facilitating access to critical external linkages, information, and capital. Scholars argue that the demographic and cognitive diversity of directors enhances the board's capacity to provide these resources (Hillman et al., 2002; Terjesen et al., 2009). The board thus functions as a strategic intermediary between the firm and its environment, enhancing the firm's adaptability and resilience.

Indeed, diverse boards are believed to bring heterogeneous perspectives to decision-making, which can yield either synergistic benefits or coordination costs (Anderson et al., 2011). Such diversity has been shown to foster innovative problem-solving, but it may also complicate consensus-building processes. Therefore, here we use resource dependence theory as a complementary lens to investigate whether board diversity acts as a strategic resource that can improve the quality of financial reporting.

In summary, each of the three theoretical frameworks—human capital, agency, and resource dependence theory—offers distinct yet complementary insights into the potential influence of board diversity on earnings management. Collectively, they form a comprehensive framework for understanding how individual and firm-level characteristics interact to shape corporate financial outcomes (Terjesen et al., 2009). Figure 1 illustrates the theoretical framework used in this study.

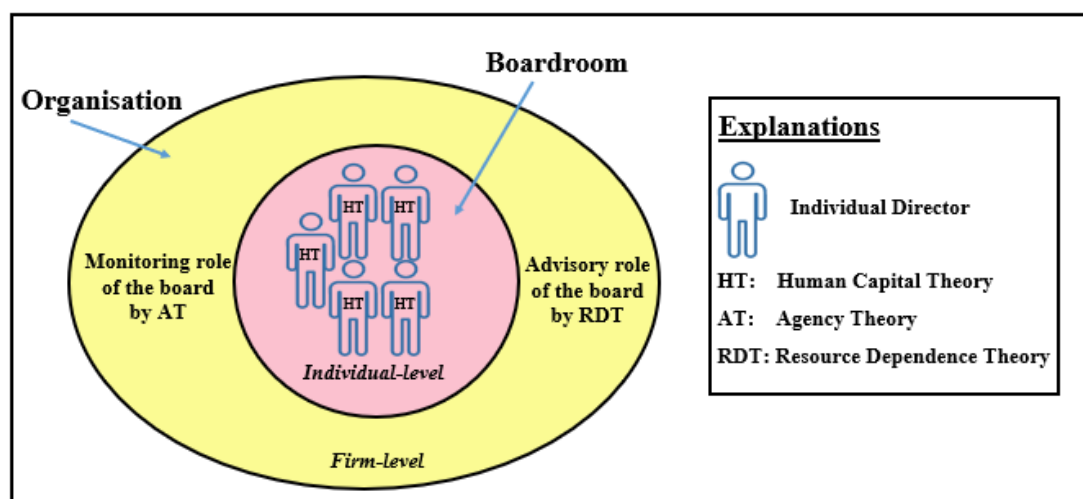


Figure 1. A multi-theory application.

The figure conceptually maps the relationships among the three theories and their collective influence on earnings management. Human capital theory addresses director-level attributes. Agency theory considers the board's role in mitigating managerial opportunism. Resource dependence theory highlights the strategic value of board members' connections and capabilities. At the individual level, the directors' unique skills and experiences (human capital) constitute the foundation of diversity. At the firm level, agency theory elucidates monitoring needs, while resource dependence theory highlights advisory and strategic functions.

1.2. Earnings management

Earnings management is a critical concern in corporate governance research due to its potential to distort financial reporting and mislead stakeholders. It is broadly defined as the deliberate

intervention into financial reporting by management to achieve specific objectives, often at the expense of transparency and reliability (Healy & Wahlen, 1999; Schipper, 1989). Earnings management can be dichotomized into two main types: accrual-based earnings management (AEM) and real earnings management (REM) (Thi, 2025).

AEM refers to the manipulation of accounting entries through discretionary accruals. Managers may exploit the flexibility inherent in accounting standards to overstate or understate earnings by altering provisions, depreciation schedules, or revenue recognition criteria. In contrast, REM involves manipulating actual business operations, such as overproduction, delaying maintenance, or cutting R&D spending, to influence reported earnings. Braam (2015), Fields et al. (2001), and Mnif and Ben Hamouda (2020) argued that focusing exclusively on either AEM or REM could lead to underestimating the true extent of earnings manipulation. Managers often use both strategies in tandem to achieve targeted financial outcomes. Therefore, a comprehensive analysis of earnings management should encompass both AEM and REM.

Earnings management undermines the integrity of financial statements, compromises investor confidence, and may obscure the firm's underlying economic performance. As such, the presence of effective CG mechanisms, including a diverse and well-functioning board, plays a crucial role in constraining managerial discretion and preserving the quality of financial reporting. Whilst we acknowledge above that individual characteristics of board members can influence earnings management, we have not yet broached whether this will be identical for both real and accruals-based earnings management. There are reasons to anticipate a trade-off between the willingness of the board to manage earnings according to real events rather than through accruals (Ali & Kamardin, 2018; Cohen et al., 2008). For example, as Cohen and Zarowin (2010) pointed out, "accrual-based earnings management is more likely to draw auditor or regulatory scrutiny than real decisions, such as those related to product pricing, production, and expenditures on R&D or advertising [whilst] ... relying on accrual manipulation alone is risky ... [because] the realized shortfall between unmanaged earnings and the desired threshold can exceed the amount by which it is possible to manipulate accruals after the end of the fiscal period". Ferentinou & Anagnostopoulou (2016) also suggested that firms will replace AEM with REM following the mandatory adoption of international accounting standards, as IFRS will impose tighter restrictions than home-based regulation (cf. Ippino & Parbonetti, 2017).

1.3. Board diversity and earnings management

Boardroom diversity encompasses a range of demographic, cognitive, and experiential attributes among directors. Van der Walt and Ingley (2003) conceptualized board diversity as a combination of human and social capital, including gender, age, ethnicity, education, and professional experience, that collectively enhance the board's governance capabilities. Diversity fosters broader perspectives, encourages more comprehensive oversight, and improves decision-making, thereby mitigating the risk of earnings management (Adams & Ferreira, 2009; Terjesen et al., 2009; Upadhyay et al., 2014).

While the theoretical rationale for the benefits of board diversity is strong, empirical findings remain mixed. Some studies indicate that diversity strengthens monitoring and advisory capabilities, thereby deterring opportunistic behavior (e.g., Abdelsalam & Street, 2007; Gull et al., 2018; Orazalin, 2019; Srinidhi et al., 2011; Strydom et al., 2016). Conversely, other research suggests that diversity

may impair group cohesion and communication, thereby reducing board effectiveness (e.g., Martinez-Jimenez et al., 2020; Yang, 2011; Walker et al., 2015).

A major limitation in existing research is its predominant focus on singular attributes of diversity, such as gender or education, without considering their combined influence. This approach has led to fragmented findings that are difficult to reconcile (Hoang et al., 2017). In response, recent studies advocate for the use of composite diversity indices that can capture the multidimensional nature of board diversity (Ben-Amar et al., 2013; Hafsi & Turgut, 2012; Onuoha et al., 2021). Building upon this integrated perspective, the present study adopts a composite measure of board diversity to examine its impact on earnings management. Based on the theoretical discussion and prior empirical evidence, the following hypothesis is proposed:

H1: There is a negative relationship between board diversity and earnings management.

1.4. The moderating role of board functions

The functional responsibilities of the board can be broadly categorized into monitoring and advisory roles (Adams & Ferreira, 2007; Faleye et al., 2011). These roles not only influence firm outcomes directly but may also moderate the relationship between board diversity and earnings management. Therefore, we suggest that the board's ability to perform these roles effectively conditions the extent to which board diversity influences earnings management.

1.4.1. Monitoring role of the board

Agency theory underscores the monitoring function as being essential for reducing agency costs and aligning managerial actions with shareholder interests (Jensen & Meckling, 1976). The board is expected to oversee management, scrutinize financial reports, and ensure compliance with regulations. A diverse board may enhance this function by bringing varied skills and viewpoints to bear on oversight activities (Labelle et al., 2010; Onuoha et al., 2021).

The presence of individuals with diverse backgrounds can enrich board deliberations and increase the likelihood of detecting irregularities in financial reporting. Moreover, board capital, which comprises directors' skills, knowledge, and expertise, has been empirically linked to effective monitoring (Hillman & Dalziel, 2003). Empirical studies also find that boards with active monitoring committees are associated with enhanced market valuation and reduced earnings manipulation (Ntim, 2013; Upadhyay et al., 2014). Given the pivotal role of board monitoring in governance, we propose the following hypothesis:

H2: The monitoring role of the Board of Directors improves the effect of board diversity on earnings management.

1.4.2. The advisory role of the board

The advisory role of the board of directors is conceptually underpinned by resource dependence theory, which emphasizes the strategic interface between an organization and its external environment. This theoretical perspective suggests that firms are not self-sufficient entities but are embedded in an

external environment characterized by uncertainty, competition, and the need for critical resources. In this context, firms must engage in strategic actions to secure resources necessary for survival, growth, and competitive advantage (Pfeffer & Salancik, 1978; Onuoha et al., 2021). Resource dependence theorists argue that the Board of Directors serves as a vital link between the organization and its environment by facilitating access to external knowledge, legitimacy, and other critical resources (Hillman et al., 2009).

The composition of the board is central to its ability to perform this advisory function effectively. A diverse board, which comprises individuals with varying skills, knowledge, experience, perspectives, and cognitive approaches, is more likely to bring a wider array of information and strategic insights into the decision-making process (Labelle et al., 2010; Onuoha et al., 2021). This diversity enriches the advisory capacity of the board by enhancing its ability to challenge managerial assumptions, identify strategic opportunities, and respond more effectively to environmental complexities. In essence, the presence of cognitively and experientially diverse directors increases the board's collective problem-solving capacity and strategic guidance capabilities (Hillman et al., 2009).

Moreover, the board's advisory role is reinforced through the concept of board capital, as articulated by Hillman and Dalziel (2003). Board capital is defined as the aggregation of two interrelated dimensions: human capital and relational capital. Human capital refers to directors' individual attributes, such as expertise, education, industry knowledge, and professional experience. Relational capital, on the other hand, encompasses directors' social networks, reputations, and affiliations with other firms and stakeholders. The combination of these two forms of capital enhances the board's ability to provide valuable counsel, link the firm to external resources, and support executive decision-making.

From a resource dependence perspective, a well-composed and diverse board is instrumental in helping the firm navigate resource constraints and capitalize on environmental opportunities. This is achieved by leveraging directors' external linkages, professional standing, and industry-specific knowledge to attract investments, forge partnerships, and align firm strategies with broader market and regulatory trends (Daily et al., 2003; Hillman et al., 2009). In doing so, the advisory role of the board transcends mere consultation and evolves into a strategic function that complements the firm's leadership and enhances corporate governance outcomes.

Importantly, the advisory function of the board also intersects with corporate financial practices, including earnings management. The presence of directors who bring diverse and substantive advisory capital may mitigate the likelihood of opportunistic managerial behavior by improving the quality of strategic decision-making and enhancing the credibility of financial reporting processes. In this way, the board's advisory capacity, shaped by diversity and board capital, can indirectly constrain earnings manipulation by increasing managerial accountability and promoting ethical standards in reporting (Labelle et al., 2010; Onuoha et al., 2021).

Based on the foregoing discussion, it is reasonable to imagine that the board's advisory role moderates the relationship between board diversity and earnings management. A diverse board, when equipped with strong advisory capacity, can leverage its heterogeneous knowledge base and external linkages to influence corporate reporting practices positively. Thus:

H3: The advisory role of the Board of Directors improves the effect of board diversity on earnings management.

2. Materials and methods

2.1. Data collection procedure

This study employs secondary data obtained from established proprietary databases to examine the relationship between board diversity and earnings management practices. Specifically, financial statement data were sourced from S&P Capital IQ (2021) and Datastream International (2021), a service provided by Refinitiv. Board characteristic data were collected from BoardEx (2021) and S&P Capital IQ (2021). The time frame covered in this study spans five years, from 2016 to 2020, and the analysis focuses on publicly listed companies across six developed economies: Australia, Singapore, Hong Kong, Canada, the United Kingdom (UK), and the United States (US).

The selection of these six countries is grounded in both theoretical and empirical considerations within the corporate governance (CG) literature. Prior studies (Baker et al., 2020; Nguyen et al., 2020) consistently showed that developed economies dominate CG scholarship, with the UK, US, and Australia producing substantial academic output on board structures and attributes. Historically, these nations have served as institutional leaders in CG reforms, such as the Cadbury Report in the UK and major regulatory responses to corporate scandals in the US and Australia in the early 2000s. At the same time, there has been increasing scholarly interest in Asia-Pacific markets, particularly Singapore and Hong Kong, which represent developed Asian economies with sophisticated regulatory environments and growing influence in CG research (Zheng & Kouwenberg, 2019). Importantly, all six countries employ a one-tier board structure, commonly referred to as the Anglo-American model, ensuring comparability across jurisdictions (Khan et al., 2020; Tian & Smith, 2020). This structural consistency avoids complications associated with comparing one-tier and two-tier systems, where monitoring and management functions are institutionally separated. By selecting six developed markets from different regions but with harmonized board functions, the study provides a comprehensive and internationally relevant context for analyzing board characteristics and financial reporting behavior. This multi-country design also responds to calls for more research examining board diversity and CG practices across different developed economies rather than relying solely on single-country evidence (Baker et al., 2020; Terjesen et al., 2009).

Industries that fall within the financial and utility sectors are excluded from the sample. The rationale for this exclusion lies in the distinctive regulatory frameworks that govern these industries, which can significantly influence corporate financial behavior and governance practices. The decision aligns with standard practice in earnings management and CG literature, where such exclusions ensure greater homogeneity and comparability across firms.

Another key justification for country selection is the uniformity in board structure across these jurisdictions. All countries in the sample operate under a unitary or one-tier board system, commonly referred to as the Anglo-American model. In this structure, executive and non-executive directors serve on a single board, and appointments are generally made by shareholders. This contrasts with the two-tier board structure, where supervisory and management boards operate separately, and cross-membership is typically prohibited (Rose, 2005). The two-tier model, common in countries such as Germany, introduces distinct governance dynamics that are not easily comparable with the Anglo-American model (Tian & Smith, 2020; Khan et al., 2020). By focusing on countries with a homogeneous board system, the study ensures greater internal validity in cross-country comparisons.

In summary, the selection of six developed economies with unitary board systems and non-regulated industries ensures consistency and comparability, allowing for robust hypothesis testing regarding board characteristics and earnings management.

2.2. Measures

2.2.1. Measuring earnings management

Earnings management is the dependent variable in this study. It is broadly categorized into accrual-based earnings management (AEM) and real earnings management (REM). Since earnings management is not directly observable, proxy variables are employed to infer its presence. The modified Jones model (MJM) is one of the most widely used approaches for estimating discretionary accruals, which serve as a proxy for earnings management. The justification for using the MJM, particularly in recent literature, stems from its improvements in controlling for normal accruals, robust empirical validation, and its continued relevance in both developed and emerging markets. The MJM, proposed by Dechow et al. (1995), refines the original Jones (1991) model by adjusting for the effects of credit sales. This correction reduces bias in estimating discretionary accruals, particularly around earnings management events such as mergers, IPOs, or regulatory changes.

Recent empirical studies have reaffirmed the MJM's robustness and applicability; for example, Zang (2012) used the MJM to examine how firms navigate between real and accrual-based earnings management strategies, and Enomoto et al. (2015) utilized the MJM in a cross-country study, finding it effective across institutional settings. Its flexibility has also been shown to be useful in various contexts, such as CSR reporting, where firms with high CSR disclosures may still engage in earnings management, as detected using MJM (Velte, 2020); also, it remains effective in evaluating governance mechanisms' impact on earnings quality (e.g., Shira, 2024).

Although models such as the performance-matched modified Jones model (Kothari et al., 2005) attempt to further improve measurement accuracy by controlling for firm performance, the MJM is still widely preferred due to its balance between complexity and usability. The MJM remains a justified and credible tool for earnings management research due to its empirical reliability, wide adoption across various economic contexts, and validation in recent academic studies. Researchers continue to rely on MJM for its methodological clarity, especially in studies seeking to isolate managerial discretion in financial reporting.

Accruals are used here as proxies for managerial discretion in financial reporting. Total accruals (TA) are first estimated on a cash flow basis as follows:

$$TA_{i,j,t} = NI_{i,j,t} - CFO_{i,j,t} \quad (1)$$

where $TA_{i,j,t}$: total accruals of firm i in country j at time t ; $NI_{i,j,t}$: net income; $CFO_{i,j,t}$: cash flow from operations.

Accruals-based earnings management (AEM)

Next, total accruals are separated into non-discretionary and discretionary components. The latter represents managerial manipulation and is the core indicator of AEM. Three models are employed to estimate discretionary accruals.

1. Modified Jones model (AEM1), based on Jones (1991) and Dechow et al. (1995):

$$\frac{TA_{i,j,t}}{A_{i,j,t-1}} = \alpha_1 \left(\frac{1}{A_{i,j,t-1}} \right) + \beta_1 \frac{\Delta REV_{i,j,t} - \Delta REC_{i,j,t}}{A_{i,j,t-1}} + \beta_2 \frac{PPE_{i,j,t}}{A_{i,j,t-1}} + \varepsilon_{i,j,t} \quad (2)$$

where $A_{i,j,t-1}$: total assets of firm i from a country j lagged by one year; $\Delta REV_{i,j,t}$: annual change in revenues; $\Delta REC_{i,j,t}$: change in accounts receivable; $PPE_{i,j,t}$: gross properties plants and equipment; $\varepsilon_{i,j,t}$: error term.

2. Performance-matched model (AEM2), modified from the above with additional controls for firm performance (Kothari et al., 2005; Raman & Shahrur, 2008):

$$\frac{TA_{i,j,t}}{A_{i,j,t-1}} = \alpha_1 \left(\frac{1}{A_{i,j,t-1}} \right) + \beta_1 \frac{\Delta REV_{i,j,t} - \Delta REC_{i,j,t}}{A_{i,j,t-1}} + \beta_2 \frac{PPE_{i,j,t}}{A_{i,j,t-1}} + \beta_3 ROA_{i,j,t} + \beta_4 MTB_{i,j,t} + \varepsilon_{i,j,t} \quad (3)$$

where $ROA_{i,j,t}$: return on assets of firm i from the country j in year t ; $MTB_{i,j,t}$: ratio of market to book.

3. Accruals quality model (AEM3), integrating Dechow & Dichev (2002) and Francis et al. (2005), to include the firm's change in revenue and properties, plants, and equipment.

$$\frac{TA_{i,j,t}}{A_{i,j,t-1}} = \alpha_1 + \beta_1 \frac{CFO_{i,j,t-1}}{A_{i,j,t-1}} + \beta_2 \frac{CFO_{i,j,t}}{A_{i,j,t-1}} + \beta_3 \frac{CFO_{i,j,t+1}}{A_{i,j,t-1}} + \beta_4 \Delta REV_{i,j,t} + \beta_5 PPE_{i,j,t} + \varepsilon_{i,j,t} \quad (4)$$

The residuals ($\varepsilon_{i,j,t}$) from these models reflect discretionary accruals, with higher residuals implying lower accrual quality and greater earnings management.

Real earnings management (REM)

REM refers to manipulative actions in operations to influence reported earnings. Based on Roychowdhury (2006), three types of operational manipulation are examined:

1. Sales manipulation (ABCFO)

Captured via abnormal cash flow:

$$\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{A_{i,t-1}} \right) + \beta_1 \frac{SALE_{i,t}}{A_{i,t-1}} + \beta_2 \frac{\Delta SALE_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (5)$$

where $SALE_{i,t}$ is firm i 's sales in year t .

2. Discretionary expenditure manipulation (ABDIS)

$$\frac{DISEX_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{A_{i,t-1}} \right) + \beta_1 \frac{SALE_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (6)$$

where $DISEX_{i,t}$: firm i 's selling, general, administrative expenses (SG&A) in year t .

3. Overproduction manipulation (ABPRO)

$$\frac{\text{PROD}_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{A_{i,t-1}} \right) + \beta_1 \frac{\text{SALE}_{i,t}}{A_{i,t-1}} + \beta_2 \frac{\Delta \text{SALE}_{i,t}}{A_{i,t-1}} + \beta_3 \frac{\Delta \text{SALE}_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (7)$$

where $\text{PROD}_{i,t}$: firm i 's cost of goods sold plus a change in inventory in year t .

To capture combined REM strategies, three aggregate indices are constructed:

$$\text{REM1} = (\text{ABCFO} \times -1) + (\text{ABDIS} \times -1) \quad (8)$$

$$\text{REM2} = (\text{ABDIS} \times -1) + \text{ABPRO} \quad (9)$$

$$\text{REM3} = (\text{ABCFO} \times -1) + (\text{ABDIS} \times -1) + \text{ABPR} \quad (10)$$

where REM1: the sum of abnormal cash flow and abnormal discretionary expenses; REM2: the sum of abnormal discretionary expenses and abnormal production; REM3: the sum of the three individual real earnings management.

In constructing the REM index, abnormal cash flow from operations (ABCFO) and abnormal discretionary expenses (ABDIS) are multiplied by -1 , in line with Cohen and Zarowin (2010) and Ghaleb et al. (2020). This adjustment is necessary because managers typically reduce operating cash flows (for example, by offering price discounts to boost current-period sales) and cut discretionary expenses (such as advertising, R&D, or SG&A) to increase reported earnings. In their raw form, these manipulation strategies generate negative abnormal values, which reflect income-increasing REM. Multiplying ABCFO and ABDIS by -1 therefore rescales the variables so that higher values consistently represent greater real activities manipulation. This transformation ensures comparability with abnormal production costs (ABPROD), which naturally yield positive abnormal values when manipulation occurs, allowing the REM index to function as a unified measure of upward earnings manipulation.

2.2.2. Measuring board diversity

Board diversity is the independent variable, categorized into surface-level diversity (gender and age) and deep-level diversity (education, tenure, and experience). This classification is based on Webber and Donahue (2001), Ali et al. (2022), and Harjoto et al. (2014). The Blau index (Blau, 1977) is employed to quantify diversity:

Surface-level diversity index:

$$\begin{aligned} \text{Surface}_{i,j,t} = & \left[\left(1 - \sum_{g=1}^n \left(\frac{\text{gender}_{i,j,t}}{\text{total directors}} \right)^2 \right) \times \frac{K}{K-1} \right] \\ & + \left[\left(1 - \sum_{g=1}^n \left(\frac{\text{age}_{i,j,t}}{\text{total directors}} \right)^2 \right) \times \frac{L}{L-1} \right] \end{aligned} \quad (11)$$

where $\text{gender}_{i,j,t}$: the number of directors in each gender cohort (female and male) of firm i from a country j in year t ; K : categories; in this case, $K = 2$; $\text{age}_{i,j,t}$ is the number of directors in each age

cohort (less than 36 years, 36–45 years old, 46–55 years old, 56–65 years old, and older than 65 years old) of firm i from a country j in year t ; L is categories; in this case, $L = 5$.

Deep-level diversity index:

$$\begin{aligned} \text{Deep}_{i,j,t} = & \left[\left(1 - \sum_{g=1}^n \left(\frac{\text{education}_{i,j,t}}{\text{total directors}} \right)^2 \right) \times \frac{M}{M-1} \right] \\ & + \left[\left(1 - \sum_{g=1}^n \left(\frac{\text{tenure}_{i,j,t}}{\text{total directors}} \right)^2 \right) \times \frac{N}{N-1} \right] + \left[\left(1 - \sum_{g=1}^n \left(\frac{\text{exper}_{i,j,t}}{\text{total directors}} \right)^2 \right) \times \frac{O}{O-1} \right] \end{aligned} \quad (12)$$

where $\text{education}_{i,j,t}$: the number of directors in each education cohort (below Bachelor's degree, Bachelor's degree, Master's degree, and Doctoral degree) of firm i from a country j in year t ; M : categories; in this case, $M = 4$; $\text{tenure}_{i,j,t}$: the number of directors in each tenure cohort (less than 4 years, 4–6 years, 7–9 years, and more than 9 years); N : categories; in this case, $N = 4$; $\text{exper}_{i,j,t}$ is the number of directors in each expertise/experience cohort (directors with expertise/experience in business management, finance accounting, law, art, science, industry, and others); O : categories; in this case, $O = 7$.

An index closer to 2 for surface-level and 3 for deep-level diversity denotes higher board heterogeneity.

2.2.3. Measuring the Board of Directors' roles

The moderating variables for monitoring and advisory roles represent the functional responsibilities of the board rather than the demographic or cognitive characteristics of individual directors. Monitoring roles are operationalized as the number of formally established oversight committees, consistent with prior governance literature (Adams & Ferreira, 2007). Advisory roles capture committees that provide strategic and consultative support, such as risk management, sustainability, or strategic planning committees, aligning with prior work emphasizing the board's service and resource-provision functions (Hillman & Dalziel, 2003). These constructs are defined as continuous variables representing the number of relevant committees in each firm-year observation (cf. Reeb & Upadhyay, 2010; Zalata et al., 2019). While all directors contribute to oversight to some degree, formally constituted committees provide deeper scrutiny and specialized expertise, supporting prior findings that committee structure enhances monitoring intensity beyond general board participation (Bedard et al., 2004). Although board diversity may indirectly enhance monitoring quality, the diversity indices measure individual director attributes, whereas the board-role variables represent structural governance architecture; therefore, they capture distinct dimensions of board functioning.

The board's roles are treated as moderator variables, specifically via board committees: monitoring committees (audit, compensation, and nominating) and advisory committees (finance, investment, public issues, diversity, ethics, etc.) (Reeb & Upadhyay, 2010; Zalata et al., 2019). This classification reflects a functional dichotomy: oversight versus strategic guidance.

Control variables are included to address potential endogeneity and omitted variable bias. These include:

- Firm characteristics: size, age, growth, ROA.
- Governance variables: bankruptcy risk, CG index.

- Accounting environment: accounting standards, auditor type.
- Fixed effects: industry, country, and year dummies.
- Statistical adjustments: clustered robust standard errors at the firm level.

A comprehensive list of variable definitions is provided in the Appendix.

2.3. Regression models

To test both the direct and indirect impact of board diversity on earnings management, the following OLS regression models are applied:

Model 1: *The effect of board diversity on earnings management*

$$\begin{aligned} EM_{i,j,t} = & \beta_0 + \beta_1(\text{Diversity}_{i,j,t-1}) + \beta_2(\text{Firm size}_{i,j,t-1}) + \beta_3(\text{Firm age}_{i,j,t-1}) \\ & + \beta_4(\text{ROA}_{i,j,t-1}) + \beta_5(\text{Firm growth}_{i,j,t-1}) + \beta_6(\text{ZScore}_{i,j,t-1}) + \beta_7(\text{IFRS}_{i,j,t-1}) \\ & + \beta_8(\text{Big4}_{i,j,t-1}) + \text{Industry dummy} + \text{Year dummy} + \text{Country dummy} + \varepsilon_{i,j,t-1} \end{aligned} \quad (13)$$

Model 2: *Moderating effects of the monitoring board's role on the link between board diversity and earnings management*

$$\begin{aligned} EM_{i,j,t} = & \beta_0 + \beta_1(\text{Diversity}_{i,j,t-1}) + \beta_2(\text{Monitoring}_{i,j,t-1}) \\ & + \beta_3(\text{Diversity}_{i,j,t-1} \times \text{Monitoring}_{i,j,t-1}) + \beta_4(\text{Firm size}_{i,j,t-1}) + \beta_5(\text{Firm age}_{i,j,t-1}) \\ & + \beta_6(\text{ROA}_{i,j,t-1}) + \beta_7(\text{Firm growth}_{i,j,t-1}) + \beta_8(\text{ZScore}_{i,j,t-1}) + \beta_9(\text{IFRS}_{i,j,t-1}) \\ & + \beta_{10}(\text{Big4}_{i,j,t-1}) + \text{Industry dummy} + \text{Year dummy} + \text{Country dummy} + \varepsilon_{i,j,t-1} \end{aligned} \quad (14)$$

Model 3: *Moderating effects of the advisory board's role on the link between board diversity and real earnings management*

$$\begin{aligned} EM_{i,j,t} = & \beta_0 + \beta_1(\text{Diversity}_{i,j,t-1}) + \beta_2(\text{Advisory}_{i,j,t-1}) \\ & + \beta_3(\text{Diversity}_{i,j,t-1} \times \text{Advisory}_{i,j,t-1}) + \beta_4(\text{Firm size}_{i,j,t-1}) + \beta_5(\text{Firm age}_{i,j,t-1}) \\ & + \beta_6(\text{ROA}_{i,j,t-1}) + \beta_7(\text{Firm growth}_{i,j,t-1}) + \beta_8(\text{ZScore}_{i,j,t-1}) + \beta_9(\text{IFRS}_{i,j,t-1}) \\ & + \beta_{10}(\text{Big4}_{i,j,t-1}) + \text{Industry dummy} + \text{Year dummy} + \text{Country dummy} + \varepsilon_{i,j,t-1} \end{aligned} \quad (15)$$

OLS is chosen for its efficiency under classical assumptions: linearity, homoscedasticity, and absence of multicollinearity (Gujarati, 2009). Prior to estimation, multicollinearity and heteroskedasticity diagnostics are conducted, and appropriate transformations are applied. This methodology section has offered a rigorous empirical foundation to investigate the relationship between board diversity and earnings management, ensuring the reliability, comparability, and validity of the study's findings, to which we now turn.

3. Results and discussion

3.1. Descriptive statistical analysis

This section presents the descriptive statistics of the variables used in the analysis. Tables 1–3 display the means, minimum and maximum values, and standard deviations of the variables. To mitigate the influence of extreme values, all continuous variables were Winsorized at the 1st and 99th percentiles.

As indicated in Table 1, the absolute value of accrual-based earnings management (AEM) across the sampled firms ranges from 0.082 to 0.128, which is consistent with prior empirical findings reported by Francis et al. (2005), Hoang et al. (2017), Kapoor and Goel (2017), and Srinidhi et al. (2011). For real earnings management (REM), the average value of REM1 is -0.006 , indicating a general tendency among the sampled firms to reduce reported earnings through real activity manipulation. Accordingly, the aggregate value of three REM components (REM3) also records a negative average at -0.007 , lending support to existing research that suggests a negative tendency in REM practices (e.g., Ben Amar & Sayadi, 2022; Liao & Ouyang, 2019). In contrast, REM2 records a positive average, implying that companies may be increasing earnings through overproduction, thereby reducing the cost of goods sold—a tactic often adopted in REM.

Table 1. Descriptive statistics of accruals earnings management (dependent variables).

Country	N Obs	Firms	AEM1				AEM2				AEM3			
			Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
AU	303	115	0.125	0.205	0	1.6085	0.125	0.205	0	1.609	0.076	0.085	0.015	0.268
CA	931	301	0.116	0.195	0	1.6085	0.116	0.195	0	1.609	0.092	0.092	0.015	0.270
HK	1155	355	0.090	0.109	0	1.0557	0.090	0.109	0	1.056	0.088	0.098	0.017	0.285
SN	519	165	0.102	0.174	0	1.5068	0.102	0.174	0	1.507	0.087	0.106	0.007	0.286
UK	1360	447	0.116	0.190	0	1.6085	0.116	0.190	0	1.609	0.080	0.098	0.005	0.281
US	9254	2697	0.138	0.253	0	1.6085	0.138	0.253	0	1.609	0.082	0.102	0.006	0.284
Pooled Sample	13522	4080	0.128	0.231	0	1.6085	0.129	0.231	0	1.609	0.082	0.101	0.005	0.286
Country	N Obs	Firms	REM1				REM2				REM3			
			Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
AU	303	115	0.016	0.208	-1.635	0.817	-0.001	0.148	-0.897	0.487	0.019	0.232	-1.788	0.887
CA	931	301	-0.007	0.191	-1.592	1.192	-0.004	0.125	-0.770	0.898	-0.006	0.216	-1.689	1.536
HK	1155	355	0.008	0.139	-0.991	1.356	-0.004	0.102	-0.554	0.769	0.008	0.190	-0.962	1.701
SN	519	165	-0.028	0.202	-1.157	0.411	-0.001	0.072	-0.399	0.576	-0.030	0.214	-1.175	0.434
UK	1360	447	-0.010	0.177	-1.190	1.289	-0.006	0.151	-1.000	0.898	-0.011	0.209	-1.315	1.330
US	9254	2697	-0.007	0.248	-1.796	2.017	0.006	0.159	-1.000	0.898	-0.007	0.278	-2.145	1.965
Pooled Sample	13522	4080	-0.006	0.228	-1.796	2.017	0.003	0.149	-1.000	0.898	-0.007	0.258	-2.145	1.965

To explore potential differences in earnings management practices, independent samples t-tests were conducted by categorizing firms into high- and low-diversity groups based on board composition characteristics. Results indicate statistically significant mean differences in both AEM and REM across these groups. Moreover, firms with boards that fulfil stronger monitoring and advisory roles demonstrate significant variations in earnings management behavior. These univariate findings imply that both diversity and functional roles of the board are influential determinants in shaping the type and magnitude of earnings management practices.

As reported in Table 2, the mean surface-level diversity index for the board is 1.119. This metric, determined by gender and age heterogeneity, approaches a maximum of two when diversity is high. These findings are in line with Ali et al. (2022), who reported a surface-level diversity average of 1.25. Deep-level diversity, which encompasses educational background, tenure, and professional expertise, yields a sample mean of 2.086. Given that a score closer to three reflects high diversity, this figure indicates that boards across countries in the sample exhibit a relatively consistent level of deep-level diversity.

With respect to board roles, the average number of monitoring committees is approximately three, a finding consistent with Reeb and Upadhyay (2010) and Upadhyay et al. (2014). Interestingly, advisory committees are less prevalent, particularly in UK-based firms, where the average is only 0.38. The lack of mandatory regulation may explain this trend, suggesting that advisory functions are adopted voluntarily rather than institutionally mandated.

Table 2. Descriptive statistics of Board diversity and Board roles (independent variable and moderators).

Country	Mean	Board's surface level diversity				Mean	Board's deep level diversity			
		Median	SD	Min	Max		Median	SD	Min	Max
AU	1.066	1.102	0.450	0	1.821	2.057	2.155	0.475	0.762	2.793
CA	1.118	1.185	0.381	0	1.847	2.149	2.263	0.396	0.857	2.860
HK	1.062	1.051	0.364	0	1.914	2.040	2.110	0.393	0.757	2.810
SN	1.067	1.102	0.383	0	1.903	2.070	2.149	0.397	0.887	2.833
UK	1.150	1.247	0.415	0	1.914	2.098	2.184	0.428	0.519	2.851
US	1.127	1.198	0.369	0	1.938	2.086	2.182	0.427	0	2.830
Pooled Sample	1.119	1.181	0.377	0	1.938	2.086	2.177	0.423	0	2.860
Country	Mean	Monitoring committee				Mean	Advisory committee			
		Median	SD	Min	Max		Median	SD	Min	Max
AU	2.01	2	0.78	0	5	0.99	1	1.09	0	6
CA	2.49	2	0.69	1	6	1.09	1	1.07	0	9
HK	3.15	3	0.57	1	5	0.46	0	0.71	0	5
SN	2.82	3	0.72	1	5	0.51	1	0.89	0	4
UK	2.87	3	0.61	1	5	0.38	0	0.74	0	5
US	2.91	3	0.56	0	6	0.55	1	0.84	0	5
Pooled Sample	2.87	3	0.62	0	6	0.57	1	0.86	0	9

Control variable statistics are summarized in Table 3. The average firm age is 41 years, and the average logarithm of market capitalization is approximately 6. A notable finding is the negative average return on assets (ROA) at -6% , which suggests that most of the sampled firms have low or negative profitability. Firm growth averages 20% , ranging from 10% to 26% . The average Altman Z-score is 2.25, with Australian firms demonstrating the highest financial stability with a score of 3.57. Moreover, the data reveal that most firms follow IFRS, except for U.S. firms that adopt US GAAP. Approximately 71% of the sample firms are audited by one of the Big Four firms.

Table 3. Descriptive statistics of control variables.

Country	Firm size		Firm age		ROA		Firm growth		Z-Score		IFRS		Big4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
AU	5.27	2.60	38.69	39.81	-0.05	0.21	0.26	1.02	3.57	10.03	0.95	0.21	0.72	0.45
CA	5.76	2.30	37.25	35.48	-0.04	0.21	0.14	0.64	1.82	5.43	0.82	0.38	0.83	0.37
HK	6.53	1.85	32.48	36.36	0.02	0.06	0.22	0.81	3.24	6.00	0.90	0.29	0.76	0.42
SN	5.87	2.08	34.77	33.64	0.02	0.08	0.10	0.53	2.39	5.13	0.97	0.16	0.79	0.41
UK	5.62	2.81	54.41	53.65	-0.02	0.21	0.19	0.76	3.56	6.46	0.99	0.12	0.66	0.47
US	6.27	2.59	40.75	34.06	-0.08	0.28	0.20	0.79	1.92	8.61	0.00	0.06	0.69	0.46
Pooled Sample	6.15	2.54	40.90	37.26	-0.06	0.25	0.20	0.78	2.25	7.98	0.29	0.46	0.71	0.45

3.2. Correlation analysis

Table 4 displays the correlation coefficients among the variables. A statistically significant negative correlation is observed between board diversity and AEM. In contrast, the relationship between board diversity and REM is mixed, with both positive and negative correlations depending on the REM metric. Additionally, board roles, monitoring and advisory, show a negative correlation with AEM, supporting the governance efficacy of such functions. Notably, multicollinearity does not appear to be an issue in this dataset. All correlation coefficients fall below 0.70 (Gujarati, 2009), and variance inflation factors (VIFs) for the independent variables are below the threshold of 3, well under the critical value of 10 (Hair et al., 2018).

Table 4. Pearson correlation matrix.

	Surface	Deep	Monitoring	Advisory	Firm size	Firm age	ROA	Firm growth	Z-Score	IFRS	Big4
Surface	1										
Deep	0.216	1									
Monitoring	0.087	0.076	1								
Advisory	0.148	0.250	-0.071	1							
Firm size	0.358	0.314	0.173	0.287	1						
Firm age	0.181	0.253	0.020	0.200	0.256	1					
ROA	0.174	0.214	0.024	0.151	0.407	0.207	1				
Firm growth	-0.034	-0.087	-0.003	-0.044	-0.030	-0.088	-0.053	1			

Continued on next page

	Surface	Deep	Monitoring	Advisory	Firm	Firm	ROA	Firm	Z-	IFRS	Big4
					size	age		growth	Score		
Z-Score	0.102	0.031	0.037	0.014	0.283	0.036	0.376	0.024	1		
IFRS	-0.030	0.005	-0.086	0.017	-0.074	0.016	0.117	-0.015	0.059	1	
Big4	0.295	0.192	0.086	0.194	0.536	0.162	0.291	-0.031	0.137	0.056	1
AEM1	-0.146	-0.187	-0.052	-0.103	-0.379	-0.121	-0.385	0.055	-0.197	-0.058	-0.234
AEM2	-0.146	-0.187	-0.052	-0.103	-0.379	-0.121	-0.385	0.055	-0.197	-0.059	-0.234
AEM3	-0.082	-0.145	-0.043	-0.084	-0.209	-0.089	-0.432	0.023	-0.144	-0.041	-0.160
REM1	0.044	0.074	0.007	0.026	0.078	0.049	0.018	-0.050	0.000	0.005	0.011
REM2	0.013	-0.050	0.009	-0.023	0.020	-0.024	0.050	0.040	0.042	-0.031	0.000
REM3	0.042	0.065	0.004	0.024	0.075	0.046	0.020	-0.049	0.002	0.005	0.018

Note: The table presents the correlation matrix of variables used in this study. All variables are defined in Appendix A. Bold text in the table indicates significance at the 10% level or higher.

3.3. Regression results

Regression results are summarized in Table 5. Columns 1 and 2 show the relationship between board diversity and AEM after controlling for industry-country-year fixed effects. The adjusted R-squared is 0.22, consistent with previous literature. A statistically significant negative coefficient (-0.014 , $p < 0.05$) for surface-level board diversity suggests that demographic diversity reduces the extent of accrual-based earnings management, supporting the findings of Attia et al. (2024).

Although deep-level board diversity also exhibits a negative relationship with AEM, the coefficient is statistically insignificant. This is consistent with prior research suggesting that cognitive diversity (e.g., education, expertise) does not always translate into effective oversight in the context of earnings management (Abdullah & Ismail, 2016; Li & Wahid, 2018; Okaily et al., 2019; Rojana & Yang, 2019).

The insignificant effect of deep-level diversity on AEM may reflect the fact that cognitive attributes such as expertise and tenure do not necessarily activate stronger monitoring behavior in the same way that visible attributes do. Surface-level characteristics such as gender and age tend to increase board independence, stimulate active voice, and reduce group conformity (Adams & Ferreira, 2009; Nielsen & Huse, 2010), thereby enhancing financial oversight. In contrast, deep-level traits are less observable and often exert heterogeneous or offsetting influences: longer tenure may increase relational closeness with management (Vafeas, 2003), educational diversity may enhance strategic decision-making but contribute little to detecting technical accrual manipulation (Kim & Lim, 2010), and expertise effects vary widely across firms. When aggregated into a composite index, these mixed effects may neutralize one another, leading to an overall insignificant association with AEM. This suggests that not all forms of cognitive diversity translate into effective monitoring, and that surface diversity may play a more salient role in constraining accruals-based manipulation.

Contrary to expectations, surface-level diversity is positively associated with REM (coefficient = 0.052, $p < 0.01$). This may be attributed to the broader scope of diversity assessed in this study relative to earlier studies focused narrowly on individual characteristics. These findings resonate with studies by Debnath et al. (2019), Ghazali et al. (2019), and Khan et al. (2022), who noted similar positive associations between gender diversity and REM.

The deep-level diversity coefficient for REM is positive (0.014) but statistically insignificant, consistent with Zalata et al. (2021) and Al-Absy (2022), who found that deep-level diversity does not meaningfully deter real activity manipulations. As per Table 6, the robustness test results reaffirm these findings, indicating that board diversity is negatively associated with AEM but positively associated with REM, thereby partially supporting the hypothesis that board diversity constrains earnings management.

Table 5. The link between Board diversity and earnings management.

Variables	Dependent Variables			
	AEM1	AEM1	REM3	REM3
Constant	0.009 (0.119)	0.003 (0.119)	-0.034 (0.257)	-0.020 (0.257)
<i>Independent variable</i>				
Surface	-0.014** (0.007)		0.052*** (0.014)	
Deep		-0.003 (0.007)		0.014 (0.014)
<i>Control variable</i>				
Firm size	-0.008*** (0.002)	-0.008*** (0.002)	-0.029*** (0.004)	-0.029*** (0.004)
Firm age	0.001 (0.000)	0.001 (0.000)	0.001*** (0.000)	0.001*** (0.000)
ROA	-0.060*** (0.012)	-0.060*** (0.012)	-0.123*** (0.025)	-0.123*** (0.025)
Firm growth	0.001 (0.002)	0.001 (0.002)	-0.006 (0.004)	-0.005 (0.004)
Z-Score	-0.002*** (0.000)	-0.002*** (0.000)	-0.001 (0.001)	-0.001 (0.001)
IFRS	-0.068** (0.028)	-0.070** (0.028)	-0.262*** (0.061)	-0.257*** (0.061)
Big4	-0.009 (0.010)	-0.010 (0.010)	-0.136*** (0.021)	-0.135*** (0.021)
Observations	13522	13522	13522	13522
R-Squared	0.220	0.222	0.313	0.312
Durbin-Watson	2.403	2.402	2.162	2.161
F-Stat	<0.0001	<0.0001	<0.0001	<0.0001

Note: The table presents fixed-effects regressions of Board diversity where the dependent variables are earnings management: accruals and real earnings management. All variables are defined in Appendix A. All explanatory variables are lagged by one year to avoid simultaneous problems. Standard errors are also clustered at the firm level and are reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

Further analysis was conducted to examine the trade-off between AEM and REM. Following Enomoto et al. (2018) and Evans et al. (2014), the ratio of REM to AEM was regressed on board

diversity. As shown in Panel A of Table 7, the positive and significant coefficient suggests that increased board diversity corresponds to a shift from AEM to REM, indicative of a substitution effect.

Table 6. Robustness test: the link between Board diversity and earnings management.

Variables	AEM2	AEM2	AEM3	AEM3	REM1	REM1	REM2	REM2
Constant	0.009 (0.119)	0.004 (0.119)	-0.048 (0.394)	-0.022 (0.395)	-0.039 (0.222)	-0.038 (0.223)	0.090 (0.148)	0.110 (0.148)
<i>Independent variable</i>								
Surface	-0.014** (0.007)		-0.044** (0.022)		0.047*** (0.012)		0.010 (0.008)	
Deep		-0.003 (0.007)		-0.037* (0.022)		0.021* (0.012)		-0.008 (0.008)
<i>Control variable</i>								
Firm size	-0.008*** (0.002)	-0.008*** (0.002)	-0.028*** (0.007)	-0.028*** (0.007)	-0.029*** (0.004)	-0.029*** (0.004)	0.009*** (0.003)	0.009*** (0.003)
Firm age	0.001 (0.000)	0.001 (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001 (0.000)	0.001 (0.000)
ROA	-0.060*** (0.012)	-0.060*** (0.012)	-0.650*** (0.039)	-0.650*** (0.039)	-0.107*** (0.022)	-0.107*** (0.022)	0.337*** (0.014)	0.337*** (0.014)
Firm growth	0.001 (0.002)	0.001 (0.002)	0.012** (0.006)	0.011** (0.006)	-0.006* (0.003)	-0.005* (0.003)	0.001 (0.002)	0.001 (0.002)
Z-Score	-0.002*** (0.000)	-0.002*** (0.000)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.000)	-0.001 (0.000)
IFRS	-0.069** (0.028)	-0.070** (0.028)	0.278*** (0.094)	0.273*** (0.094)	-0.223*** (0.053)	-0.218*** (0.053)	0.046 (0.035)	0.046 (0.035)
Big4	-0.009 (0.010)	-0.009 (0.010)	0.114*** (0.032)	0.114*** (0.032)	-0.154*** (0.018)	-0.153*** (0.018)	-0.007 (0.012)	-0.006 (0.012)
Observations	13522	13522	13522	13522	13522	13522	13522	13522
R-Squared	0.220	0.222	0.251	0.253	0.340	0.340	0.318	0.318
Durbin-Watson	2.403	2.402	2.347	2.347	2.187	2.185	2.190	2.190
F-Stat	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Note: The table presents fixed-effects regressions of Board diversity where the dependent variables are alternative measures of earnings management. All variables are defined in Appendix A. All explanatory variables are lagged by one year to avoid simultaneous problems. Standard errors are also clustered at the firm level and are reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

To validate this, REM was introduced as an independent variable in the AEM regression model. Panel B of Table 7 reveals a significant negative coefficient, reinforcing the substitution effect hypothesis; when firms are constrained in accrual manipulation (e.g., due to diverse boards), they may switch to real activity-based manipulation (Cohen et al., 2008; Choi et al., 2018). This substitution effect can be theoretically understood by integrating agency theory, human capital theory, and resource dependence theory. Agency theory suggests that diversity enhances monitoring and reduces managers' ability to manipulate accruals. However, human capital theory and resource dependence theory

highlight that diverse boards also possess broader expertise, richer cognitive resources, and wider external networks. These attributes strengthen advisory capacity and provide managers with greater strategic flexibility. As a result, when accruals manipulation becomes harder to execute due to stronger monitoring, managers may shift toward real activities manipulation, which is less transparent and more difficult for boards to detect. Thus, the combined predictions of the three theories jointly explain why board diversity simultaneously suppresses one channel of manipulation (AEM) while unintentionally enabling another (REM).

Table 7. The trade-off between accruals and real earnings management.

Variables	Dependent Variables			
	Panel A (Main Test)		Panel B (Robustness Test)	
	Ratio REM to AEM	Ratio REM to AEM	AEM1	AEM1
Constant	0.291 (7.021)	1.361 (7.042)	0.299*** (0.014)	0.337*** (0.015)
<i>Independent variable</i>				
Surface	0.683* (0.393)		-0.006 (0.005)	
Deep		0.475** (0.388)		-0.024*** (0.004)
<i>Control variable</i>				
REM3			-0.136*** (0.007)	-0.135*** (0.007)
Firm size	0.118 (0.122)	0.120 (0.122)	-0.023*** (0.001)	-0.022*** (0.001)
Firm age	0.018*** (0.005)	0.017*** (0.005)	0.001** (0.001)	0.001*** (0.001)
ROA	-3.090*** (0.688)	-3.085*** (0.688)	-0.219*** (0.009)	-0.216*** (0.009)
Firm growth	-0.108 (0.100)	-0.105 (0.100)	0.006*** (0.002)	0.006** (0.002)
Z-Score	-0.030* (0.018)	-0.031* (0.018)	-0.001*** (0.001)	-0.001*** (0.001)
IFRS	-0.775 (1.678)	-0.730 (1.677)	-0.006 (0.011)	-0.004 (0.011)
Big4	-0.065 (0.564)	-0.031 (0.564)	-0.007 (0.005)	-0.008 (0.005)
Year Dummy	Yes	Yes	Yes	Yes
Country Dummy	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes
Observations	13522	13522	13522	13522
R-Squared	0.285	0.285	0.243	0.244
F-Stat	<0.0001	<0.0001	<0.0001	<0.0001

Note: The table shows fixed-effects regressions of Board diversity, with accruals earnings management as the dependent variable and real earnings management as an additional explanatory variable. All variables are

defined in Appendix A. All explanatory variables are lagged by one year to avoid simultaneous problems. Standard errors are clustered at the firm level and are reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

Overall, our results suggest that board diversity (understood by our analysis of human capital theory to incorporate directors' expertise, knowledge, and skills) enhances board monitoring (a corollary of agency theory) and reduces AEM in a complementary manner. However, pro contra, it may inadvertently incentivize REM, as a substitutive response. We accept, therefore, that stronger monitoring creates pressure on management, which, in turn, prompts a strategic shift toward operational manipulation (REM). This managerial response represents a strategic action aligned with resource dependence theory, as managers aim to meet external expectations, and underscores the importance of adopting an integrated governance approach to mitigate both forms of earnings management. The significance of board functional roles further substantiates the necessity of considering governance as a holistic system rather than a collection of isolated mechanisms. Control variables also provide significant insights. Larger firms and those with higher ROA are less inclined to engage in earnings management, possibly due to reputational considerations. IFRS-adopting firms also show lower levels of earnings manipulation. Firms audited by Big Four auditors exhibit reduced earnings management, reaffirming the role of high-quality auditing.

Lastly, the findings highlight the stronger influence of demographic over cognitive diversity in mitigating earnings management. This observation aligns with Sanad et al. (2020) and Labelle et al. (2010), who argued for the inclusion of diverse demographic profiles to improve decision-making and stakeholder protection. Given that statutory diversity (e.g., board independence) is often insufficient, our findings contribute to the growing literature advocating for comprehensive diversity considerations in corporate governance design. Further, our integrated theoretical explanation strengthens the interpretation of the substitution effect as a logical outcome of the multi-theory perspective.

3.4. Interaction analyses

The board's roles are considered as the moderators here. Our work centers on the advisory and monitoring functions of the board, contending that both categories of committees are crucial components of efficient board supervision. This thesis uses three monitoring committees to assess the monitoring functions of the board, motivated by the historical dominance of audit committees as the principal regulatory mechanism for subordinate board structures over the previous six decades. After 2003, the prominent stock exchanges, in response to the Securities and Exchange Commission's implementation of the Sarbanes–Oxley Act of 2002, enforced the requirement for companies to establish a compensation committee and a nominating or corporate governance committee. Consequently, it became mandatory for publicly traded corporations to establish three monitoring subcommittees inside their board structure (Reeb & Upadhyay, 2010).

According to Fama and Jensen (1983), Boards of Directors also fulfil advisory functions by supervising long-term investments and the development of strategic plans. Advisory activities such as these are considered to be the remit of committees other than monitoring committees (Reeb & Upadhyay, 2010; Zalata et al., 2019). These include finance, investment, public issues, diversity,

mergers and acquisitions, ethics, environment, and other advising-related committees. Therefore, this study defines the board's monitoring committees as audit, compensation, and nominating committees, while advisory committees are all others.

Table 8. The moderating effect of the monitoring Board's roles on the link between Board diversity and earnings management.

Variables	Panel A: Monitoring Committee (Main Test)				Panel B: Monitoring Director (Robustness Test)			
	AEM1	AEM1	REM3	REM3	AEM1	AEM1	REM3	REM3
Constant	0.066 (0.123)	0.174 (0.130)	0.003 (0.266)	0.010 (0.280)	0.039 (0.120)	0.022 (0.120)	0.018 (0.257)	0.035 (0.259)
<i>Independent variable</i>								
Surface	-0.046* (0.027)		0.066 (0.057)		-0.027*** (0.008)		0.049*** (0.017)	
Deep		-0.072*** (0.024)		0.025 (0.052)		-0.006 (0.008)		0.011 (0.017)
<i>Moderator</i>								
Monitoring	-0.019* (0.011)	-0.059*** (0.018)	-0.012 (0.024)	-0.010 (0.039)	-0.014*** (0.005)	-0.009 (0.009)	-0.020* (0.011)	-0.022 (0.018)
<i>Interaction</i>								
Surface*Monitoring	0.011 (0.009)		-0.005 (0.019)		0.010*** (0.004)		0.004 (0.008)	
Deep*Monitoring		0.024*** (0.008)		-0.004 (0.017)		0.003 (0.004)		0.003 (0.008)
<i>Control variable</i>								
Firm size	-0.008*** (0.002)	-0.008*** (0.002)	-0.029*** (0.004)	-0.028*** (0.004)	-0.008*** (0.002)	-0.008*** (0.002)	-0.029*** (0.004)	-0.028*** (0.004)
Firm age	0.001 (0.000)	0.001 (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001 (0.000)	0.001 (0.000)	0.001*** (0.000)	0.001*** (0.000)
ROA	-0.061*** (0.012)	-0.061*** (0.012)	-0.123*** (0.025)	-0.123*** (0.025)	-0.060*** (0.012)	-0.060*** (0.012)	-0.123*** (0.025)	-0.122*** (0.025)
Firm growth	0.001 (0.002)	0.001 (0.002)	-0.006 (0.004)	-0.005 (0.004)	0.001 (0.002)	0.001 (0.002)	-0.006 (0.004)	-0.005 (0.004)
Z-Score	-0.002*** (0.000)	-0.001*** (0.000)	-0.001 (0.001)	-0.001 (0.001)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001 (0.001)	-0.001 (0.001)
IFRS	-0.069** (0.028)	-0.069** (0.028)	-0.263*** (0.061)	-0.258*** (0.061)	-0.069** (0.028)	-0.070** (0.028)	-0.267*** (0.061)	-0.261*** (0.061)
Big4	-0.009 (0.010)	-0.010 (0.010)	-0.136*** (0.021)	-0.135*** (0.021)	-0.010 (0.010)	-0.010 (0.010)	-0.138*** (0.021)	-0.136*** (0.021)
Observations	13522	13522	13522	13522	13522	13522	13522	13522
R-Squared	0.220	0.223	0.313	0.313	0.220	0.222	0.314	0.313
F-Stat	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Note: The table shows fixed-effects regressions of Board diversity, with earnings management as the dependent variable and Board monitoring roles as moderators. All variables are defined in Appendix A. All explanatory variables are lagged

by one year to avoid simultaneous problems. Standard errors are clustered at the firm level and are reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively

3.4.1. Board monitoring role

Panel A of Table 8 presents the results of the second regression model relating to the second hypothesis, which examines the moderating effect of the board's monitoring role on the relationship between board diversity and earnings management. The findings indicate that board diversity is significantly and negatively associated with accrual-based earnings management (AEM), suggesting that a diverse board contributes to reducing managerial manipulation of accounting figures through accruals. This outcome aligns with expectations, as board diversity is often linked to enhanced monitoring quality and greater resistance to opportunistic managerial behavior. Even when introducing the interaction term representing the board's monitoring role, the coefficient on board diversity remains statistically significant and negative for AEM. However, no such relationship is observed between board diversity and real earnings management (REM), indicating that diversity may be less effective in constraining manipulation through operational decisions such as discretionary expenditures or production activities.

The monitoring role of the board is further examined by distinguishing between directors who serve on two or more monitoring committees ("monitoring directors"), based on criteria established by Faleye et al. (2011), Hsu and Hu (2016), and Zalata et al. (2019). Table 8 illustrates that these monitoring functions are significantly negatively related to earnings management, particularly in the context of AEM. This finding supports the agency theory framework, which conceptualizes the Board of Directors as an oversight mechanism designed to align managerial actions with shareholder interests.

In line with Ibrahim et al. (2023), who demonstrated that strong, independent audit committees amplify the constraining effect of board diversity on earnings management, our findings confirm that effective monitoring structures enhance board governance. The interaction term between board diversity and the monitoring role is significant in the AEM model, suggesting a moderating effect. In other words, the extent of AEM is significantly reduced when board diversity is coupled with active monitoring roles. However, in the case of REM, the interaction term is not statistically significant, although the coefficient remains negative, implying a potential, though unconfirmed, mitigating effect. Consequently, despite these insights, the second hypothesis must be rejected, as the interaction between board diversity and the monitoring role does not have a statistically significant impact on REM.

3.4.2. Board advisory role

In relation to the third hypothesis concerning the advisory role of the board, Table 9 demonstrates a nuanced outcome. Board diversity continues to show a negative and significant association with AEM, corroborating the first hypothesis. However, an unexpected result is observed in REM, where board diversity has a significant and positive relationship, suggesting that greater diversity may, in some cases, facilitate rather than constrain REM practices.

We further investigate the advisory role by isolating directors who do not serve on any monitoring committees, classified as "advisory directors" following the frameworks established by Faleye et al.

(2011), Hsu and Hu (2016), and Zalata et al. (2019). Table 9 suggests that advisory functions of the board generally reduce both forms of earnings management, although the impact is more consistently observed in the context of AEM. This observation supports the resource dependency theory, which views the board not only as a monitoring body but also as a source of strategic counsel and external connections that contribute to firm performance and governance.

Table 9. The moderating effect of the advisory board's roles on the link between Board diversity and earnings management.

Variables	Panel A: Advisory Committee (Main Test)				Panel B: Advisory Director (Robustness Test)			
	AEM1	AEM1	REM3	REM3	AEM1	AEM1	REM3	REM3
Constant	0.021 (0.120)	0.012 (0.120)	-0.036 (0.257)	-0.019 (0.258)	0.010 (0.119)	0.015 (0.120)	-0.037 (0.257)	-0.018 (0.258)
Independent variable								
Surface	-0.010** (0.005)		0.055*** (0.016)		-0.016** (0.008)		0.056*** (0.016)	
Deep		-0.008 (0.007)		0.014*** (0.016)		-0.010 (0.007)		0.013 (0.016)
Moderator								
Advisory	-0.013 (0.016)	-0.025 (0.016)	-0.005 (0.021)	-0.003 (0.035)	-0.001 (0.003)	-0.011** (0.006)	0.007 (0.007)	0.003 (0.012)
Interaction								
Surface*Advisory	0.005* (0.005)		-0.005 (0.016)		0.001 (0.003)		-0.003 (0.005)	
Deep*Advisory		0.013* (0.007)		-0.002 (0.015)		0.006** (0.002)		0.001 (0.005)
Control variable								
Firm size	-0.008*** (0.002)	-0.008*** (0.002)	-0.029*** (0.004)	-0.029*** (0.004)	-0.008*** (0.002)	-0.008*** (0.002)	-0.029*** (0.004)	-0.028*** (0.004)
Firm age	0.001 (0.000)	0.001 (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001 (0.000)	0.001 (0.000)	0.001*** (0.000)	0.001*** (0.000)
ROA	-0.060*** (0.012)	-0.061*** (0.012)	-0.123*** (0.025)	-0.123*** (0.025)	-0.060*** (0.012)	-0.060*** (0.012)	-0.123*** (0.025)	-0.123*** (0.025)
Firm growth	0.001 (0.002)	0.001 (0.002)	-0.006 (0.004)	-0.005 (0.004)	0.001 (0.002)	0.001 (0.002)	-0.006 (0.004)	-0.005 (0.004)
Z-Score	-0.002*** (0.000)	-0.002*** (0.000)	-0.001 (0.001)	-0.001 (0.001)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001 (0.001)	-0.001 (0.001)
IFRS	-0.068** (0.028)	-0.070** (0.028)	-0.262*** (0.061)	-0.257*** (0.061)	-0.068** (0.028)	-0.070** (0.028)	-0.261*** (0.061)	-0.256*** (0.061)
Big4	-0.009 (0.010)	-0.010 (0.010)	-0.136*** (0.021)	-0.135*** (0.021)	-0.009 (0.010)	-0.010 (0.010)	-0.136*** (0.021)	-0.135*** (0.021)
Observations	13522	13522	13522	13522	13522	13522	13522	13522
R-Squared	0.221	0.223	0.313	0.312	0.221	0.224	0.313	0.312
F-Stat	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Note: The table shows fixed-effects regressions of Board diversity, with earnings management as the dependent variable and Board advisory roles as moderators. All variables are defined in Appendix A. All explanatory variables are lagged by one year to avoid simultaneous problems. Standard errors are clustered at the firm level and are reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

Examining the interaction between board diversity and advisory roles, Panel A of Table 9 reveals a significant positive interaction effect on AEM, indicating that increased diversity within advisory committees may paradoxically undermine their capacity to restrain accruals manipulation. For REM, however, the interaction term is negative but statistically insignificant. These results suggest that while board advisory functions may independently curb earnings manipulation, diversity within such committees does not amplify this effect. Therefore, the third hypothesis is also rejected due to the lack of consistent, significant interaction effects.

3.5. Visualizing the interaction effect

To better understand the moderating effects of board roles, graphical visualizations of marginal effects were employed, as recommended by Berry et al. (2012), Brambor et al. (2006), and Hayes (2018). These visual tools clarify how the impact of board diversity on earnings management varies across distinct levels of board roles, eliminating the need for arbitrary categorization (Lamina et al., 2012). Although the coefficient tests for H₂ and H₃ are formally insignificant, the marginal effects plots (Figures 2–5) provide robust evidence of meaningful conditional relationships. Visual analyses allow us to examine how the effect of board diversity varies across the continuous distribution of board roles, capturing nuanced patterns that single-point statistical tests cannot detect. Consistent with the complementarity and substitution framework, Figures 2 and 3 demonstrate that board diversity and board roles act as substitutes in the context of AEM, whereas Figures 4 and 5 indicate that the same mechanisms operate as complements in the context of REM. These visual patterns highlight dynamic governance interdependencies that are not fully reflected in the average interaction coefficient alone.

It is important to clarify that the formal rejection of H₂ and H₃ reflects only the binary significance test of the interaction coefficient in the regression tables. In moderation analysis, especially with continuous moderators, a nonsignificant interaction term does not imply the absence of meaningful conditional effects. Rather, it indicates that the average interaction effect across the entire moderator range is not statistically different from zero. Therefore, the hypotheses are rejected conditionally, based strictly on conventional significance thresholds and not on the broader pattern of marginal effects.

Figures 2 and 3 illustrate that the negative relationship between board diversity and AEM becomes less pronounced as the strength of board monitoring and advisory roles increases. These interactions are constructed from two continuous variables: board diversity and board role strength (Golder, 2006). This pattern implies a substitution effect: when board roles are strong, the marginal benefit of diversity in curbing AEM diminishes. The implication here is that diverse boards may function either as monitors or advisors, and their effect is strongest when other governance mechanisms are weak.

The interaction analysis suggests that the presence of board roles—both monitoring and advisory—may amplify the positive relationship between board diversity and accrual-based earnings management, consistent with a substitution effect. This can be explained through a combined

theoretical lens. Although monitoring committees are expected to strengthen oversight under agency theory, their presence may lead boards to allocate more attention toward strategic and operational oversight, unintentionally reducing scrutiny of complex accrual decisions. At the same time, diverse boards possess broader expertise and resource linkages (human capital theory; resource dependence theory), which may enhance managerial flexibility in applying accounting judgments. When monitoring and advisory structures operate alongside high diversity, these governance mechanisms may substitute for one another, creating an environment where directors assume that other mechanisms are providing adequate oversight. This diffusion of responsibility may increase managers' opportunity to exercise discretion in accrual adjustments, thereby contributing to higher levels of AEM.

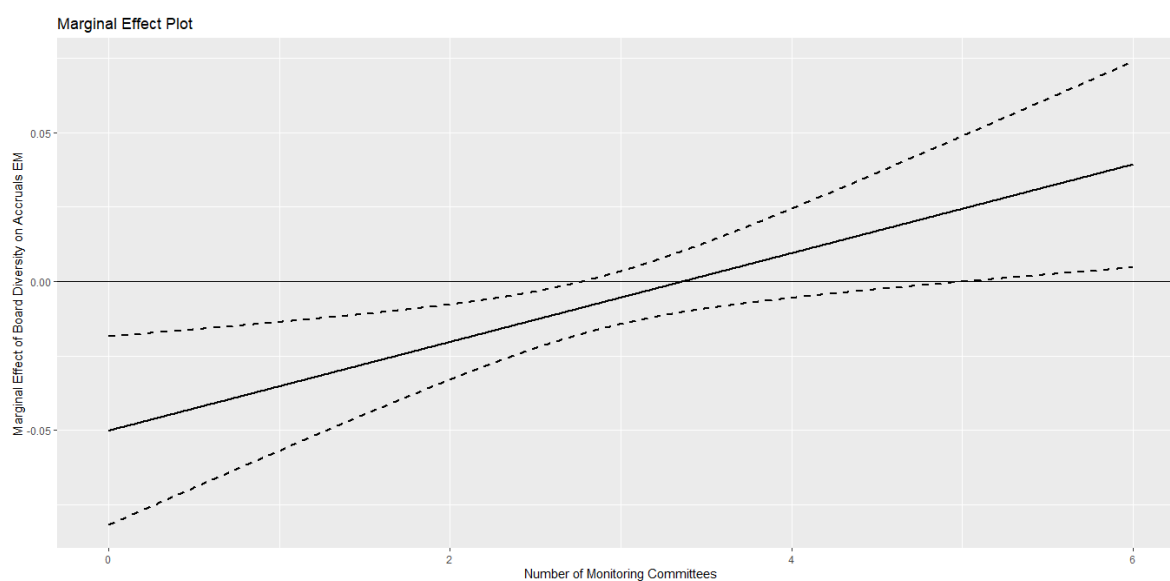


Figure 2. Conditional effects of monitoring and diversity on AEM.

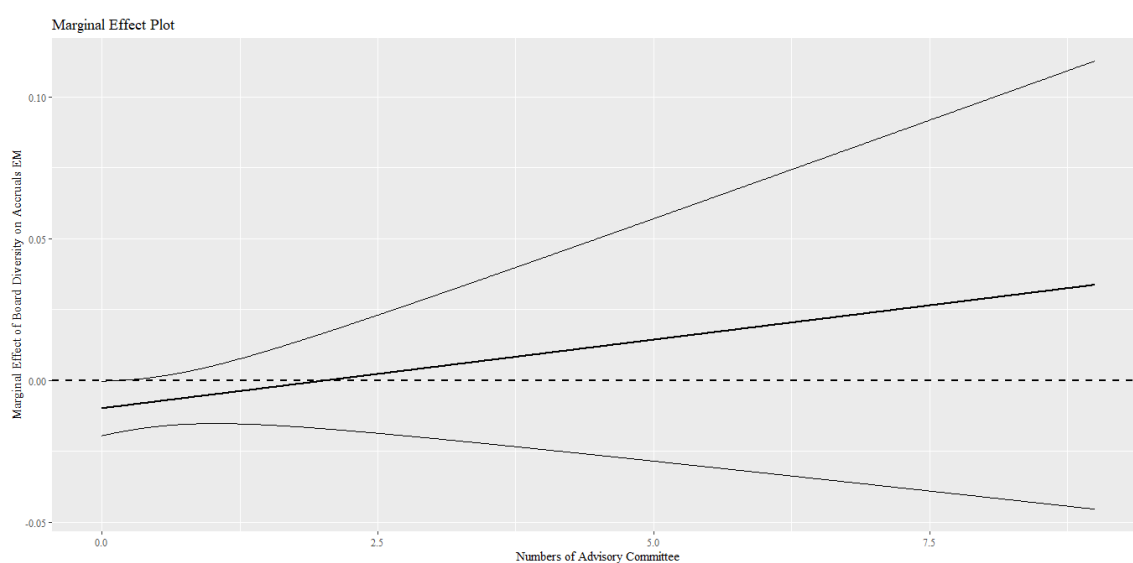


Figure 3. Conditional effects of advisory and diversity on AEM.

In contrast, Figures 4 and 5 illustrate an opposite dynamic for REM. The figures show that the positive association between board diversity and REM diminishes as the strength of monitoring and advisory roles increases, indicating a complementary relationship. That is, board roles and diversity together mitigate REM. These findings align with those of Hasan et al. (2022), who argued that governance mechanisms can act synergistically. For instance, Muhammad et al. (2025) found that gender diversity enhances the efficacy of CSR in mitigating earnings manipulation, while Musa et al. (2023) showed that independent directors amplify the role of female CEOs in reducing REM.

The moderating influence of board roles counteracts the substitution effect because functional governance mechanisms reinforce the effectiveness of structural diversity. Strong monitoring roles intensify oversight and limit managerial discretion, making it more difficult for managers to redirect manipulation toward real activities. Likewise, strong advisory roles improve information flow, reduce decision-making asymmetry, and enhance the board's ability to assess the operational consequences of managerial actions. Together, these functional roles close the governance gap created by diversity-induced substitution, thereby reducing opportunities for managers to exploit REM as an alternative channel for earnings manipulation.

The reduction of real earnings manipulation in the presence of strong board monitoring and advisory roles reflects a complementary governance effect. Drawing on agency theory, monitoring committees strengthen oversight of managerial operating decisions, limiting the ability of managers to manipulate production, sales timing, or discretionary expenditures that underpin REM. At the same time, human capital theory and resource dependence theory explain why diversity enhances the board's advisory capacity by bringing broader expertise, strategic insight, and external resource access. When these advisory resources operate alongside strong monitoring structures, directors are better equipped to evaluate the economic substance of operational decisions and detect deviations from normal business practices. Thus, the functional roles of the board reinforce rather than substitute for the structural benefits of diversity. This complementary interaction constrains REM more effectively than either board diversity or board roles alone, reducing managers' opportunities to distort real activities to achieve earnings targets.

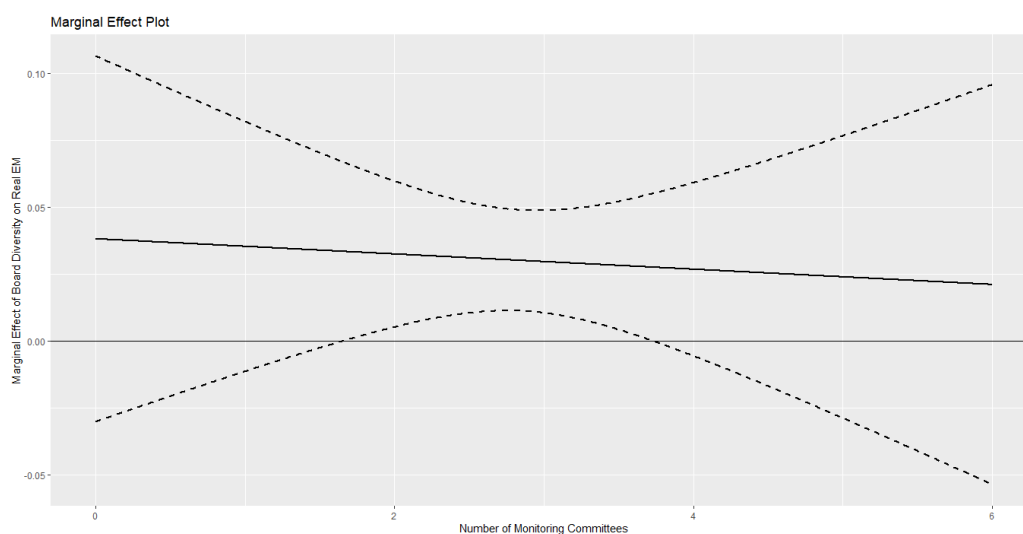


Figure 4. Conditional effects of monitoring and diversity on REM.

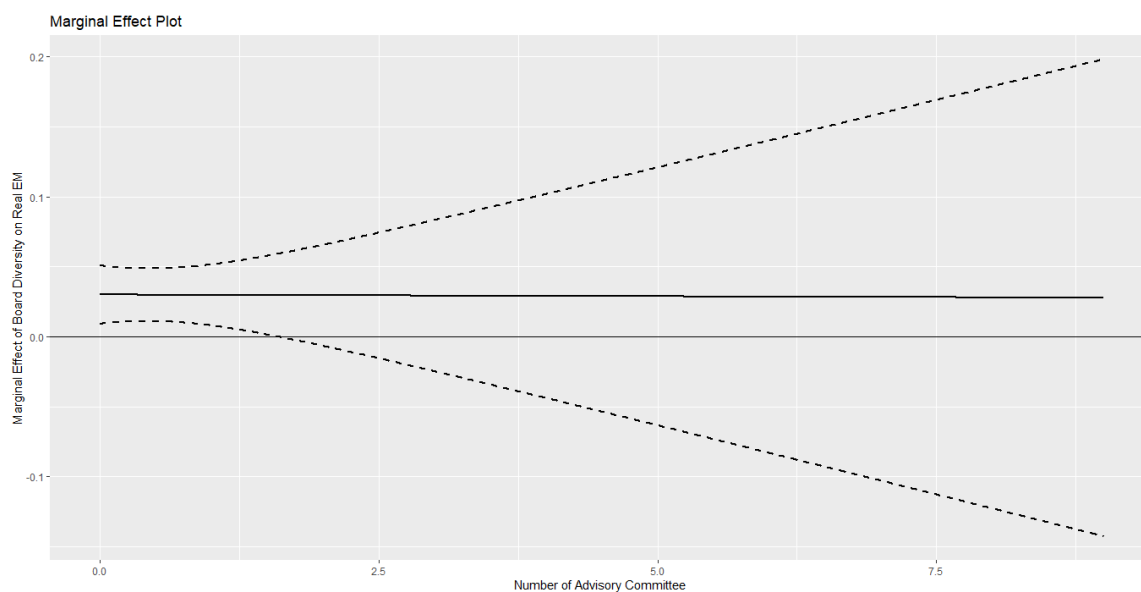


Figure 5. Conditional effects of advisory and diversity on REM.

Moreover, Figures 2 and 4 reveal that the effect of board diversity on AEM is beneficial up to approximately three monitoring committees, based on the point at which the confidence intervals lie entirely below zero (Berry et al., 2012; Hayes, 2018). This finding supports regulatory recommendations, such as those from Reeb and Upadhyay (2010), advocating for three core committees (audit, remuneration, and nomination). Conversely, Figures 3 and 5 suggest that the optimal number of advisory committees is around one. Having more than one advisory committee may generate inefficiencies due to overlapping functions and increased costs associated with additional meetings and director fees.

Furthermore, comparative analysis of Tables 8 and 9 indicates that monitoring roles have a stronger mitigating effect on earnings management than advisory roles. For instance, in Table 8, the interaction coefficient for Diversity \times Monitoring (0.019 surface, 0.059 deep) exceeds that of Diversity \times Advisory in Table 9 (0.013 surface, 0.025 deep). This supports the view that the primary governance role of boards is to monitor management, a position backed by regulatory frameworks such as the Sarbanes–Oxley Act (2002), the ASX CG Principles, and the UK Corporate Governance Code. The significance of clearly defined committee responsibilities is further supported by Latané et al. (1979), who highlighted the importance of identifiability in group settings to prevent shirking. Requiring public disclosure of committee memberships ensures that directors are held accountable. Thus, establishing specific board committees improves governance by clarifying duties and enhancing oversight effectiveness (Ntim, 2013).

The benefits of cognitive diversity, including having a broader range of perspectives, greater knowledge, and better problem-solving styles, are not automatic but require specific organizational conditions and leadership, which are often difficult to implement. For example, differences in educational or professional expertise mean board members might ‘speak different languages’, use different valuation techniques, or prioritize different types of information. This can hinder coordination, lead to miscommunication, and slow down decision-making. The oversight function, which requires

timely and unified action, may struggle with this friction. For cognitive diversity to work, directors must feel comfortable expressing a view that runs counter to the group consensus, for example, by questioning a complex financial model presented by an expert colleague. Visible attributes like gender and age often serve as more immediate, albeit imperfect, proxies for different life experiences, cognitive styles, and risk preferences that are highly relevant to financial oversight.

Deep-level differences can lead to task conflict, which, while potentially constructive, can also become personal or simply be hard to manage. If the diverse perspectives lead to perpetual disagreement or a lack of consensus, it can cause decision paralysis—a significant risk in financial oversight where clear direction is vital. Research on surface attributes often suggests that, on average, women exhibit a greater degree of risk aversion and higher ethical standards than men. In a sector like finance, which is prone to excessive risk-taking, the inclusion of women may lead to more prudent oversight, stronger earnings quality, and a reduced risk of corporate crises. Similarly, older executives may also exhibit different, generally lower, levels of overconfidence and risk-taking than younger executives. Visible differences in gender or age make it immediately clear that the board is not homogeneous. This physical difference can subtly but powerfully make it easier for individuals to voice dissenting opinions, as they are already aware of their differences. This is less true for “invisible” cognitive attributes like a specific educational background or a few years of tenure. Further, visible diversity better reflects the company’s customer base and society.

A board that looks diverse may be perceived as more legitimate, responsive, and accountable by regulators, investors, and the public, which improves the overall climate for effective oversight. Surface-level diversity is easier to measure and implement, making it a more immediate and tangible goal for regulation and corporate governance, e.g., regulators can easily set clear targets for gender or age representation (e.g., at least 40% female directors). Changes in visible diversity are immediately observable, leading to easier public accountability for progress. In contrast, measuring “expertise diversity” or “cognitive style diversity” is complex, subjective, and difficult to enforce. In summary, while cognitive diversity has the potential to be the true driver of superior decision-making by broadening the information and knowledge base, the benefits of surface-level diversity are often more readily realized in financial oversight because they are easier to implement, help disrupt homogeneity, and may be correlated with valuable risk-averse or ethics-focused behavior.

Taken together, the formal interaction tests and the marginal effects plots should be interpreted as complementary evidence. While the interaction terms fail to reach conventional significance thresholds, the visual analysis reveals governance dynamics consistent with integrated governance theory: diversity substitutes for strong board roles in mitigating AEM, but diversity and board roles reinforce each other in mitigating REM. This reframing situates the results within a complex governance system rather than a simple accept–reject hypothesis framework.

3.6. Endogeneity tests

Previous studies have raised concerns about endogeneity in the relationship between board diversity and firm outcomes (Adams & Ferreira, 2009; Campbell & Mínguez-Vera, 2007; Nyeadi et al., 2021). To address this, we employed an instrumental variable approach via two-stage least squares (2SLS) regression, using instruments such as the percentage of female employees and board size,

following studies by Abdelfattah et al. (2020), Harjoto et al. (2014), and Zhou (2019). Female representation in the workforce is likely to predict surface-level board diversity, while larger boards tend to be more diverse at the cognitive level (Agrawal & Knoeber, 2001).

Table 10. Results of endogeneity test (2SLS).

Variables	Panel A: First stage				Panel B: Second stage			
	Surface (AEM1)	Deep (AEM1)	Surface (REM3)	Deep (REM3)	Surface (AEM1)	Deep (AEM1)	Surface (REM3)	Deep (REM3)
Constant	0.678*** (0.018)	1.968*** (0.024)	0.678*** (0.018)	1.968*** (0.024)	0.231*** (0.006)	0.190*** (0.007)	-0.041*** (0.007)	-0.044*** (0.010)
<i>Independent variable</i>								
Female employee	0.002*** (0.001)		0.002*** (0.001)					
Board size		0.040*** (0.002)		0.040*** (0.002)				
Surface ^A					-0.008* (0.005)		0.011* (0.006)	
Deep ^A						-0.015** (0.007)		0.017** (0.007)
<i>Control variable</i>								
Firm size	0.038*** (0.002)	0.007*** (0.002)	0.038*** (0.002)	0.007*** (0.002)	-0.019*** (0.001)	-0.008*** (0.002)	0.007*** (0.001)	0.008*** (0.001)
Firm age	0.001*** (0.001)	0.001*** (0.001)	0.001*** (0.001)	0.001*** (0.001)	0.001 (0.001)	0.010 (0.011)	0.001*** (0.001)	0.001 (0.001)
ROA	0.005 (0.015)	0.013 (0.014)	0.005 (0.015)	0.013 (0.014)	-0.249*** (0.008)	-0.075*** (0.013)	-0.024** (0.010)	0.041*** (0.015)
Firm growth	-0.006 (0.004)	-0.003 (0.004)	-0.006 (0.004)	-0.003 (0.004)	0.009*** (0.002)	0.001 (0.002)	-0.013*** (0.003)	-0.009*** (0.003)
Z-Score	0.001 (0.001)	-0.001*** (0.001)	0.001 (0.001)	-0.001*** (0.001)	-0.001** (0.001)	-0.001** (0.001)	0.001 (0.001)	-0.001 (0.001)
IFRS	-0.009 (0.007)	0.007 (0.010)	-0.009 (0.007)	0.007 (0.010)	-0.015*** (0.004)	-0.048 (0.031)	0.005 (0.005)	0.007 (0.006)
Big4	0.117*** (0.008)	0.023*** (0.008)	0.117*** (0.008)	0.023*** (0.008)	-0.006 (0.004)	-0.020** (0.010)	-0.010* (0.006)	-0.013* (0.007)
Observations	13522	13522	13522	13522	13522	13522	13522	13522
R-Squared	0.156	0.441	0.156	0.441	0.205	0.168	0.297	0.297
F-Stat	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Note: The table shows two-stage regressions; where female employees and Board size are the instrumental variables used in this study. All variables are defined in Appendix A. All explanatory variables are lagged by one year to avoid simultaneous problems. Standard errors are clustered at the firm level and are reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively. ^A Surface and Deep have been instrumented using the instrumental variables included in the first-stage OLS regression shown in Panel A of this table: female employee and Board size, respectively.

We employed Durbin–Wu–Hausman tests and found that board diversity is indeed endogenous. In the first stage of the 2SLS estimation (Panel A, Table 10), both instruments were significantly correlated with board diversity. In the second stage (Panel B, Table 10), the results remain consistent with the fixed-effects analysis. Board diversity negatively affects AEM and positively affects REM. The results for control variables also mirror the earlier fixed-effects models, affirming the robustness of our primary findings.

4. Conclusions

This study has sought to investigate the influence of board diversity on earnings management practices through a multi-theoretical lens. By applying human capital theory, agency theory, and resource dependence theory, the research provides a comprehensive perspective on how diversity within corporate boards can influence both the monitoring and advisory functions of directors, subsequently impacting earnings quality. While this work represents a significant step in synthesizing theoretical and empirical insights, it also identifies several avenues for future research that could further refine and challenge existing assumptions in corporate governance (CG) scholarship.

Although the study primarily relied on established theories, new theoretical developments are increasingly relevant in this evolving field. For instance, future researchers may wish to adopt behavioral and psychological frameworks to better capture the nuanced interpersonal dynamics within boards. These perspectives are currently excluded from our analysis due to the complexity of obtaining robust data at the individual or team level, especially when constrained by secondary data sources. However, such theories could shed light on the underlying mechanisms of decision-making, accountability, and cognitive diversity that are not captured by structural variables alone.

Our research employed a deductive methodological approach using secondary data, which, while allowing for broad generalizability, limits the ability to capture context-specific dynamics. To address this limitation, future studies might consider employing experimental methods and simulations that offer control over variables and provide new empirical insights. Additionally, qualitative approaches could prove valuable, particularly in understanding directors' subjective experiences of accountability and influence. For instance, Elms and Nicholson (2020) demonstrated the utility of semi-structured interviews and non-participant observation in capturing complex, qualitative aspects of board processes, which could complement and deepen our findings.

The temporal scope of our study, spanning five years, was a pragmatic choice based on data availability and time constraints. Nevertheless, longer time horizons or expanded sample sizes could offer a more comprehensive view of the impact of board diversity. Comparative studies across countries, especially in developing economies, could enrich the analysis by integrating institutional variables such as legal frameworks, investor protections, and regulatory environments. This would not only test the external validity of our findings but also highlight how contextual factors shape the functioning and outcomes of diverse boards.

Emerging governance mechanisms represent another promising area for further exploration. Developments such as AI-enhanced decision-making tools, ESG-mandated board reforms, and the rise of shareholder activism may redefine traditional board roles. These innovations challenge longstanding assumptions from agency and resource dependence theories by altering how boards perform their

oversight and advisory functions. For example, AI-enabled transparency mechanisms may bolster monitoring effectiveness, while ESG imperatives may lead boards to adopt deeper, more substantive approaches to diversity beyond symbolic representation.

The empirical results of this study indicate a complex relationship between board diversity and earnings management. A significant negative association was observed between board diversity and accruals-based earnings management, consistent with agency theory and resource dependence theory. This suggests that diverse boards may improve the quality of financial disclosures by limiting discretionary accruals. However, an unexpected positive association emerged between board diversity and real earnings management, implying that firms may substitute accrual-based manipulation with real activities manipulation when facing greater board scrutiny. This finding highlights the interchangeability of earnings management strategies and underscores the need for a nuanced understanding of how diversity affects managerial behavior.

Further, the interaction effects between board diversity and specific board functions revealed nuanced patterns. While board diversity alone may encourage real earnings management, its interaction with active board roles appeared to reinforce the use of accrual-based techniques. Our results also indicate that the presence of up to three monitoring committees and one advisory committee may optimize the positive effects of board diversity, reducing overall earnings management. These findings illustrate the importance of considering both the individual and combined roles of structural and functional board characteristics.

The empirical findings reveal a clear optimal configuration of governance structures. The marginal effects analysis indicates that earnings management is most effectively reduced when firms maintain approximately three monitoring committees, typically audit, remuneration, and nomination, and one advisory committee. This configuration aligns the structural and functional roles of the board, providing both strong oversight and targeted strategic support without creating excessive coordination costs. The practical implication is that firms should avoid both under- and over-structuring their committees, as too few monitoring committees weaken oversight, while too many advisory committees may generate duplication and dilute director accountability.

Furthermore, the study highlights the importance of weighing board roles. Monitoring roles exert a systematically stronger mitigating effect on earnings manipulation than advisory roles, as shown by the comparative magnitude of interaction coefficients in Tables 8 and 9. This reinforces the core premise embedded in major governance frameworks, including the Sarbanes–Oxley Act (2002), the UK Corporate Governance Code, and the ASX Corporate Governance Principles, that robust monitoring remains the cornerstone of effective governance. While advisory roles provide valuable strategic insight, the findings confirm that they serve as a complement rather than a substitute for monitoring when the objective is to constrain earnings management.

These results strengthen the policy argument for enhanced disclosure of non-financial governance information. Given that real earnings management is inherently difficult to detect and tends to increase when diverse boards constrain accrual manipulation, regulators and investors require more transparency regarding deep-level board characteristics and committee practices. Comprehensive disclosure of directors' expertise, tenure profiles, committee responsibilities, and workload allocation would improve market visibility over the internal governance environment. This would enable

stakeholders to better evaluate whether board structures are configured in a manner consistent with effective earnings quality oversight.

In practical terms, the results suggest that regulatory bodies should consider mandating the disclosure of non-financial information, including detailed accounts of board composition and governance practices. Such disclosures would improve transparency and enhance investor communication, particularly in an era where non-financial metrics are gaining prominence. Organizations can also use our findings to refine internal governance policies, aiming for a composition and structure that deters earnings manipulation while enhancing decision-making.

The multi-theoretical framework employed here underscores the inadequacy of relying on a single theory to explain the multifaceted nature of CG dynamics. Our findings support the integration of human capital, agency, and resource dependence theories to capture the diverse ways in which board characteristics influence corporate outcomes. Specifically, board diversity plays both substitutive and complementary roles in relation to other board functions, affecting the quality of earnings reporting and managerial accountability.

Human capital theory explains the unique resources each board member brings, while agency theory supports the role of diversity in strengthening monitoring mechanisms. Meanwhile, resource dependence theory justifies the value of diverse perspectives in the advisory function. Together, these theoretical contributions create a more holistic understanding of how board diversity influences both monitoring and advisory roles, leading to improved earnings quality and reduced earnings management. Moreover, our methodological contributions, including the use of comprehensive diversity indices and moderating regression analysis, allow for a more detailed and conditional interpretation of the data. By supplementing statistical models with visual tools such as marginal effects graphs, we provide clearer insight into interaction effects, addressing one of the key challenges in interpreting complex empirical relationships.

Rather than simply asking whether board diversity affects earnings management, this study takes a deeper look into when it matters and how it works. It considers the specific roles boards play, such as monitoring management and offering strategic advice, and looks at two different forms of earnings management—one based on accounting choices and the other on actual business activities. By using a combination of theories and a detailed diversity index that captures both visible traits (like gender and age) and deeper qualities (like experience and education), the study paints a fuller picture of how board composition shapes financial reporting. It also highlights an important trade-off: while diversity may reduce one type of manipulation, it could unintentionally increase another. These findings offer fresh, more nuanced insights that go beyond the usual one-dimensional approaches of traditional governance research.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Author contributions

N.S. conceived and designed the study; N.S. performed the data collection and formal analysis; N.S. wrote the first draft of the manuscript and J.S. worked on the draft for the current article; J.S. and L.T. provided software support and N.S. provided data curation; J.S. and L.T. supervised the project and N.S. acquired funding. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

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