



Does Board Age Diversity Influence Shareholder Value Creation? Empirical Evidence from South African Listed Non-Financial Companies

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ABSTRACT

This study investigated the influence of board age diversity (BAD) on the shareholder value creation (SVC) of South African non-financial companies listed on the JSE. A quantitative quasi-experimental design was used. The data collection sources included integrated annual reports, the Who Owns Whom database and the Osiris database. The study measured board age diversity using the Blau index (BI_BAD), average age (AVE_ABM), standard deviation (SD_ABM), coefficient of age variation (CV_ABM) for board members, and dummy variables for age diversity categories. The proxies of the SVC included standard market value added (SMVA), market-to-book ratio (MTB) and Tobin's Q (TBQ). A fixed effects model was employed to test the hypotheses. The curvilinear quadratic models revealed that all BAD measures positively and negatively impacted all SVC measures, highlighting a U-shaped or an inverted U-shaped effect. The empirical findings suggest that moderate levels of age diversity contribute positively to shareholder value, while very low or high BAD levels may be less beneficial. The statistical results support the multi-theoretical perspective that BAD has a double-edged sword effect. These results offer important insights for corporate governance practices, highlighting the strategic role of board composition in enhancing shareholder value creation in emerging markets. Also, the results highlight the importance of balanced BAD for optimising shareholder value in emerging markets.

Keywords: Corporate Governance, Board Age Diversity, Shareholder Value Creation, South African, Listed Companies, Theories of Diversity, Curvilinear Quadratic Models

JEL Classifications: M14, M41, M42

1. INTRODUCTION

The age of directors in corporate governance has become a topical global discussion subject (Gardiner, 2022). The most dominant question is why age is a significant factor in boardroom dynamics. Another pertinent question is whether younger or older individuals should occupy board positions (Jaafar and Rahmat, 2021). Given the background, board members have traditionally tended to be older and often labelled as the “old boy network” (Schank, 2019; Stefanelli et al., 2024). The implications arising from board domination by young directors are another exciting topic. The age diversity indicates that the board has a mix of directors

of different ages (Alberly et al., 2023). The King IV report on corporate governance in South Africa recommends that companies listed on the Johannesburg Stock Exchange (JSE) disclose the age diversity of directors. Despite the recommendations by the King IV report of the need for board age diversity, debate continues to rage over what age constitutes an optimal board age diversity to enhance shareholder value.

Recent research provides inconsistent and troubling results, with board age diversity often having positive, but also negative or no effect on shareholder value creation (Jonson et al., 2020; Ben Selma et al., 2022; Pandey et al., 2022; Mubarka and Kammerland,

2023). Indeed, the conceptualisation and measurement of board age diversity appears to be one of the challenges. A closer examination of the literature on board age diversity reveals that scholars often inconsistently use board age diversity variables. For instance, For example, some studies measure board age diversity using the average age of board members (Liang et al., 2022; Proença and Neves, 2022). Others used the Blau index to assess board age diversity (Kagzi and Guha, 2018; Khan et al., 2024; Vetchagool, 2025; Jeyhunov et al., 2025). Additionally, some researchers apply the standard deviation of age among board members (Jonson et al., 2020), while others use the coefficient of variation for age (Pandey et al., 2022; Mubarka and Kammerland, 2023). Furthermore, some studies incorporate a dummy variable set to one if the average age for board members' categories (Vetchagool, 2025). Overall, there is no "one-size-fits-all" mechanism for measuring board age diversity to enhance shareholder value effectively. Therefore, the current research investigates how various multidimensional measures of board age diversity influence shareholder value creation.

Indeed, the question that also continually arises is how shareholder value creation can be explained and accurately measured can also create another research gap. Thus, researchers are faced with an ever-increasing array of research findings on ways to express shareholder value creation. Indeed, shareholder value creation can be measured using two categories. First, shareholder value creation can be expressed using traditional accounting-based measures such as earnings per share (EPS), return on assets (ROA), return on equity (ROE) and dividend per share (DPS) (Venugopal et al., 2018; Nieuwoudt and Hall, 2022). These traditional measures had their inherent limitations as they were based on accounting statements like an income statement and balance sheet, which themselves are prepared on arbitrary accounting assumptions like the accrual concept. These measures thus failed to measure the true economic performance of the companies (Pandya, 2016; Nieuwoudt and Hall, 2022). Many scholars criticise traditional measures, as they are not proper guidance for making a strategic decision (Laksana and Mayasari, 2020). Then, shareholder creation can also be expressed using value-based management (VBM) measures such as economic value added (EVA), cash value added (CVA), market value added (MVA), total shareholder return (TSR), market-to-book ratio (MTB), Tobin's Q (TBQ) (Venugopal et al., 2018; Kaczmarek, 2024). Managers may need such VBM metrics in order to set targets that are in line with shareholder interests (Lueg and Toft, 2022; Tontiset, 2025). Therefore, this research examined how multiple board age diversity measures influenced multiple VBM measures of shareholder value creation of South African listed non-financial companies.

Another research gap appears to emanate from the models used by the previous studies. Most of the previous studies examining board age diversity influence on firm performance used linear models instead of curvilinear models (Jonson et al., 2020; Pandey et al., 2022; Mubarka and Kammerland, 2023). However, linear models are often criticised in the analysis of board age diversity's influence on shareholder value creation, primarily because they may oversimplify the relationship by assuming it is strictly linear. Yet, curvilinear models that include quadratic terms reveal these complex relationships better, capturing the "too little or too

much" effect and the potential inverted U-shaped influence on shareholder value or firm financial performance. In fact, extant literature suggests that the lack of theoretical integration leads to poor methodological rigour (Nuhu, 2024). Thus, this research used curvilinear models based on a multi-theoretical perspective to examine the influence of board age diversity on shareholder value creation of South African listed non-financial companies.

This study presents several essential contributions to the field of corporate governance research. First, the study advances understanding by capturing the nonlinear or inverted U-shaped relationship between board age diversity and shareholder value creation, which linear models fail to identify. This reveals that optimal levels of age diversity exist, beyond which the contribution to shareholder value may plateau or decline. Second, using multidimensional measures of board age diversity (such as average age, Blau index, standard deviation, coefficient of variation and dummy variables of short tenured and long tenured boards) provides a more comprehensive analysis of how various aspects of age heterogeneity influence performance. Third, applying multiple shareholder value creation proxies (e.g., market value added, market-to-book ratio, Tobin's Q) across South African non-financial firms allows for robust validation of the curvilinear effects, showing that age diversity impacts different value metrics variably. Fourth, the findings highlight the "double-edged sword" effect of board age diversity, showing both positive contributions at moderate diversity levels and potential negative effects if diversity is too low or too high, thus informing better board composition and governance policies in emerging economies like South Africa. Fifth, this study addresses measurement issues common in the literature on board tenure diversity and shareholder value creation, employing a positivist epistemological perspective. Finally, the results provide valuable insights for policymakers and corporate executives regarding the importance of board age diversity in enhancing shareholder value for non-financial companies listed in South Africa.

The rest of the study is organised as follows. Section 2: Literature review. Section 3 Research methodology. Section 4: Empirical results and discussion. Section 5: Conclusion. Section 6: Theoretical implications. Section 7 Practical implications. Section 8 Limitations and recommendations for future research.

2. LITERATURE REVIEW

2.1. Theoretical Background

The question of how board member age diversity is likely to affect company shareholder value creation is addressed by several theories on board age diversity. There are two types of theories: Those that take an optimistic view or a pessimistic view of board age diversity. The optimistic view of diversity, also known as "value-in-diversity," focuses on the information/decision-making aspect of diversity and indicates better quality outcomes (Myint, 2023). On the other hand, the pessimistic view of diversity emphasizes social relationships/social categorisation aspects of diversity and points out the negative effects of diversity. Thus, the theories of diversity applied in this research include upper echelon theory, agency theory, resource dependency theory, resource-

based view theory, social-categorisation theory, and similarity/attraction theory.

2.1.1. Upper echelons theory

The upper echelons theory (UET) posits that an organisation mirrors its leadership team and guides its strategic direction while being influenced by external forces and constrained by the leadership's thought processes (Puntaier et al., 2022). Leaders' experiences, values, and personal characteristics serve as natural filters, limiting their vision, perception, and interpretation of information and signals (Collecchio et al., 2025). Board member age indicates relevant business experience and is associated with behaviours and attitudes. Notably, the theory presents conflicting views about directors' behaviours across different age groups. For instance, older directors tend to demonstrate greater risk aversion than their younger counterparts (Knežević et al., 2023; Vetchagool et al., 2025). Conversely, younger directors are typically more willing to take risks and possess a higher risk tolerance (Hambrick and Mason, 1984). However, due to the heightened possibility of termination, younger directors may display herding behaviour, leading them to take fewer risks (Hambrick and Mason, 1984).

2.1.2. Agency theory

The agency theory is a contract that describes the relationship between the firm's shareholders and its board of directors (Alqatan, 2024). Appointing young and older people to these positions means that the board has a blend of experience and creativity, proving helpful in ensuring that the board has a practical and accurate system for monitoring the firm's business activities. The age diversity on a board may improve the board's capacity to conduct its job of providing resources and oversight (Ali et al., 2021; Pandey et al., 2022). This could be due to the many viewpoints and points of view and the invaluable expertise and experience that directors of varying ages can offer (Martikainen et al., 2022). From an agency perspective, more significant monitoring effects may arise in firms with pronounced age gaps of board members (Neukirchen et al., 2023).

2.1.3. Resource dependency theory

The resource dependence theory suggests that a more age-diverse board of directors helps the company obtain vital resources from its external environment, which improves performance (Bonaparte et al., 2022). For instance, the unique and essential resources that both young and older directors contribute provide the company with a competitive edge and boost profitability (Al-Jaifi et al., 2023). Additionally, by balancing the youthful enthusiasm and energy of the younger directors and the older directors' seasoned experience and risk aversion, a varied group of board members can improve oversight and prevent groupthink (Alshabibi, 2022). Consequently, boards with a mix of young and experienced directors are more likely to perform effectively than ones made up only of seniors or young directors, as each group brings unique benefits to the business (Ozdemir and Erkmén, 2022).

2.1.4. Resource-based view theory

The resource-based view (RBV) theory indicates that the firm's competitive advantages and financial performance are closely related to internal resources (Mehedi et al., 2024). According to

RBV, firms' sustained performance varies due to differing ability levels and internal resource utilisation capacities. The RBV theory suggests that the age diversity of board members is a significant "firm's human resources" that improves competitive advantage (Khan et al., 2024). The competitive advantage of the board may suffer if members of the same age group make decisions and exercise leadership that are biased toward a different age group (Beji et al., 2021). The optimum age diversity for the board would be a mix of older and younger members from different generations to help the firm reach higher performance (Petersson and Wallin, 2017).

2.1.5. Social categorisation theory

The social categorisation theory suggests that age-diverse boards run a greater risk of inciting in-group and out-group sentiments among their members and "us versus them" attitudes (Roberson et al., 2017). It has been observed that directors of different ages tend to associate more with other board members in their age group because they are easier to have a good relationship with and more likely to share their values and expectations with (Ali et al., 2014). Consequently, age-based subgrouping may make it more difficult for coworkers to integrate socially and cohesively (De Meulenaere et al., 2022). Social categorisation theory states disagreements among board members are more likely to occur when there are gaps in beliefs and values, which are reflected in age differences (Janahi et al., 2023). As a result, due to problems relating to social groups, more conflict, and a decline in social cohesiveness, a greater age variety on the board may be detrimental to performance.

2.1.6. Similarity/attraction theory

The similarity-attraction theory posits that group members with similar values and beliefs are more likely to engage in favourable behaviours toward their in-group while potentially discriminating against out-group members, which can adversely affect group performance (Bhat et al., 2020). This theory also indicates that the age of board members may influence their attraction to one another, often leading to the formation and maintenance of social groupings based on age differences (Syakhroza et al., 2021). Consequently, the similarity-attraction theory suggests that the cohesion between older and younger board members may decline, resulting in lower levels of attachment and less effective social interactions (Gardiner, 2024). Additionally, it implies that age diversity among board members can negatively impact a company's performance (Petersson and Wallin, 2017; Liang et al., 2022).

2.2. Conceptual Literature Review

2.2.1. Board age diversity

Growing up in different times, each generation can develop a unique set of world views. Directors can see themselves as part of a certain generation (Jeyhunov et al., 2025). Thus, age often highlights a generational gap that influences personal values. Individuals from different age groups are expected to appreciate and embrace various experiences, customs, habits, and characteristics that shape their decision-making processes (Farooq et al., 2024). Board directors' life experiences and personal values shape firms' strategic direction. In recent years, research has indicated that age can be a reliable indicator of a person's

experience level and willingness to take risks (Zhang et al., 2024). For example, younger directors are typically perceived as more adventurous and inclined to take risks, whereas older directors are generally viewed as steadier and more cautious. Furthermore, older directors tend to feel less pressure to demonstrate their worth in the market, leading them to adopt a less aggressive and risk-averse decision-making approach (Khan et al., 2024).

Evidence suggests that companies with boards composed of older directors are less likely to face bankruptcy (Proença and Neves, 2022). Moreover, younger directors are often seen as more innovative and capable of proposing riskier initiatives (Al-Jaifi et al., 2023). They infuse the board with vitality and attentiveness. In contrast, older directors tend to have more significant accomplishments (Al-Jaifi et al., 2023) but are less inclined to embrace change. Conversely, their younger counterparts are associated with driving strategic change (Fernández-Temprano and Tejerina-Gaite, 2020). Moreover, older directors may be more apprehensive about losing assets than younger directors are (Proença and Neves, 2022). Thus, both young and older directors offer unique insights and experiences that can benefit organisations.

Indeed, Age diversity on the board reflects a blend of directors from various age groups (Farooq et al., 2024). The board's composition includes both middle-aged and senior directors, with middle-aged members able to leverage the extensive experience of their senior counterparts (Alberty et al., 2023). This diversity in age can help mitigate groupthink and enhance oversight by balancing the youthful enthusiasm and energy of newer directors with the seasoned insights and risk aversion of their more experienced peers (Alshabibi, 2022). In essence, the coexistence of different generations on corporate boards fosters a variety of worldviews, values, cultural norms, and perspectives (Branco et al., 2022). Consequently, age diversity may facilitate the exchange of ideas and create a synergistic effect, leading to improved team performance (EmadEldeen et al., 2023; Mubarka and Kammerlander, 2023). Additionally, age-diverse boards benefit from their older members' knowledge, experience, and financial resources while gaining their younger counterparts' vitality, fresh ideas, and viewpoints, along with the active contributions of middle-aged directors (Branco et al., 2022). Ultimately, board age diversity can represent a powerful combination of organisational productivity and experience (Khan et al., 2024).

On the other hand, diversity in boardrooms could also lead to potential costs as a result of conflicts, communication problems, and bias against out-of-group members. In other words, board members can divide themselves based on age, resulting in less collaboration and negatively impacting the group decision-making process (EmadEldeen et al., 2025). Hence, it can be more challenging for board members of different ages to find common ground and collaborate effectively (Waligóra, 2024). Thus, diversity in corporate boards could be considered a double-edged sword that could affect shareholder value creation (Arioglu, 2021).

2.2.2. Shareholder value creation

Creating shareholder value remains a fundamental focus in management accounting (Srinivasan et al., 2021). Nevertheless, the challenge of measuring and optimising the returns that owners and investors anticipate continues to persist (Hall, 2024). Creating shareholder value poses a significant challenge for organisations (Makhija and Trivedi, 2021). This leads us to a central question: How can we effectively measure value creation? This inquiry is vital for investors and managers (Faiteh and Mohammed, 2023). To address this, shareholder value creation can be quantified using traditional accounting-based measures and value-based management (VBM) techniques (Hall, 2018).

Numerous traditional accounting-based measures are available, such as earnings before interest, tax, and amortisation (EBITA), return on sales (ROS), return on assets (ROA), return on equity (ROE), return on investment (ROI), and earnings per share (EPS) (Hall, 2024). These metrics serve as the foundation of conventional approaches to company analysis (Mamilla and Vasumathi, 2020). Traditional accounting-based measures have been used to assess a firm's valuation (Zawna and Singh, 2020). While the relevance of these measures cannot be overlooked, they possess some inherent limitations. Firstly, accounting-based measures rely on historical data, primarily focusing on an organisation's short-term performance (Singla and Prakash, 2023). Moreover, most of these measures look backwards, are heavily influenced by accounting practices, and primarily highlight management's achievements. They often overlook the cost of capital, complicating assessing whether a company is genuinely generating value due to managerial decisions (Kolamker and Ingalhalli, 2024). Traditional accounting-based measures do not reflect value creation that is caused by management decisions. Hence, they do not provide strategic value management guidance (Kolamker and Ingalhalli, 2024). The limitations of traditional accounting-based measures create a significant opportunity for value-based management (VBM) metrics (Mengi and Bhatia, 2017; Sura et al., 2022).

VBM is a structured approach to corporate management that focuses on maximising shareholder value (Elgharbawy and Abdel-Kader, 2021). VBM is described as a comprehensive approach to management that focuses on value creation by achieving goals (Mitan et al., 2021). Also, VBM has emerged as a tool for addressing agency conflicts and enhancing shareholder activism against managerial opportunism (Makhija et al., 2021). VBM is a concept that allows decision-makers to determine priorities in decision-making so that they contribute to the value of companies as much as possible (Kovsca, 2023; Kaczmarek, 2024). VBM can effectively motivate management to prioritise shareholder value maximisation (Lueg and Paraschiv, 2023). The core principle of VBM indicates that companies generate value when their returns on capital exceed their cost of capital. There are various VBM measures. Examples of VBM measures include Economic Value added (EVA), cash flow return on investment (CFROI), market capitalisation (MCAP), market value added (MVA), market-to-book ratio (MTB), total shareholder return (TSR), Tobin's Q (TBQ) and cumulative abnormal return (CAR) (Hall, 2018; Mohammed et al., 2021; Singla and Prakash, 2023; Yaman and Topal, 2024). The emergence of a value-based measures system

helps managers make better decisions by concentrating on the drivers influencing shareholder value (Venugopal et al., 2018). The adoption of VBM has prompted numerous consulting firms to develop metrics for monitoring shareholder wealth, leading to a competitive “metric war” to identify the most effective proprietary metrics (Nieuwoudt and Hall, 2022).

Notably, there are distinctions in the systems used to create shareholder value when comparing accounting-based measurements to those of VBM (Makhija and Trivedi, 2021). Some studies concluded that accounting methods outperform VBM, while others did not (Oke and Ajeigbe, 2024). The differences between the two methods lie in the fact that VBM offers a company’s long-term report, whereas the accounting variables offer a short-term one. Another point of contention is that although VBM focuses on value creation, accounting variables produce financial profit results (Shah, 2020). The fact that the two models produce different outcomes when used to assess a company’s performance adds another point of contention. For successful shareholder value creation, the company must have high-quality, proficient management or good corporate governance (Mulla and Misra, 2021). Parallel to the development of shareholder value creation measures, research has been conducted to determine the shareholder value creation measure that best explains value creation or destruction (Hall, 2018).

2.3. Empirical Literature Review and Hypotheses Development

Previous empirical studies examining the influence of board age diversity (BAD) on shareholder value creation (SVC) have produced inconsistent results. For instance, a study by Ali et al. (2014) examined 288 firms listed on the Australian securities exchange from 2011 to 2012. This research measured BAD using two metrics: The coefficient of variation of age for board members (CV_ABM) and the squared coefficient of variation of age for board members (CV_ABM²). The return on assets (ROA) was used as a shareholder value creation proxy. The findings indicated that while CV_ABM positively influences ROA, CV_ABM² has a detrimental effect on ROA, revealing an inverted U-shaped relationship consistent with the integration of the resource dependency social identity theories. Similarly, Ferrero-Ferrero et al. (2015) investigated 205 European-listed companies in 2009. The study measured BAD using the Blau index for board age diversity (BI_BAD), the standard deviation of the age of board members (SD_ABM), and CV_ABM. Earnings before interest and tax (EBIT) represented SVC. Their analysis demonstrated that BI_BAD positively impacts EBIT, which supports the upper echelons theory, while no statistically significant relationship was found between SD_ABM and EBIT. In contrast, CV_ABM negatively affected EBIT, which is consistent with the similarity attraction theory.

In another study, Petersson and Wallin (2017) studied 1,438 Swedish companies listed on OMX Large Cap, Mid Cap, and Small Cap Stockholm from 2011 to 2015. They implemented BI_BAD, SD_ABM, and CV_ABM to measure BAD, while Tobin’s Q (TBQ) measures SVC. Their regression results revealed that BI_BAD, SD_ABM, and CV_ABM significantly negatively impact

TBQ, which lends support to the similarity attraction theory. On the other hand, Kagzi and Guha (2018) investigated the Top 200 Indian knowledge-intensive firms (KIFs) listed on the NSE from 2010 to 2014. The BAD was measured using BI_BAD and the Blau index for board age diversity squared (BI_BAD²), while TBQ proxied the SVC. The results of Generalised Least Squares (GLS) revealed that BI_BAD had a positive impact on TBQ, while BI_BAD² had a negative influence on TBQ, highlighting an inverted U-shaped effect consistent with the integration of resource dependency and social categorisation theories.

In assorted studies, Jonson et al. (2020) examined 130 Australian companies from 2011 to 2015. The study measured BAD through the metrics of AVE_ABM and AVE_ABM². They assessed SVC using ROA and TBQ. Their regression analysis revealed that AVE_ABM positively influenced ROA and TBQ, whereas AVE_ABM² negatively impacted these metrics, indicating an inverted U-shaped relationship consistent with integration. The findings are consistent with the integration of stewardship and social identity theories. Similarly, Song et al. (2020) analysed 320 firms within the US lodging industry from 1993 to 2018, measuring BAD with SD_ABM and employing TBQ as a proxy for SVC. The results from their fixed effects model (FEM) and two stage least squares (2SLS) indicate that SD_ABM has an insignificant positive effect on TBQ, partially consistent with resource dependency and human capital theories. Also, Arioglu (2021) investigated 2,279 company-year observations from firms listed on Borsa Istanbul between 2009 and 2017. This study utilised CV_ABM and AVE_ABM to measure BAD, while ROE and ROA proxied SVC. The analysis via pooled ordinary least squares (OLS). The results of OLS indicated that CV_ABM and AVE_ABM significantly positively influenced ROE and ROA, consistent with the agency and resource dependency theories. Also, Pandey et al. (2022) examined 197 companies listed on NSE from 2008 to 2018. This study measured BAD using CV_TBM. The generalised method of moments (GMM) results indicated CV_ABM had an insignificant negative impact on impact on ROA and TBQ, which is inconsistent with the agency theory.

In another study, Liang et al. (2022) focused on 14 Chinese hospitality firms from 1999 to 2018. The BAD was measured using AVE_ABM and AVE_ABM² to measure BAD and TBQ as an indicator of SVC. Their GMM results indicated that while AVE_ABM positively impacts TBQ, AVE_ABM² has a negative effect, again suggesting an inverted U-shaped relationship consistent with the integration of resource dependency and similarity/attraction theories. Similarly, Proença and Neves (2022) investigated 23 Portuguese companies and 74 Spanish companies listed from 2015 to 2019. The BAD was measured using AVE_TBM, while SVC was proxied using ROA, ROE, MTB and TBQ. The results FEM revealed that AVE_ABM had a significant positive impact on ROE and TBQ. However, AVE_TBM had an insignificant positive impact on ROA and MTB, which lends support to the agency and resource dependency theories. In contrast, Pandey et al. (2022) investigated 197 companies listed on NSE from 2008 to 2018. In this study, CV_TBM measured BAD, while ROA and TBQ proxied SVC. The results of GMM showed that CV_ABM had an insignificant negative impact on ROA and TBQ, which

partially supports the agency and resource dependency theories. In the same vein, Mubarka and Kammerland (2023) examined 341 German family and nonfamily firms from 2014 to 2018. BAD was measured using CV_TBM, while ROA represented SVC. The results of OLS revealed that CV_ABM had an insignificant positive impact on ROA.

In another study, Khan et al. (2024) explored 88 non-financial firms listed on the Pakistan Stock Exchange from 2009 to 2020, measuring BAD with BI_BAD. The study evaluated ROA and TBQ as proxies for SVC. The random effects model (REM) and GMM results indicate that BI_BAD negatively impacts ROA and TBQ significantly, which is inconsistent with RBV theory. Also, Vetchagool (2025) examined 45 agriculture and food companies listed on the SET between 2018 and 2022. The results of FEM revealed that BI_BAD had a negative influence on ROA and ROE, while having a positive impact on TBQ. Table 1 summarises the empirical research findings on the relationship between board age diversity and company shareholder value creation.

In summary, theoretical and empirical data suggest a potential connection between board age diversity and shareholder value

creation. However, the nature of this relationship may be positive, negative or curvilinear, effect. Therefore, the following hypotheses will guide the current study on board age diversity and its impact on shareholder value creation:

- H_{1a}: The Blau index for board age diversity (BI_BAD) has a significant positive or negative effect on shareholder value creation of South African-listed non-financial companies.
- H_{1b}: The average age of board members (AVE_ABM) has a significant positive or negative effect on shareholder value creation of South African listed non-financial companies.
- H_{1c}: Standard deviation of age for board members (SD_ABM) has a significant positive or negative effect on shareholder value creation of South African listed non-financial companies.
- H_{1d}: Coefficient of age variation for board members (CV_ABM) has a significant positive or negative effect on shareholder value creation of South African listed non-financial companies.
- H_{1e}: Company boards with an average age of board members ranging from 40 to 49 years (A40-A49) have a significant positive or negative effect on shareholder value creation of South African listed non-financial companies.
- H_{1f}: Company boards with an average age of board members ranging from 50 to 59 years (A50-A59) have a significant

Table 1: Illustration of inconsistent results in empirical board age diversity and shareholder value creation studies

Author (s) and year	Sample and period	Board age diversity measure (s)	Shareholder value creation measure (s)	Theoretical lens	Estimation method	Key findings
Kagzi and Guha (2018)	Top 200 Indian knowledge-intensive firms (KIFs) listed on the NSE from 2010 to 2014.	BI_BAD, BI_BAD ²	TBQ	Resource dependency theory and social categorisation theory	GLS	BI_BAD had a positive impact on TBQ, while BI_BAD ² had a negative influence on TBQ, highlighting an inverted U-shaped effect.
Jonson et al. (2020)	130 Australian companies from 2011 to 2015.	AVE_ABM, SD_ABM	ROA, TBQ	Stewardship theory, social identity theory	FEM	AVE_ABM had a significant positive impact on ROA and an insignificant positive impact on TBQ. SD_ABM had a negligible negative effect on ROA and TBQ
Pandey et al. (2022)	197 companies listed on NSE from 2008 to 2018	CV_ABM	ROA and TBQ	Agency theory, resource dependency theory	GMM	CV_ABM had an insignificant negative impact on impact on ROA and TBQ
Liang et al. (2022)	14 Chinese hospitality companies engaged in hotel operations from 1999 to 2018	AVE_ABM, AVE_ABM ²	ROA, ROE, TBQ	Human capital theory, similarity attraction theory	GMM	AVE_ABM positively influenced ROA, ROE and TBQ, while AVE_ABM ² negatively impacted ROA, ROE and TBQ, suggesting an inverted U-shaped effect.
Khan et al. (2024)	188 nonfinancial firms listed in the PSX from 2009 to 2020.	BI_BAD	ROA, TBQ	Resource-based view theory	GMM	BI_BAD had a significant negative impact on ROA and TBQ.
Proença and Neves (2022)	23 Portuguese companies and 74 Spanish companies were listed from 2015 to 2019.	AVE_ABM	ROA, ROE, MTB, TBQ	Resource dependency theory and social identity theory	FEM	AVE_ABM had a significant positive impact on ROE and TBQ, while having an insignificant positive impact on ROA and MTB.
Mubarka and Kammerland (2023)	341 German family and nonfamily firms from 2014 to 2018	CV_ABM	ROA	Socioemotional wealth theory	OLS	CV_ABM had an insignificant positive impact on ROA.
Vetchagool, (2025)	45 agriculture and food companies listed on the SET between 2018 and 2022	BI_BAD	ROA, ROE, TBQ	Upper echelons theory, Resource dependency theory, Similarity attraction theory	FEM	BI_BAD had a negative influence on ROA and ROE, while having a positive impact on TBQ.

positive or negative effect on shareholder value creation of South African listed non-financial companies.

H_{1g}: Company boards with an average age of board members ranging from 60 to 69 years (A60-A69) have a significant positive or negative effect on shareholder value creation of South African listed non-financial companies.

H_{2a}: Blau index for board age diversity squared (BI_BAD²) has an inverted U-shaped effect on shareholder value creation of South African listed non-financial companies.

H_{2b}: Average age of board members squared (AVE_AB²) has an inverted U-shaped effect on shareholder value creation of South African listed non-financial companies.

H_{2c}: Standard deviation of the age of board members squared (SD_AB²) has an inverted U-shaped effect on shareholder value creation of South African listed non-financial companies.

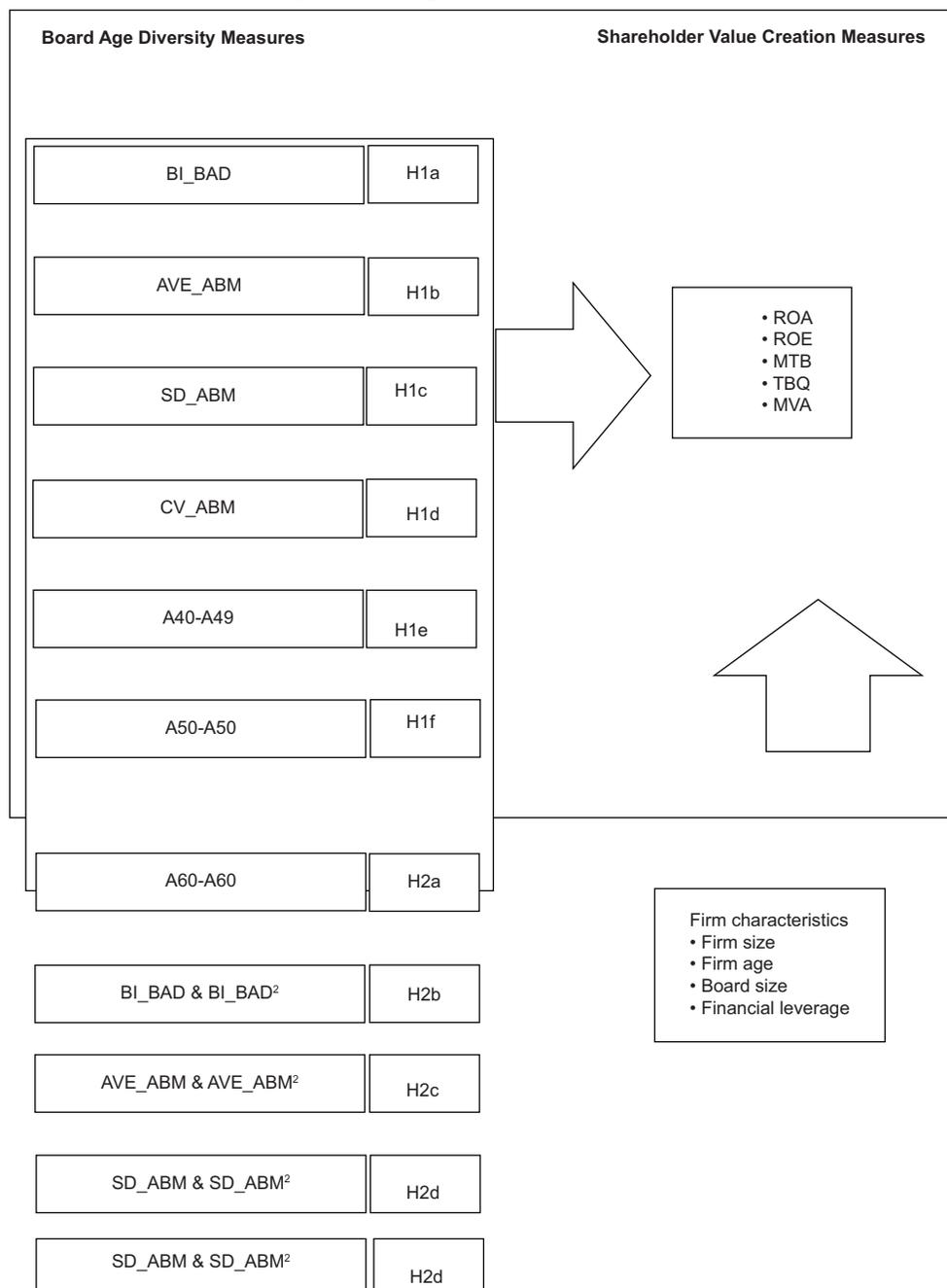
H_{2d}: The coefficient of age variation for board members squared (CV_AB²) has an inverted U-shaped effect on creating shareholder value for South African-listed non-financial companies.

Figure 1 shows a conceptual framework on board age diversity and shareholder value creation derived from the hypotheses above.

3. RESEARCH METHODOLOGY

This study adopted a quantitative quasi-experimental research method to examine the influence of board age diversity on shareholder value creation of South African non-financial companies listed on the JSE for 10 years from 2013 to 2022. The research methodology section provides sample selection,

Figure 1: Conceptual framework of the study



data collection, variable measurements and empirical model specifications.

3.1. Sample Selection

The sample comprises panel data spanning a period of 10 years, from 2013 to 2022. The researcher initiates the process by identifying non-financial companies listed on the JSE using the Who Owns Whom (WOW) database. A purposive sampling method is employed to determine the sample size, which is justified for several reasons. First, the researcher bases the selections on analytical, logical, or theoretical considerations. Unlike random sampling, purposive sampling strategies ensure that specific instances are included in the final sample for the study (Campbell et al., 2020). The criteria considered are as follows:

- i. The sample excludes non-financial companies headquartered outside of South Africa
- ii. The sample excludes non-financial companies that do not have JSE as their primary stock exchange
- iii. The sample excludes non-financial companies with no shareholder value creation and the ages of board members

The sample is assembled as a panel dataset. Table 2 below shows the steps taken to obtain the final data sample.

Table 3 below illustrates the distribution of the sample of nonfinancial companies across various industry sectors. These nonfinancial companies were selected based on the JSE Industry classification benchmark codes, categorising them into nine primary sectors. The analysis encompasses 95 nonfinancial companies from 2013 to 2022 over a decade. The most significant representation among the nonfinancial companies in this study is found in the industrial sector, accounting for 28.4%, consumer services at 26.3%, basic materials at 20.0%, and health care and communication at 5.3%. The Technology sector constituted 4.2% of the sample. Notably, companies in the Oil and Gas and Utilities sectors were excluded from this analysis, whereas the

Table 2: Sample selection process for hypothesis testing

Sampling criteria	Sample
Total number of nonfinancial companies listed on the JSE in 2013-2022	158
Less companies with a head office outside South Africa	21
Target population- South African nonfinancial companies	137
Less South African nonfinancial companies with missing data	42
Final sample	95
Company- year observations×10 years	950

Table 3: Sample description by industry

Code	Industry	No. of companies	Percentage
J500	Oil and gas	0	0.0
J510	Basic materials	19	20.0
J520	Industrials	27	28.4
J530	Consumer goods	10	10.5
J540	Health care	5	5.3
J550	Consumer services	25	26.3
J560	Telecommunications	5	5.3
J570	Utilities	0	0.0
J590	Technology	4	4.2
Total		95	100.0

Health Care and Telecommunications sectors represented the smallest samples.

The study used Slovin's formula to estimate the minimum sample size of a target population and avoid sampling mistakes (Alghamdi et al., 2024). The following is Slovin's formula, which can be used to determine the minimum sample size:

$$n = \frac{N}{1 + Ne^2} = \frac{158}{1 + 158(0,1)^2} = 61.2 \text{ or } 61 \text{ South African listed}$$

non-financial companies

Where:

n is the number of members of the sample, N is the target population, and is the error tolerance limit of 10%. The forecast minimum sample of 61 South African JSE-listed nonfinancial companies is below the sample of 95 JSE-listed South African nonfinancial companies, which can warrant the generalisation of the results to all JSE-listed South African nonfinancial companies listed on the JSE.

3.2. Data Collection Sources

Data collection is a crucial stage in the research process since the data's validity, reliability, and precision may be affected by the information sources employed to gather it (Bwanya, 2019). The three data collection sources used in this study are the integrated annual reports, the OSIRIS database, and the WOW database.

3.2.1. Integrated annual reports

The integrated annual reports provide both financial and non-financial data in a concise and structured format that reflects a company's overall value creation over time. These reports are prepared under frameworks such as the International Integrated Reporting Council (IIRC) guidelines. In fact, the publication of integrated annual reports is mandatory for companies listed on the JSE. Since these integrated annual reports are audited before release, the data presented is widely regarded as highly valid. Consequently, this study used the corporate governance report in the integrated annual reports to gather profiles of the directors, including their names, ages, dates of appointment, and termination dates or resignations, which are critical data points.

3.2.2. Osiris database

The Osiris database offers extensive information on companies worldwide, encompassing a vast array of data on publicly traded entities. Bureau van Dijk compiles information from various sources, standardising the data and integrating these sources to enhance its overall value. A broad range of information is available within OSIRIS, including standardised company financials, ratings, financial strength indicators, original filings and images, profiles and contact details of current and past directors, stock data, private equity data and portfolios, patents, detailed corporate and ownership structures, industry research, as well as business and company-related news. Research findings on shareholder value creation measures are sourced directly from the OSIRIS database.

Table 4: Board demographic data collection sheet

Name of company: e.g., Mr price group ltd						
Fin year end: 30 June			2013	2014	2021	2022
Director name	DA	DT	Age	Age	Age	Age
Nigel Payne	Jul 2007		55	56	61	62
Bobby Johnston	Feb 1998	May 2020	64	65		
Daisy Naidoo	May 2012		41	42	49	40

3.2.3. Who owns whom

The Who Owns Whom (WOW) database was established in 1980 in Cape Town, South Africa, as an independent entity devoted to producing high-quality, distinctive research on African companies and industries. The WOW provides comprehensive industry research papers, detailed company profiles, insights into corporate ownership and structures, biographies of directors and management, and information on merger and acquisition activities and fixed direct investment in Africa. The WOW database is a valuable resource covering over 300 key industries across the continent. Therefore, the researcher used the WOW database's search engine to address gaps in the data regarding directors' biographies, specifically the dates of their appointments and terminations, since the integrated annual reports do not always indicate termination or resignation dates. Table 4 presents a partially populated demographic data sheet for directors of selected non-financial companies listed on the JSE over 10 years from 2013 to 2022. This data includes the company name, names of directors, financial year-end, date appointed (DA), date terminated (DT), and age (AGE).

3.3. Variable Measurements

The main objective of this study is to examine the influence of board age diversity on shareholder value creation of South African-listed non-financial companies on the JSE for 10 years from 2013 to 2022. There are three types of study variables: dependent, independent, and control.

3.3.1. Dependent variables

The dependent variables include shareholder value creation measures, namely standardised market value added (SMVA), market-to-book ratio (MTB) and Tobin's Q (TBQ). MVA indicates the difference between the total market value of the company and the total capital invested by the investors (Shah, 2020; Hall, 2024). MVA is the difference between the market value of the company's shares and the book value as indicated in the balance sheet (Bessembinder, 2020; Patel, 2022; Oke and Ajeigbe, 2024). A positive MVA indicates successful financial management, maximising shareholders' wealth (Al-Ali and Al-Shabeeb, 2024). However, suppose the MVA value is <0 or negative, MVA shows that management cannot provide added value through the growth of the market capitalisation value of the shares issued (Dobrowolski et al., 2022; Kaczmarek, 2024). Then, SMVA refers to MVA divided by the invested capital at the beginning of the year (Turan Kurtaran et al., 2021). MVA has a similar meaning to MTB as MVA is an absolute measure, whereas MTB is a relative measure (Choong and Muthaiyah, 2021). MTB ratio denotes the equity market value divided by the equity book value (Lakatos, 2020). A firm with a high MTB value reflects the market and has higher expectations of the firm's performance

(Prasetiawatia and Sudanab, 2019; Hall, 2024). TBQ refers to the market value of equity plus the book value of interest-bearing debt to the replacement cost of fixed assets (Jordão and Costa, 2023; Hall, 2024). TBQ is the most widely used quantitative regressor in organisational economics. A high TBQ value usually indicates an elevated level of intangible assets and a solid overall current and future operating performance (Cardao-Pito, 2022; Jordão and Costa, 2023). A TBQ ratio >1.0 indicates that the company is expected to perform better than the industry average. A ratio below 1.0 implies that the company will underperform in the overall industry (de Oliveira and Basso, 2024; Hall, 2024).

3.3.2. Independent variables

The diversity of ages on the board of directors reflects the age distribution of the board members (Farooq et al., 2023). Different conceptions of board age diversity have different theoretical implications; therefore, researchers must have appropriate measurements for each conceptualisation (De Meulenaere et al., 2023). The study's initial instrument for measuring board age diversity is the Blau index (BI). The BI is defined as $1 - \sum_{i=1}^k P_i^2$. P_i represents the proportion of the board members in the i th category of a given attribute and k is the number of categories in each attribute (Casu et al., 2023). The Blau index is then divided for each category by its theoretical maximum value ($(k-1)/k$) (Bin Khidmat et al., 2020). The study uses five categories in the Blau index for board age diversity (BI_BAD): 40 and under, 41-49, 50-59, 60-69, and 70 years and above (Bhat et al., 2020; Ullah et al., 2020; Vetchagool, 2025). Therefore, the following is the Blau index for board age diversity (BI_BAD) formula:

$$BI_BAD_{i,t} = 1 - \left(\left(\frac{\text{Total board member with age below } 40_{i,t}}{\text{Total board members}_{i,t}} \right)^2 + \left(\frac{\text{Total board member with age } 40 - 49_{i,t}}{\text{Total board members}_{i,t}} \right)^2 + \left(\frac{\text{Total board members with age } 50 - 59_{i,t}}{\text{Total board members}_{i,t}} \right)^2 + \left(\frac{\text{Total board members with age } 60 - 69_{i,t}}{\text{Total board members}_{i,t}} \right)^2 + \left(\frac{\text{Total board members with age } \geq 70_{i,t}}{\text{Total board members}_{i,t}} \right)^2 \right)$$

Second, by using the average age of board members, the study assesses the diversity of board age. The total age of board members

divided by the number of members on the board is the average age of board members. Third, the standard deviation of board member ages is used to calculate the board age diversity (De Meulenaere et al., 2023). The following formula is used to determine the age standard deviation of board members (SD_{ABM}):

$$SD_{ABM_{i,t}} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$$

Where:

“Each member’s age is represented by x,” the mean of all board members is represented by \bar{x} , and the number of board members in each board of directors is denoted by “n.” The study also evaluates the diversity of board member ages by employing the coefficient of variation (Syakhroza et al., 2021). This coefficient is calculated by dividing the standard deviation of directors’ ages by their average age. A higher coefficient of variation indicates greater age diversity among board members (Agustia et al., 2022). Lastly, the research used dummy variables to categorise board age diversity based on the average age of board members. These dummy variables are set to one if the average age of board members falls within the ranges of 40-49 years, 50-59 years, or 60-69 years, and zero otherwise.

3.3.3. Control variables

Four control variables might affect the study’s board age diversity and company shareholder value creation. The control variables include firm size, firm age, board size and leverage. To reduce the skewness problem, firm size is measured by the natural logarithm of the book value of an asset (Liang et al., 2022). Firm age refers to the natural logarithm of the difference between the current year and the year the company was founded (Arioglu et al., 2021). Board size is measured by the natural logarithm number of board members on a company’s board of directors (Biçer and Şit, 2023). Leverage calculated reflects the riskiness of a company’s financing choices made by boards of directors (Arioglu et al., 2021). Leverage is total debt divided by total assets (Pandey et al., 2022).

3.4. Empirical Models Specification

The panel data regression methodology examines the influence of the various board age diversity measures on shareholder value creation. The empirical models used to evaluate hypotheses are as follows:

H_{1a} to H_{1g}: Board age diversity measures and company shareholder value creation measures (linear models).

$$SMVA_{i,t}/MTB_{i,t}/TBQ_{i,t} = \beta_0 + \beta_1 BI_BAD_{i,t} + \beta_2 AVE_ABM_{i,t} + \beta_3 SD_ABM_{i,t} + \beta_4 CV_ABM_{i,t} + \beta_5 A40-A49_{i,t} + \beta_6 A50-A59_{i,t} + \beta_7 A60-A69_{i,t} + \beta_8 LnSIZE_{i,t} + \beta_9 LnAGE_{i,t} + \beta_{10} LnBSIZE_{i,t} + \beta_{11} LEV_{i,t} + \epsilon_{i,t}$$

Where:

SMVA is the standard market value added, MTB is the market-to-book ratio, TBQ is Tobin’s Q, BI_BAD is the board age diversity, AVE_ABM is the average age of board members, SD_ABM is the standard deviation of the age for board members, CV_ABM is the coefficient of variation of age for board members, A40-A49,

A50-A59, A60-A69 refer to dummy variables equal one for company board with the average age for board members ranging 40-49, 50-59 and 60-69 years and zero otherwise, Ln FSIZE is the natural logarithm of firm size, Ln FAGE is the natural logarithm of firm age, Ln BSIZE natural logarithm of board size, LEV is leverage, β_1 - β_7 are coefficients of independent variables, β_8 - β_{11} are coefficients of control variables, *i* is the company, *t* is the year and ϵ is the error term.

H_{2a} to H_{2d}: Curvilinear quadratic effects of board age diversity measures on shareholder value creation measures.

The curvilinear U-shaped or inverted U-shaped effects are evaluated by adding squared terms. For instance, the impact is a U-shape if $\beta_1 < 0$ and $\beta_2 > 0$ and an inverted U-shape if $\beta_1 > 0$ and $\beta_2 < 0$ (Liang et al., 2022). The curvilinear quadratic models appear as follows:

$$SMVA_{i,t}/MTB_{i,t}/TBQ_{i,t} = \beta_0 + \beta_1 BI_BAD_{i,t} + \beta_2 BI_BAD^2_{i,t} + \beta_3 AVE_ABM_{i,t} + \beta_4 AVE_ABM^2_{i,t} + \beta_5 SD_ABM_{i,t} + \beta_6 SD_ABM^2_{i,t} + \beta_7 CV_ABM_{i,t} + \beta_8 CV_ABM^2_{i,t} + \beta_9 LnFSIZE_{i,t} + \beta_{10} LnFAGE_{i,t} + \beta_{11} LnBSIZE_{i,t} + \beta_{12} LEV_{i,t} + \epsilon_{i,t}$$

Where:

SMVA is the standard market value added, MTB is the market-to-book ratio, TBQ is Tobin’s Q, BI_BAD is the Blau index for the average age of board members, BI_BAD² is the Blau index for age diversity squared, AVE_ABM is the average age for board members, AVE_ABM² is the average age for board members squared, SD_ABM is the standard deviation of age for board members, SD_ABM² is the standard deviation of age for board members squared CV_ABM is the coefficient of age for board members, CV_ABM² is the coefficient of variation of age for board members squared, Ln FSIZE is the natural logarithm of firm size, Ln FAGE is the natural logarithm of firm age, Ln BSIZE is the natural logarithm of board size, LEV is leverage, β_1 - β_8 are coefficients of independent variables, β_9 - β_{12} are coefficients of control variables, *i* is the company, *t* is the year and ϵ is the error term.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Table 5 exhibits the descriptive statistics of the dependent, independent and control variables of 101 non-financial companies listed on the JSE from 2013 to 2022. Included in the results are the mean (Mean), standard deviation (SD), minimum (Min) and maximum (Max). The SMVA had a mean value of 1.75, with a minimum value of 0.00 and a maximum value of 13.07. The mean value of SMVA is above the unitary mark, suggesting that nonfinancial companies created shareholder value based on SMVA. On the other hand, MTB had a mean value of 2.20, with a minimum value of -6.92 and a maximum value of 26.04. The mean value of MTB is above the unitary mark, suggesting that shareholder value was created on the basis of MTB. The TBQ had a mean value of 1.38, with a minimum value of 0.00 and a maximum value of. The TBQ mean value was >1, highlighting that South African nonfinancial companies created shareholder value.

Table 5: Descriptive statistics

Variables	Obs	Mean	SD	Min	Max
Dependent variables					
SMVA	950	1.75	1.70	0	13.07
MTB	950	2.20	2.55	-6.92	26.04
TBQ	950	1.38	1.36	0	11.96
Independent variables					
BI_BAD	950	0.654	0.083	0.320	0.922
AVE_ABM	950	56.613	3.876	45.023	70.833
SD_ABM	950	9.739	2.539	4.221	21.742
CV_ABM	950	0.173	0.049	0.067	0.483
A40-A49	950	0.037	0.188	0	1
A50-A59	950	0.763	0.425	0	1
A60-A69	950	0.196	0.397	0	1
Ln FSIZE	950	15.573	1.878	8.865	19.978
Control variables					
FAGE (in years)	950	54.876	32.886	10	1369
Ln FAGE	950	3.786	0.714	2.303	4.913
BSIZE	950	10.958	3.352	4	22
Ln BSIZE	950	2.345	0.318	1.386	3.091
LEV	950	0.781	2.854	0	40.492

SD: Standard deviation

The Blau index for board age diversity (BI_BAD) has a mean value of 0.654, with a minimum of 0.320 and a maximum of 0.922. The average age of board members (AVE_ABM) is reported to have a mean of 56.21 years, with a minimum age of 45.023 years and a maximum age of 70.833 years. A study conducted by Liang et al. (2022) on 14 Chinese hospitality companies engaged in hotel operations from 199 to 2018 revealed that the AVE_ABM had a mean of 49.33 years, which is lower than the reported 56.21 years, with a minimum age of 38 years, <45.023 years, and a maximum age of 60.8 years, which is <70.833 years. The standard deviation of board members' ages (SD_ABM) averages 9.739 years, with a minimum of 4.221 and a maximum of 21.742 years. The coefficient of variation for board member age (CV_ABM) had a mean of 0.173, with a minimum value of 0.067 and a maximum of 0.483. Similarly, a study by Pandey et al. (2022) examining 197 companies listed on India's National Stock Exchange from 2008 to 2018 revealed that CV_ABM had a mean of 0.18, with a minimum of 0.003 and a maximum of 0.52. Based on the distribution of board age diversity categories, boards with an average age of board members (AVE_ABM) in the categories A40-A49 had a mean of 0.037, A50-A59 had a mean of 0.763, and A60-A69 had a mean of 0.196.

In relation to control variables, the results indicated that the company size (FSIZE) had a mean value of 15.573, with minimum and maximum values of 8.865 and 19,978, respectively. The range of the firm age (FAGE) was five years to 136 years, with a mean of 54.876. BSIZE had a mean value of 10.958, with a minimum value of four and a maximum value of 22.

4.2. Panel Data Regression Results

Hypotheses H_{1a} to H_{1g} predict that BI_BAD, AVE_ABM, SD_ABM, CV_ABM, A40-A49, A50-A59, and A60-A69 may have a significant positive or negative effect on the SVC measures of nonfinancial companies listed on the JSE. The panel data linear regression results can be found in Table 6 below. The regression results indicated that BI_BAD had an insignificant positive effect on all SVC measures—SMVA ($\beta = 0.464, p = n.s.$), MTB ($\beta = 1.169,$

Table 6: Board age diversity and shareholder value creation (linear models)

Variables	(1)	(2)	(3)
	SMVA	MTB	TBQ
BI_BAD	0.464 (0.427)	1.169 (0.788)	0.369 (0.384)
AVE_ABM	-0.0415 (0.0356)	-0.0346 (0.0656)	-0.0189 (0.0320)
SD_ABM	-0.0442 (0.172)	-0.222 (0.317)	-0.0477 (0.155)
CV_ABM	0.926 (9.310)	9.076 (17.19)	2.092 (8.387)
A40-A49	3.651*** (0.645)	5.346*** (1.191)	1.947*** (0.581)
A50-A59	3.802*** (0.624)	5.682*** (1.152)	2.078*** (0.562)
A60-A69	3.849*** (0.611)	5.810*** (1.128)	2.163*** (0.550)
Ln FSIZE	-0.809*** (0.0801)	-1.216*** (0.148)	-0.446*** (0.0722)
Ln FAGE	-0.925*** (0.290)	-0.480 (0.536)	-1.614*** (0.261)
Ln BSIZE	0.118 (0.188)	0.0520 (0.347)	-0.147 (0.169)
LEV	-0.0977*** (0.0186)	-0.0949*** (0.0343)	-0.0441*** (0.0168)
Constant	16.40*** (2.211)	19.29*** (4.084)	13.85*** (1.992)
Observations	950	950	950
R-squared	0.219	0.121	0.176
No. of companies	95	95	95

Standard errors in parentheses. ***P<0.01, **P<0.05, *P<0.1

p = n.s.), and TBQ ($\beta = 0.369, p = n.s.$). The results suggest that while some board age diversity exists, it may not be pronounced enough or consistently beneficial enough to drive a significant increase in SVC. On the other hand, AVE_ABM had an insignificant negative effect on all SVC measures—SMVA ($\beta = -0.0415, p = n.s.$), MTB ($\beta = -0.0346, p = n.s.$) and TBQ ($\beta = -0.01893, p = n.s.$). The average age of board members reflects the general experience level and possibly conservatism or risk aversion of the board. Its insignificant negative impact may indicate boards with an older average age do not significantly enhance shareholder value, potentially due to less adaptability or slower decision-making. Similarly, SD_ABM had an insignificant negative effect on all SVC measures, SMVA ($\beta = -0.0442, p = n.s.$), MTB ($\beta = -0.222, p = n.s.$) and TBQ ($\beta = -0.0477, p = n.s.$). The results signal a greater generational gap among board members and potential conflicts or challenges in consensus-building, explaining the insignificant negative impact on value. However, CV_ABM had an insignificant positive effect on all SVC measures—SMVA ($\beta = 0.926, p = n.s.$), MTB ($\beta = 9.076, p = n.s.$) and TBQ ($\beta = 2.092, p = n.s.$). The impact remains insignificant, likely because the boards in the study sample do not reach the optimal level of age diversity to have a strong positive effect. Research shows an optimal “hill-shaped” relationship exists where moderate age diversity maximises value, but most boards fall below this optimal point or have heterogeneity that is not sufficiently large or effectively managed.

Regarding dummy variables of average age for board members, the results show that A40-A49 have a significant positive effect on all SVC measures—SMVA ($\beta = 3.651, P < 0.01$), MTB ($\beta = 5.3464,$

$p < 0.01$) and TBQ ($\beta = 1.9474, < 0.01$). Additionally, A50-A59 had a significant positive effect on SMVA ($\beta = 3.802, p < 0.01$), MTB ($\beta = 5.682, p < 0.01$) and TBQ ($\beta = 2.078, p < 0.01$). Similarly, A60-A69 had a significant positive effect on SMVA ($\beta = 3.849, p < 0.01$), MTB ($\beta = 5.810, p < 0.01$) and TBQ ($\beta = 2.163, p < 0.01$). These age categories reflect distinct life and career stages, bringing a blend of experience, fresh perspectives, and innovation to the board. Categorising age into these discrete groups allows firms to benefit from intergenerational collaboration, which broadens the range of knowledge, expertise, and stakeholder representation present in decision-making. The dummy coding effectively identifies the presence or absence of these age groups on the board, highlighting that having representation across these key age intervals is related to positive financial outcomes and value creation

Concerning the control variables, the results indicated that Ln FSIZE had a significant negative effect on all SVC measures—SMVA ($\beta = 0.809, p < 0.01$), MTB ($\beta = -1.216, p < 0.01$) and TBQ ($\beta = -0.446, p < 0.01$). The finding reflects common corporate governance empirical results where larger size sometimes correlates with reduced market valuation due to inefficiencies, conflict of interests, or slower strategic responses, which may overshadow positive effects of governance variables like board age diversity. Additionally, Ln FAGE had a significant negative effect on SMVA ($\beta = -0.925, p < 0.01$) and TBQ ($\beta = -1.614, p < 0.01$) but an insignificant negative effect on MTB ($\beta = -0.480, p = n.s$). The negative impact likely reflects how firm age proxies for organisational inertia, slower adaptation, and matured growth potential, which can reduce shareholder value creation even when controlling for board age diversity effects. Despite this, Ln BSIZE had an insignificant positive impact on SMVA ($\beta = 0.118, p = n.s$) and MTB ($\beta = 0.0520, p = n.s$) and an insignificant negative influence on TBQ ($\beta = -0.147, p = n.s$). The positive but insignificant effect reflects that while larger boards have the potential to enhance shareholder value, practical inefficiencies or governance dynamics often limit these benefits, resulting in a weak net effect in the presence of other controls like board age diversity. Conversely, LEV had a significant negative effect on all SVC measures—SMVA ($\beta = -0.0977, p < n.s$), MTB ($\beta = -0.0949, p < n.s$) and TBQ ($\beta < 0.01$). In the presence of board age diversity effects, the negative coefficient for financial leverage reflects the detrimental impact of high debt levels on the firm’s ability to create shareholder value due to risk, inflexibility, and cost burdens.

The combined effects of board age diversity and control variables yield valuable comparative insights in evaluating the R-squared values. Among the models assessed, Model 1 for SMVA demonstrated the highest R-squared value at 21.9%. This is followed by Model 3 for TBQ, with an R-squared of 17.6%, and Model 2 for MTB, which had an R-squared of 12.1%

Hypotheses H_{2a} to H_{2d} predict that BI_BAD, AVE_ABM, SD_ABM, and CV_ABM exhibit an inverted U-shaped SVC measure of non-financial companies listed in South Africa. In alignment with other variables related to board demographic diversity, BI_BAD was assessed alongside the squared term for

board age diversity, represented as BI_BAD². Similarly, AVE_ABM is tested with the squared average age of board members (AVE_ABM²), whereas SD_ABM is evaluated with the squared standard deviation of board member ages (SD_ABM²). Finally, CV_ABM was compared with the squared coefficient of variation of board member ages (CV_ABM²). Table 7, below, presents the curvilinear quadratic regression analysis results. The results indicated that BI_BAD negatively affected SMVA, whereas BI_BAD² positively impacted SMVA. BI_BAD positively influenced both MTB and TBQ, with BI_BAD² also impacting MTB but negatively affecting TBQ, suggesting either U-shaped or inverted U-shaped effects. AVE_ABM negatively influenced all the measures of SVC, whereas AVE_ABM² positively affected the SVC measures, indicating a U-shaped effect. SD_ABM positively influenced all SVC measures, whereas SD_ABM² negatively affected them, highlighting an inverted U-shaped effect. Finally, CV_ABM negatively affected all SVC measures, whereas CV_ABM² positively influenced them, suggesting a U-shaped effect.

4.3. Graphical Analysis of Curvilinear Quadratic Models

Figures 1-4, coded using the python programming language, present a graphical analysis of the curvilinear regression models discussed earlier, allowing for a comprehensive examination of these models. In terms of graphical analysis, Figure 1 below

Table 7: Board age diversity and shareholder value creation (curvilinear models)

Variables	(1)	(2)	(3)
	SMVA	MTB	TBQ
BI_BAD	-3.324 (3.502)	0.355 (6.427)	1.630 (3.110)
BI_BAD ²	2.985 (2.818)	0.590 (5.172)	-1.131 (2.503)
AVE_ABM	-0.252 (0.278)	-0.478 (0.510)	-0.255 (0.247)
AVE_ABM ²	0.00112 (0.00208)	0.00301 (0.00382)	0.00195 (0.00185)
SD_ABM	0.925 (0.696)	0.923 (1.277)	0.274 (0.618)
SD_ABM ²	-0.0204 (0.0146)	-0.0201 (0.0268)	-0.00767 (0.0130)
CV_ABM	-46.83 (37.92)	-48.98 (69.59)	-9.391 (33.68)
CV_ABM ²	47.31 (40.38)	47.90 (74.11)	7.891 (35.87)
Ln FSIZE	-0.520*** (0.0670)	-0.770*** (0.123)	-0.278*** (0.0596)
Ln FAGE	-1.390*** (0.286)	-1.168** (0.525)	-1.849*** (0.254)
Ln BSIZE	0.0850 (0.192)	-0.0136 (0.353)	-0.177 (0.171)
LEV	-0.0863*** (0.0190)	-0.0768** (0.0349)	-0.0375** (0.0169)
Constant	26.32*** (9.496)	35.79** (17.43)	20.41** (8.434)
Observations	950	950	950
R-squared	0.184	0.093	0.163
No. of companies	95	95	95

Standard errors in parentheses. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$

depicts the curvilinear effects of BI_BAD on measures of SVC. BI_BAD revealed an inverted U-shaped effect on all SVC measures, with peak values occurring when BI_BAD reached 0.6. Beyond this threshold, any further increase in BI_BAD led to a decline in the SVC measures.

Figure 3, below, illustrates the curvilinear impact of AVE_ABM on the measures of SVC. The analysis revealed that AVE_ABM exhibited an inverted U-shaped effect on all SVC measures. The maximum values for the SVC occurred when the AVE_ABM was approximately 55 years old. Beyond this age, further increases in AVE_ABM led to a decline in the SVC measures.

Furthermore, Figure 4 below illustrates the curvilinear effects of the SD_ABM on the measures of SVC. SD_ABM exhibited an inverted U-shaped effect on all SVC measures. The maximum values of the SVC measures were achieved when the SD_ABM was between 7.5 and 10 years. Beyond this range, an increase in SD_TBM resulted in a decline in the SVC measures.

Finally, Figure 5 below illustrates the curvilinear effects of the CV_ABM on the SVC measures. The graph shows that CV_ABM has an inverted U-shaped relationship with all the measures of SVC. The SVC measures peaked when CV_ABM was between 0.10 and 0.20. However, beyond the 0.20 mark, an increase in CV_ABM led to a decline in the SVC measures.

4.4. Discussion

The research used 95 South African non-financial companies listed on the JSE from 2013 to 2022 to explore the influence of board age diversity (BAD) on company shareholder value creation (SVC). The hypotheses are rooted in upper echelons, agency, resource dependency, resource-based view, social categorisation, and similarity attraction theories. Hypotheses H_{1a} to H_{1g} predicted that BI_BAD, AVE_ABM, SD_ABM, CV_ABM, A40-A49, A50-A59 and A60-A69 could have a significant positive or negative effect on SVC measures of South Africa-listed non-financial companies. The linear regression results revealed that all SVC measures (SMVA, MTB and TBQ)

Figure 3: AVE_ABM curvilinear effects on shareholder value creation measures

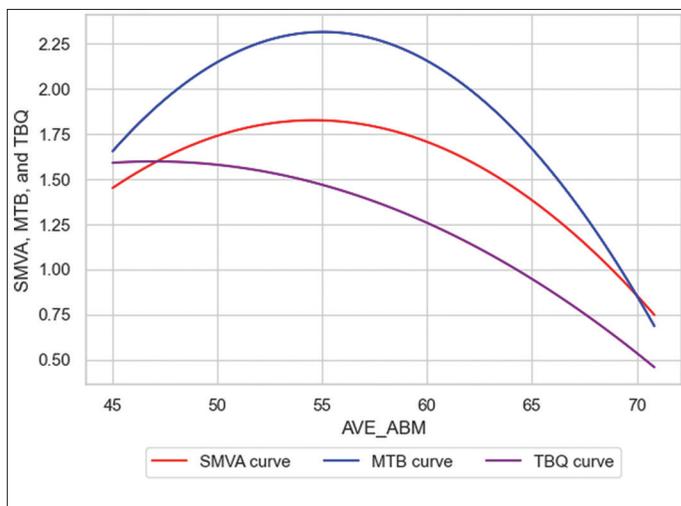


Figure 4: SD_ABM curvilinear effects on shareholder value creation measures

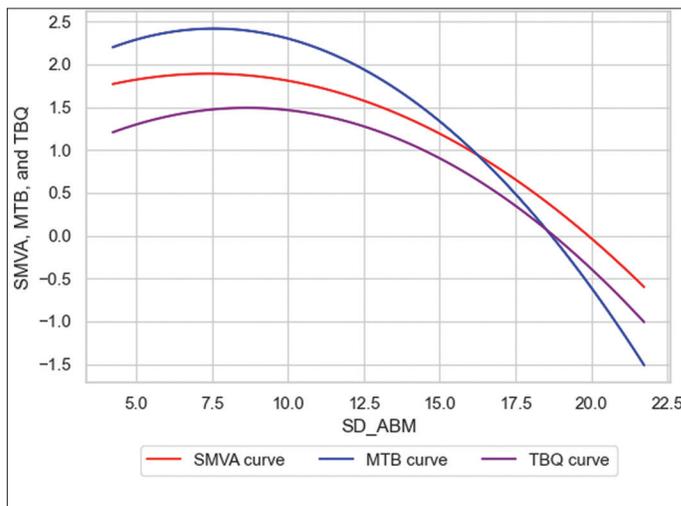


Figure 5: CV_ABM curvilinear effects on shareholder value creation measures

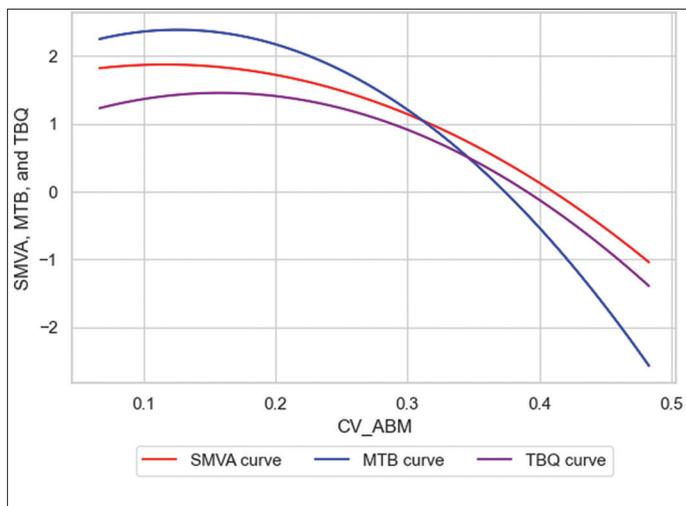
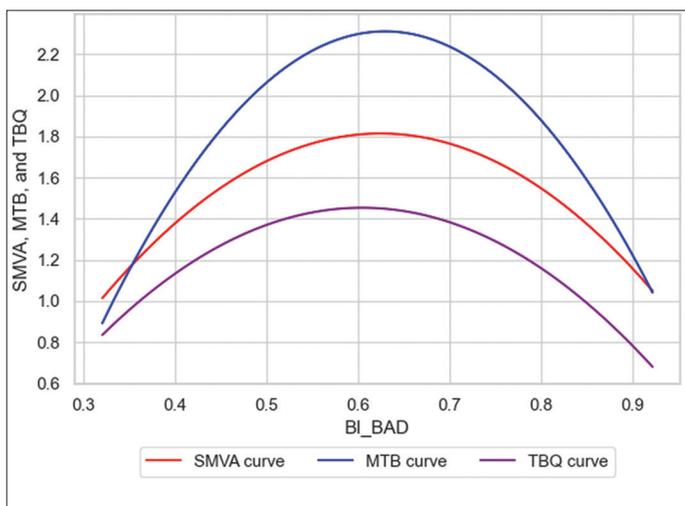


Figure 2: BI_BAD curvilinear effects on shareholder value creation measures



were insignificantly positively impacted by BI_BAD. CV_ABM, while insignificantly negatively influenced by AVE_TBM and SD_TBM. On the other hand, all SVC measures (SMVA, MBT and TBQ) were significantly positively influenced by AVE_ABM categories, namely A40-A49, A50-A59 and A60-A69. When age is treated as categorical, it reduces variability in the predictor, leading to coarser measurement and loss of information about differences within categories. This generally increases standard errors of estimates, lowering power to detect effects. The use of categories may lead to multiple hypothesis testing (comparing groups), which incurs a power penalty compared to modelling age as a continuous variable. If the true relationship between age and shareholder value is continuous, discretising age imposes artificial boundaries and lowers the ability to detect nuanced effects or trends across age.

The current research complements and extends various international studies. For instance, Petersson and Wallin (2017) examined 1438 Swedish companies listed on OMX Large Cap, Mid Cap and Small Cap Stockholm from 2011 to 2015. The results of this study revealed that BI_BAD, SD_ABM and CV_ABM had a negative influence on TBQ. On the other hand, Arioglu (2021) investigated 2279 company-year observations listed on Borsa Istanbul from 2009 to 2017 and found that CV_ABM and AVE_ABM significantly positively impact ROE and ROA. Also, Pandey et al. (2022) explored 197 non-financial companies listed on the India stock exchange from 2008 to 2018. The GMM results revealed that CV_ABM had an insignificant negative impact on ROA and TBQ. On the other hand, Khan et al. (2024) examined 88 non-financial firms in the Pakistan Stock Exchange from 2009 to 2020. The REM and 2SLS indicated that BI_BAD significantly negatively impacted ROA and TBQ.

Indeed, board age diversity measures have a positive or negative influence on SVC measures, and this can be explained by theories that take an optimistic view or a pessimistic view of board age diversity. For instance, the agency theory suggests that the age diversity on a board may improve the board's capacity to conduct its job of providing resources and oversight, thereby improving shareholder value creation (Ali et al., 2021; Pandey et al., 2022). Also, resource dependency theory indicates that the resource dependence theory suggests that a more age-diverse board of directors helps the company obtain vital resources from its external environment, which improves performance (Bonaparte et al., 2022). Similarly, RBV theory suggests that the age diversity of board members is a significant "firm's human resources" that improves competitive advantage and shareholder value creation (Khan et al., 2024). On the other hand, social categorisation theory states disagreements among board members are more likely to occur when there are gaps in beliefs and values, which are reflected in age differences among board members, thereby hampering shareholder value creation (Janahi et al., 2023). In addition, the similarity-attraction theory suggests that the cohesion between older and younger board members may decline, resulting in lower levels of attachment and less effective social interactions, thereby diminishing shareholder value creation (Gardiner, 2024).

Hypotheses H_{2a} to H_{2d} predict that BI_BAD, AVE_ABM, SD_ABM and CV_ABM have an inverted U-shaped effect on shareholder value creation of South African listed non-financial companies. The curvilinear models reveal that BI_BAD, AVE_ABM, SD_ABM and CV_ABM positively impacted SVC measures while their squared terms negatively impacted all SVC measures, highlighting inverted U-shaped effects. Similarly, Kagzi and Guha (2018) Top 200 Indian knowledge-intensive firms (KIFs) listed on the NSE from 2010 to 2014 and found that BI_BAD had a positive impact on TBQ, while BI_BAD^2 had a negative influence on TBQ, highlighting an inverted U-shaped effect. Similarly, a study by Jonson et al. (2020) of 130 Australian companies from 2011 to 2015 shows that AVE_ABM had a positive influence on ROA and TBQ, while AVE_ABM^2 negatively influenced ROA and TBQ, highlighting an inverted U-shaped effect. Another study by Liang et al. (2022) of 14 Chinese hospitality firms between 1999 and 2018 revealed that AVE_ABM positively impacts TBQ, while AVE_ABM^2 negatively impacts TBQ, suggesting an inverted U-shaped effect. The inverted U-shaped effects are consistent with integrating resource dependency, resource-based view, social categorisation, and similarity attraction theories. These findings revealed that board age diversity is a double-edged sword.

5. CONCLUSION

This study examined the impact of board age diversity on shareholder value creation among non-financial companies listed on the JSE over ten years from 2013 to 2022. The relationship is often not linear but follows a more complex pattern, typically an inverted U-shape. This means that shareholder value may increase with board age diversity to an optimal point, after which further diversity can have diminishing or negative returns. Such curvilinear models capture this "too much of a good thing" effect, revealing an optimal level of age diversity that maximises value creation, while either too little or too much diversity may reduce firm performance. The results revealed that board age diversity can provide a range of perspectives, experiences, and innovative ideas beneficial to shareholder value. However, excessive board age diversity may cause communication challenges, conflicts, or mismatched incentives, which can harm value creation. Hence, by modelling the relationship as curvilinear, typically quadratic, researchers identify an optimal balance where benefits peak, which cannot be detected using only linear models. This approach acknowledges that board age diversity variables and shareholder value creation measures are complexly linked, deserving more nuanced modelling than simplistic linear approaches.

5.1. Theoretical Implications

The results are consistent with the integrating theories of optimistic and pessimistic views of diversity, is requires examining the relationship between board age diversity and shareholder value creation. This may be because the impact of board age diversity is complex and can produce both positive and negative shareholder value creation. The optimistic view emphasises the benefits of diversity, drawing from theories like resource dependency theory and upper echelons theory, which suggest that board age diversity brings a broader range of perspectives, knowledge, problem-solving abilities, and innovation potential to the firm. This can

enhance decision-making quality, strategic adaptability, and ultimately shareholder value. Conversely, the pessimistic view highlights potential downsides, based on social identity theory and similarity-attraction theory, which point out that diversity may cause conflicts, communication difficulties, fragmented group cohesion, and biases against out-group members, potentially hindering effective collaboration and reducing shareholder value. Hence, integrating these views allows a more balanced and nuanced theoretical framework that explains why empirical findings on board age diversity and shareholder value are often mixed or curvilinear, reflecting both beneficial and detrimental effects depending on the level and context of diversity.

5.2. Practical Implications

The practical implications of the relationship between board age diversity and shareholder value creation for South African listed non-financial companies are significant for corporate governance. For instance, companies should aim for an optimal level of age diversity that maximises shareholder value, avoiding both homogeneity and excessive diversity, which can have adverse effects. Additionally, governance frameworks should incorporate policies that promote diversity in age, while also ensuring effective communication and cohesion among board members. Moreover, corporate executives may prioritise recruiting members across different age groups to harness diverse perspectives while managing potential conflicts associated with high diversity. Additionally, there is a need to implement training programs that foster mutual understanding and collaboration among age-diverse board members, which can enhance the effectiveness of decisions. Also, regular assessment of the impact of age diversity on shareholder value creation can help in adjusting board composition dynamically to market conditions. Furthermore, it is prudent to recognise that the benefits of age diversity may manifest over the long term. Hence, corporate executives should align their governance practices with sustainable shareholder wealth maximisation. Moreover, given South Africa's diverse societal context, policies should consider social cohesion and transformation goals alongside shareholder value creation. Hence, South African-listed non-financial companies need to adopt nuanced, evidence-based approaches to board age diversity, emphasising the right balance that enhances shareholder value while fostering inclusive governance practices.

5.3. Limitations and Recommendations for Future Research

The study used databases and annual reports as secondary data, which may miss qualitative factors such as board dynamics, culture, or informal governance mechanisms impacting shareholder value creation. The study's limitations include using only samples of South African non-financial companies listed on the JSE. This could decrease the generalisability of the results. The subsequent research could use cross-country non-financial companies' samples because each country may have a board age diversity policy that differs in its corporate governance rules. In addition, the research uses board age diversity-related variables only. Therefore, further research could consider other types of board demographic diversity variables such as gender, race, nationality, education level and tenure.

There are several recommendations for future research. For instance, future research should incorporate qualitative approaches such as interviews or case studies to explore underlying mechanisms of how board age diversity influences shareholder value, beyond what secondary quantitative data can reveal. Also, research could investigate the combined or interactive effects of multiple diversity facets (e.g., gender, educational background, and financial expertise) alongside age diversity to understand their joint impact on shareholder value. Moreover, future research should consider shareholder value in a broader sense by including firm risk, innovation, sustainability disclosure (e.g., SDG adherence), or social performance to gain a holistic view of age diversity's impact. Also, future research should consider how different stakeholders (investors, analysts) perceive and value board age diversity, which may help explain divergent findings on shareholder value creation. These directions promote a more nuanced, context-sensitive understanding of the complex role board age diversity plays in creating shareholder value over time. Furthermore, future research could consider more flexible nonlinear specifications (e.g., cubic or spline models) to better capture complex relationships between age diversity and shareholder value creation. Last but not least, future research can go beyond financial metrics by including sustainability performance, innovation capability, or risk management outcomes that may also exhibit nonlinear relations with board age diversity.

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