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Can board gender diversity prevent corporate failure? Evidence from state-owned enterprises in an emerging economy

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Abstract

This study aims to explore the economic importance of board gender diversity for the likelihood of firm failure among state-owned enterprises (SOEs) in South Africa between 2011 and 2022. This study employs a binary logistic regression technique as the primary estimation technique. To corroborate the outcomes from the logistic model, the study also utilises panel regression approaches such as probit and feasible generalised least squares to control for nonlinearity, heteroscedasticity, autocorrelation and heterogeneity. The key finding from the study reveals that female board representation significantly reduces the odds of corporate failure. A further outcome from the study reveals that women directors must constitute a critical mass of at least 50% of the boardroom to significantly mitigate business failure among the selected SOEs. The outcome provides solid support for board gender diversity, inclusivity and equity as effective governance mechanisms to promote the financial health of SOEs. The study thus offers proof in favour of achieving Sustainable Development Goal 5, which aims to attain gender equality, particularly in positions of leadership and decision-making in the public and private sectors, and the King IV Code of corporate governance for firms in South Africa on board gender diversity.

Keywords Female board representation, SOEs, Corporate failure, Logistic regression

JEL Classification G3, G33, G34

Introduction

The importance of effective corporate governance for an organisation's performance has received increased attention among researchers, investors, business regulators and policymakers in the last two decades. In this context, financial scandals and corporate failures in the business space have been attributed to the breakdown of corporate governance [15]. Corporate firms in emerging markets such as South Africa have experienced cases of financial distress and failure. For example, the crisis that occurred in South Africa between 2012 and 2014 led to

the bankruptcy of the African Bank, one of the nation's main banks [47, 57]. Similarly, the VBS Mutual Bank failed in 2018 [52]. Similarly, state-owned enterprises (SOEs) in South Africa also experienced systemic failure, which led to the collapse of major companies, including Denel (Pty) Ltd., South African Airways, South African Broadcasting Corporation and South African Nuclear Energy Corporation [28]. To address this, many governance laws have been established to regulate corporate behaviours (Pucheta-Martinez et al., 2020; [48]). Several factors have been identified as contributing to the financial collapse of these firms. These include financial recklessness on the part of management, weak corporate governance, ineffective and inadequate internal control and an inefficient board structure [49], African Bank, 2016; [52, 57]. In particular, the issues of corporate failure and financial distress among business organisation

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became more pertinent in the post-COVID-19 era, when firms were grappling with the continuity and sustainability of their business. Therefore, it is imperative to evaluate the efficacy and effectiveness of board composition as a corporate governance mechanism to improve organisational performance and safeguard firms against unanticipated failure.

One key aspect of board structure that has garnered the attention of scholars in the governance–performance literature is board gender diversity [1, 33, 39]. Globally, there is increased concern about the need to achieve gender equality at the upper managerial level, especially with respect to the composition of board members in various companies (Credit [16, 21, 43, 76, 83]). Relatedly, the fifth indicator of sustainable development, Goal 5, emphasises the achievement of gender equality by ensuring the full participation of women in leadership and decision-making in political, economic and public life (United Nation, 2015 [6]). In response, several countries, including Norway, Spain, France and the Netherlands, have imposed mandatory quotas on women’s representation in the boardrooms of listed firms [64]. Similarly, the South African government implemented the Employment Equity Act (1998), with the main purpose of promoting gender diversity in the boardroom [51]. In addition, the issue of board gender diversity is at the heart of various King reports on corporate governance guidelines in South Africa (IoDSA, 2016 [57]). On the basis of different regulatory and institutional frameworks in emerging economies such as South Africa [60], this study explores the significance of board gender diversity in predicting the likelihood of corporate failure through the lens of state-owned enterprises.

However, a critical investigation of empirical studies reveals that several scholars have examined the nexus between board gender diversity and firm performance ([18], Pandey et al., 2023; [76], Osie et al. 2025b), whereas the handful of scholars that focus on board diversity and corporate failure relationships consider privately owned enterprises [1, 24, 27, 43], with an emphasis on Asian markets. In the literature, the benefit of board gender diversity has been vigorously debated [24]. The advocates of gender diversity posit that female directors tend to focus more on shareholder’s welfare and, as such, would not make any decision that is detrimental to a company’s shareholders [64]. Similarly, García & Herrero [24] and Guizani and Abdalkrim [27] opine that the presence of women directors on the boardroom strengthens the monitoring and supervisory functions of the board. They further contend that female directors are conservative, have greater risk aversion and are less overconfident than their male counterparts are. These intrinsic attributes of women can contribute significantly to a company’s

performance and guarantee the continuous operation of a firm in the foreseeable future. In their argument for greater board diversity, Wahid [75] and Gupta et al. [29] find that the likelihood of financial fraud is reduced in a firm with a more gender-diversified board. On the other hand, Lee and Thong [43] contend that the presence of female directors on corporate boards improves board effectiveness and ultimately mitigates the possibility of corporate failure.

However, unlike prior studies, our study concentrates on the gender diversity–firm failure nexus in the context of SOEs in South Africa. One of the major macroeconomic objectives of every economy is to achieve sustained economic growth that is all-inclusive and produces desirable outcomes in the lives of the people [66]. The role of SOEs in achieving this objective is fundamental (Kaunda and Pelsa, 2023). As documented by the World Bank [78], SOEs are key movers and drivers of economic growth and development, especially in developing economies. The importance of SOEs is underscored by the role they play in supporting and providing critical infrastructure for the smooth running of the economy and for the growth of the private sector (Kaunda and Pelsa, 2023). By definition, SOEs are publicly owned organisations established under government legislation to provide essential services or utilities to the public [54]. While some SOEs are established for commercial purposes, the major essence of SOEs is to promote growth, stability, and the welfare of the populace [69]. Recently, the performance of SOEs in delivering their core mandates has garnered the attention of the public [28]. Despite the perceived role of SOEs as catalysts of economic development, most SOEs in developing countries, especially in South Africa, have been performing below expectations despite government efforts to revamp these companies [28, 37].

Our study adds to the body of knowledge on the board diversity and corporate failure nexus in the following ways. First, unlike previous studies that focused on the gender diversity–firm performance nexus, the present study explores the relevance and economic benefits of gender diversity in reducing corporate failure to achieve the long-term survival of firms. Second, most of the studies reviewed focus on privately owned enterprises, and our study focuses on SOEs in an emerging market, South Africa, due to their importance to economic growth. SOEs provide critical infrastructure for the growth of the economy and the development of the private sector. Hence, the performance and success of SOEs are critical to the success of the private sector. In the same vein, the issue of gender diversity is at the heart of the King IV code of corporate governance for South African firms, including SOEs (IoDSA, 2016). Third, the paper contributes to the corporate governance literature by using

multiple approaches to enhance the outcomes of the main analysis.

On the basis of the background above, we explore the economic importance of board gender diversity in mitigating the likelihood of corporate failure of SOEs in South Africa. To achieve this, binary logistic regression, feasible generalised least squares and moment quantile regression approaches are applied to control for unobserved heterogeneity and the distributional effect of the explanatory variables on the outcome variables. The findings from the study show that gender diversity significantly reduces the probability of corporate failure of SOEs in South Africa. A further outcome from the study reveals that the mitigating impact of gender diversity on firm failure is stronger when the proportion of women in the boardroom exceeds the critical mass of 50%.

The remainder of the study is presented as follows. Section "[Literature review and hypothesis development](#)" presents the literature review and hypothesis development; the data and methodology used to achieve the study's objective are presented in Sect. "[Results and discussion of findings](#)". Section "[Conclusion and policy recommendations](#)" contains the results and discussion of the findings, and Sect. 5 concludes the study.

Literature review and hypothesis development

Theoretical foundation

We employ the "critical mass", agency and resource dependency theories as the theoretical foundations to unravel the impact of board gender diversity on corporate failure. The first theoretical lens employed in this study is critical mass theory (CMT). The CMT, developed by Kanter [35], argues that the proportion of female directors on corporate boards must reach a certain threshold for them to effectively influence corporate board decisions on crucial matters.

The second theory is agency theory. According to agency theory, a well-structured board provides an avenue to satisfy the heterogeneous interests of stakeholders, reduce information asymmetry and minimise conflicts of interest in manager–shareholder interactions [4, 31]. However, in accordance with agency theory, Guizani and Abdalkrim (2022) identify female directors as key governance mechanisms that play a strategic role in protecting and promoting shareholders' interests and ensuring the alignment of owners' and managers' interests. This implies that the presence of women on boards enhances board effectiveness on critical issues that affect performance and safeguard the firm from the risk of financial failure. Third, resource dependency theory, which originates from the work of Pfeffer and Salancik (1978), proposes that a diverse board and gender-balanced board enable an organisation to garner diverse resources, skills,

expertise and knowledge from its immediate environment compared with the homogenous board dominated by male directors [3, 5]. In this way, gender diversity on the board serves as a potent mechanism to access the required resources from the external environment. In their discussion of resource dependency theory, Hillman et al. [30] identify advice and counsel, legitimacy and favourable access to resources as three benefits of female representation on boards. The authors therefore identify female representation on boards as a critical asset that a firm can leverage to improve its financial outcomes and consequently reduce the likelihood of corporate failure.

Empirical studies

In line with the proposition of agency and resource dependency theories, gender diversity in the boardroom serves as an important corporate mechanism to enhance firm outcomes (Guizani and Abdalkrim, 2022; Ferrari and Deo, 2023). However, the findings on gender diversity and financial outcomes are mixed and inconclusive. For example, Brahma et al., [16], Ferrari and Deo (2023) and Chen et al., [18] documented a positive relationship between gender diversity and firm performance among listed firms in the UK, France and Taiwan, respectively. On the other hand, Wang et al. [76] find that gender diversity reduces the performance of Japanese firms. Despite these conflicting findings, scholars such as Pandey et al., (2023) and Jayaraman et al., [41] find that gender diversity has no effect on firm performance among listed firms in India. Focusing on listed firms in South Africa, Scholtz and Kieviet [65] discovered that gender diversity positively influences firm performance, whereas Jonty and Mokoteli [32] failed to document any significant association between gender diversity and firm performance. Concentrating on MENA countries, Osei [59] documented a significant positive association between gender diversity and sustainability performance.

Compared with firm performance, the nexus between board gender diversity and corporate failure or financial distress has received less attention in the literature. Moreover, several of these studies have focused more on developed economies (see [24]), whereas several scholars have focused on emerging markets in Asia, with an emphasis on private sector-driven firms. From the lens of agency theory, a gender-balanced board can promote board effectiveness and strengthen monitoring functions [4]. For example, studies such as Adams & Ferreira [2] and García & Herrero [24] assert that a higher gender ratio in the boardroom strengthens the board's supervisory and monitoring functions and ultimately lowers agency costs. Using data from Chinese A-listed companies, Yousaf et al. [80] explored board diversity and the risk of financial distress between 2007 and 2016 with

logistic regression and machine learning models such as dynamic hazard random forest and K-nearest neighbour approaches as estimation techniques. The study revealed that board diversity attributes such as gender and education significantly reduce the likelihood of corporate failure among the sampled firms. Using the Altman Z stability index to measure the likelihood of financial distress, Ali et al. [9] reported that the demographic and cognitive dimensions of board diversity significantly reduce the probability of financial distress among Chinese non-financial firms. Similarly, García and Herrero [24] apply logistic regression to study the nexus between gender diversity and the risk of bankruptcy and demonstrate that the presence of women directors mitigated the risk of financial distress among non-banking European firms between 2002 and 2019.

Lee and Thong [43] delve into the nexus among gender diversity, firm performance and financial distress risk and find that firms with a higher ratio of female directors have a lower risk of financial distress. In a separate study, Nurcahyono et al. [56] explored the nexus between gender diversity and financial distress in the transport industry in Indonesia. The authors reveal that the inclusion of more women in the boardroom lowers the potential for financial distress. Adopting the Altman Z score, Guizani and Abdalkrim [27] explored the relationship between women on boards and the likelihood of financial distress among 367 non-financial listed firms in Malaysia and reported that board diversity strengthens board effectiveness and consequently reduces a firm's exposure to financial distress and bankruptcy. Nevertheless, in Asian countries, Cho et al. [19] explored the linkage between executives' gender diversity and bankruptcy risk among Chinese firms using Altman's Z score as a proxy for bankruptcy risk. The study reveals that firms with greater gender diversity are associated with lower bankruptcy risk than their counterparts with lower gender diversity. Similarly, Abbas and Frihatni [1] reported that the inclusion of more women in the boardroom mitigates the likelihood of corporate failure among listed firms in Indonesia. With respect to the Indonesian economy, Muthia et al. [53] find that the likelihood of financial distress decreases with increasing board gender diversity. The outcome aligns with the findings of Khan et al., [38], who establish that the risk of corporate failure is lower in firms with a gender-diverse board in Malaysia.

The summary of the review presented above reveals that while there are a plethora of studies on the nexus between gender diversity and firm performance (both in developed and emerging economies), the handful of studies on the gender diversity and corporate failure/financial distress nexus have concentrated on Asian economies, as reviewed above. In addition,

existing studies have concentrated on listed private firms, whereas empirical studies on gender diversity and SOEs are relatively underexplored. To our knowledge, no study has addressed this phenomenon in South Africa. Importantly, the outcomes from previous studies might not be directly applicable in South Africa because of differences in business and regulatory environments. Unlike emerging economies such as China, Malaysia, Pakistan and Indonesia, the issue of inclusivity, diversity and equity at the top management level of South African firms is at the front burner of corporate governance on the basis of the country's Apartheid policy experience. To buttress this, various codes of corporate governance (king reports) in South Africa emphasise the criticality and importance of gender-inclusive boards as sound corporate governance to strengthen organisational performance (IoDSA, 2016). Similarly, in recognition of gender diversity in driving corporate outcomes, the South African government implemented a national policy framework known as the Employment Equity Act (1998). The act recognises gender diversity, especially at the upper echelon of corporate firms, as a corporate governance mechanism (Ntim and Soobaroyen, 2013). In addition, the effect of gender diversity on firm failure has not been investigated from the perspective of SOEs, which play an even greater role in the context of a developing economy, given their developmental mandate that they need to deliver alongside basic services to the country's citizens. Hence, this study explores the importance of gender diversity in determining corporate outcomes, with an emphasis on corporate failure among SOEs in South Africa. Following the theoretical foundations and the argument in the empirical literature, we propose that female representation on corporate boards is associated with a reduction in the likelihood of firm failure among South African SOEs, as presented in the following hypothesis.

H₁: Gender diversity reduces the probability of corporate failure among state-owned enterprises in South Africa

Data and methods

Population and sample selection

The population of this study involves SOEs that are under Schedule 2 of the South African Public Financial Management Act of 1999, covering the period between 2011 and 2022. Out of the 21 SOEs, the study excludes three SOEs¹ with incomplete data, and we arrive at the final sample of 18 SOEs (216 yearly observations). The three firms were excluded because of a lack of yearly data over

¹ Armaments Corporation of South Africa Limited (AMSCOR), DENEL (Ply) Ltd. & South African Express Limited.

the study period. Thus, the sample consists of 86% of the SOEs, which is considered adequate representation of the SOEs in South Africa. Hence, we do not envisage sample bias in the study. Data for the analysis are directly obtained from the integrated and financial reports of the sample SOEs.

Data

All the variables employed in the study are categorised into three groups. These variables include the dependent variable (corporate failure), independent variable (gender diversity), control variables described as corporate governance variables (board ethnic diversity, board size, board independence and frequency of board meetings) and firm-specific variables: return on assets, firm size, the leverage ratio and the quality of external audits. The dependent variable (failure) is a dummy variable where one (1) is assigned if a company is described as having "failed" and zero (0) is assigned to the non-fail firm. On the basis of the empirical literature, there are two approaches for describing corporate failure. A firm is considered to be in financial distress if it incurs losses for three consecutive financial years or records a negative cash flow for three consecutive years [77], Nour et al., 2023). Owing to data constraints on the cash flow statement, we follow the first definition in which an SOE is considered to be in distress if it records a net loss for three consecutive years. We adopt this definition as a strong proxy for the severe financial distress that

precedes formal corporate failure or necessitates a government bailout, which is a common outcome for struggling SOEs. Based on this definition, 9 SOEs (50% of the sample) are classified as failed firms, while 9 of them are described as non-failed firms. Table A1 in appendix contains the list of failed SOEs and non-failed companies. The descriptions and measurements of the variables used in the study are presented in Table 1.

Model specification

In line with the studies of García and Herrero [24] and Guizani and Abdalkrim [27], the nexus between gender diversity and corporate failure is expressed as follows:

$$fail_{it} = \gamma_0 + \gamma_1 gdiv_{it} + \sum_2^5 \gamma_k gov_{it} + \sum_6^9 \gamma_k firm_spec_{it} + \mu_{it} \tag{1}$$

where $fail_{it}$ represents corporate failure, which is a dummy variable as previously defined, and where $gdiv_{it}$ represents board gender diversity, which is the main independent variable. gov_{it} is the vector of corporate governance control variables, namely, ethnic diversity ($ediv_{it}$), board size (bds_{it}), board independence (bdi_{it}), and board meeting (bdm_{it}). $firm_spec_{it}$ consists of firm-specific variables such as firm size (fsz_{it}), the leverage ratio (lvr_{it}), return on (roa_{it}), assets and the quality of audits (adq_{it}), while $\hat{\mu}_{it}$ represents the stochastic error term.

In the explicit term, we respecify Eq. (1) as

$$fail_{it} = \gamma_0 + \gamma_1 gdiv_{it} + \gamma_2 ediv_{it} + \gamma_3 bds_{it} + \gamma_4 bdi_{it} + \gamma_5 bdm_{it} + \gamma_6 roa_{it} + \gamma_7 fsz_{it} + \gamma_8 lvr_{it} + \gamma_9 adq_{it} + \gamma_{it} \tag{2}$$

Table 1 Description and measurement of variables

Variables	Symbol	Description/measurement
<i>Dependent variable</i>		
Firm failure	<i>Fail</i>	Binary dummy variable in which 1 is assigned for failed companies, 0 otherwise
<i>Independent variable</i>		
Gender diversity	<i>Gdiv</i>	Ratio of women directors to the board size
<i>Control variables: Corporate governance variables</i>		
Ethnic diversity	<i>Ediv</i>	Proportion of black directors to board members (%)
Board size	<i>Bds</i>	Total number of board members
Board independence	<i>Bdi</i>	The proportion of independent non-executive directors to board members (%)
Board meetings	<i>Bdm</i>	Number of board meetings held in a year
<i>Control variables: Firm specifics</i>		
profitability	<i>Roa</i>	Return on asset
Firm size	<i>Fsz</i>	Natural logarithm of total asset
Leverage	<i>Lvr</i>	Total debt to total asset
Quality of audit	<i>Adq</i>	Dummy variable where 1 is assigned if a firm is audited by any of the big four auditors and 0 elsewhere

Source: Authors' compilation

All the variables are as previously defined.

Analytical techniques

The binary nature of the dependent variable implies that conventional panel estimation (such as ordinary least squares, random or fixed effect models) approaches cannot be employed. Hence, the study follows existing studies on binary outcome variables [27, 75] and applies a panel logistic regression as the main estimation technique. A logistic regression model is a predictive technique that can be applied to examine the nexus between a binary dependent variable and other explanatory variables, which can be categorical or continuous (Nour et al., 2023). However, before the main analysis, some preliminary tests, such as descriptive statistics, correlation analysis and univariate tests, are carried out to unravel the salient attributes of the series.

In line with the focus of the study, the logistic regression model used to examine the impact of gender diversity on corporate failure can be expressed as follows:

$$\log_{it}(\text{fail}_{it}) = \ln \frac{\text{fail}_{it}}{1 - \text{fail}_{it}} = \sigma_0 + \sigma_1 \text{gdiv}_{it} + \sigma_2 \text{ediv}_{it} + \sigma_3 \text{bds}_{it} + \sigma_4 \text{bdi}_{it} + \sigma_5 \text{bdm}_{it} + \sigma_6 \text{roa}_{it} + \sigma_7 \text{fsz}_{it} + \sigma_8 \text{lvr}_{it} + \sigma_9 \text{adq}_{it} + \mu_{it} \quad (3)$$

where all the variables maintain their initial definitions and where $\hat{I}^{1/4}_{it}$ captures the residual term.

In line with Gujarati and Porter (2004) and Nour et al. (2023), the reliability and fitness of the above logistic model are evaluated via preliminary tests, such as the likelihood ratio, Hosmer–Lemer and Andrews tests and count R^2 , which is defined as the percentage of correct predictions.

For a robustness check, we utilise the feasible generalised least squares (FGLS) method and the method of moments quantile regression (MMQR). As documented by Wahba [74], Tshipa et al. (2018a) and Tshipa et al. (2018b), the FGLS controls for possible heteroscedasticity and serial correlation in the residual. These authors also argued that the FGLS technique controls for unobserved heterogeneity among the cross-sectional units in the panel. Hence, FGLS provides robust standard errors that account for the influence of serial correlation and heterogeneity in residual terms.

On the other hand, the MMQR controls for the distributional and heterogeneous impacts of gender diversity on firm failure use across several quantiles. The MMQR was developed by Machado and Silva (2019) and is considered superior to mean-based panel estimators (such as OLS, fixed and random effects) because it is robust and resilient to outliers, which could bias the research outcomes if not addressed [14, 55]. The MMQR belongs

to a special class of the dynamic GMM estimator and is efficient in handling nonlinear and heterogeneous models with multiple endogenous variables (Machado and Silva, 2019). This approach is also effective in that it does not require the distribution assumption of a normal distribution of the residual term [20]. This implies that the approach is robust and consistent in the case of non-normality in the error distribution [58]. All these distinguishing features make the technique attractive over mean-based panel estimators, such as OLS and fixed and random effects, which rely on the least square technique.

Results and discussion of findings

Descriptive statistics

A summary of the descriptive statistics is presented in Table 2. The descriptive analysis is presented in three categories. Panels A, B and C represent the descriptive statistics of the overall sample and the low- and high-gendered board subsamples, respectively. The study examines the mean, median, minimum, maximum and

standard deviation of the series. Starting with the outcomes on the aggregate sample (Panel A), 50% of the firms are declared failed SOEs on the basis of the average value of the target variable (Failure), which is 0.50. Considering corporate governance measures, the average board size of the sampled SOEs is approximately 11 members, 43.0%, 77.6% and 82.8% of whom are women, black and independent directors, respectively. In the same vein, the selected SOEs meet 9 times per year within the study period. For the other control variables, the mean values of profitability (*roa*), leverage (*lvr*) and firm size (*fsz*) are 2.37%, 0.380 and R75, 976 million, respectively. Again, there is a wide disparity in the performance and size of the studied SOEs on the basis of the standard deviation of *roa* and *fsz*, which are estimated to be 12.429% and R157237.5 million, respectively. Finally, only 26.4% of the studied SOEs are audited by Big 4 auditors, which reflects the extent of audit quality among SOEs in South Africa.

For the subsample analysis in Panel B (low-gender firms) and Panel C (high-gender firms), 60% of the firms with a low-gender ratio on the board are classified as failed firms (Panel B), whereas 38.6% of the firms with a high proportion of female representation (Panel C) are classified. Similarly, for the low female director subsample, the average value of board gender diversity is 34.3%, whereas it is 53.1% for SOEs with a high board gender

Table 2 Descriptive statistics

Panel A: Aggregate sample										
	<i>fail</i>	<i>gdiv</i>	<i>ediv</i>	<i>bds</i>	<i>bdi</i>	<i>bdm</i>	<i>roa</i>	<i>fsz</i>	<i>lvr</i>	<i>adq</i>
Mean	0.500	0.431	0.776	11.167	0.828	8.944	-2.373	75,976.710	0.380	0.264
Median	0.500	0.417	0.778	11.000	0.833	8.000	0.844	17,529.950	0.332	0.000
Maximum	1.000	0.75	1.000	19.000	1.000	27.000	18.187	781,648.000	0.975	1.000
Minimum	0.000	0.143	0.333	4.000	0.571	2.000	-48.903	478.600	0.000	0.000
Std. Dev	0.501	0.122	0.140	2.890	0.080	4.451	12.429	157,237.500	0.310	0.442
Observations	216	216	216	216	216	216	216	216	216	216
Panel B: Low-Gender firms										
Mean	0.600	0.343	0.793	11.191	0.834	9.252	-4.581	62,061.510	0.354	0.209
Median	1.000	0.360	0.790	11.000	0.850	8.000	0.550	13,349.000	0.297	0.000
Maximum	1.000	0.417	1.000	19.000	1.000	27.000	18.187	781,648.000	0.850	1.000
Minimum	0.000	0.143	0.429	5.000	0.667	2.000	-48.903	478.600	0.000	0.000
Std. Dev	0.492	0.064	0.133	2.877	0.076	4.884	14.072	145,998.100	0.235	0.408
Observations	115	115	115	115	115	115	115	115	115	115
Panel C: High-Gender Firms										
Mean	0.386	0.531	0.757	11.139	0.823	8.594	0.141	91,820.760	0.416	0.327
Median	0.000	0.500	0.770	11.000	0.830	8.000	1.420	30,688.000	0.420	0.000
Maximum	1.000	0.75	1.000	18.000	1.000	26.000	18.187	781,648.000	0.975	1.000
Minimum	0.000	0.429	0.333	4.000	0.571	2.000	-48.903	478.600	0.000	0.000
Std. Dev	0.489	0.091	0.147	2.919	0.084	3.894	9.716	168,463.500	0.260	0.472
Observations	101	101	101	101	101	101	101	101	101	101

Source: Author's compilation

ratio. Considering the measure of firm performance (ROA), firms with a low-gender ratio record an average loss of -4.58%, whereas firms with a high-gender ratio have 0.14% of the mean value of ROA. Moreover, the average size of firms with higher female board representation (R91, 820.8 M) is greater than that of firms with low female representation (R62, 061.510). Again, firms with high female board representation have a higher average leverage ratio (0.416) than their low-gender counterparts do (0.354). In terms of audit quality, 32.7% of the firms with high-gender representation and 20.9% of low-gender-diversified boards are audited by the Big 4. Given these discrepancies, this study further probes into whether female representation on corporate boards is associated with the likelihood of corporate failure among SOEs in South Africa.

Independent 2-sample t test

To deepen our investigation of the disparity between failed and non-failed firms, we conduct a *t test* on the mean value of the variables in the study across the two subsamples. The results of the independent 2-sample *t test* are reported in Table 3. The outcomes from the *t test* reveal a substantial difference in gender diversity between the two subsamples. In addition, there is a

Table 3 T test

Variables	Non-failed		Failed		t stat (prob)
	N	mean	N	mean	
<i>gdiv</i>	108	0.454	108	0.430	2.872 (0.005) ***
<i>ediv</i>	108	0.754	108	0.798	-2.317 (0.022) **
<i>bds</i>	108	11.241	108	11.093	0.376 (0.707)
<i>bdi</i>	108	0.830	108	0.826	0.361 (0.718)
<i>bdm</i>	108	7.843	108	10.046	-3.747(0.000) ***
<i>roa</i>	108	1.341	108	-6.087	4.592(0.000) ***
<i>fsz</i>	108	10.211	108	9.154	4.310(0.000) ***
<i>lvr</i>	108	0.388	108	0.420	-0.746(0.457)
<i>adq</i>	108	0.296	108	0.264	1.079(0.282)

*** and ** represent 1% and 5% significant levels, respectively

significant difference in corporate governance variables such as ethnic diversity and the frequency of board meetings between the groups. Firm-specific indicators such as return on assets (*roa*) and firm size (*fsz*) differ markedly across the two subsamples. For instance, the results indicate that women's representation in non-failed firms is greater (45%) than that in failed firms (42%) at the 1% significance level. This provides prior insight into the

studied variables, which reveals a negative relationship between the proportion of female directors and the likelihood of corporate failure. Conversely, the failed firms have more black directors (79.8%) in their boardrooms and meet more frequently (10 times per year) than do the non-failed firms, whose proportion of black directors and the number of board meetings stand at 75.4% and approximately 8 times, respectively. Interestingly, it is further discovered that failed firms recorded an average loss of 6.078% within the study period, whereas the non-failed firms recorded an average profit of 1.34%. This finding suggests that an increase in firm performance reduces the likelihood of corporate failure among SOEs in South Africa.

Correlation analysis

The results of the correlation analysis, which used the Pearson pairwise correlation coefficients, are displayed in Table 4. In terms of the direction of the association, evidence from Table 4 shows that gender diversity (*gdiv*) is negatively associated with firm failure (*fail*). Other governance attributes, such as board size (*bds*) and board independence (*bdi*), are negatively correlated with firm failure (*fail*), whereas board ethnic diversity (*ediv*) and board meetings (*bdm*) are positively associated with the likelihood of corporate failure. On the other hand, profitability (*roa*) and the engagement of Big 4 auditors (*adq*) are negatively correlated with firm failure. Conversely, firm-specific indicators such as the leverage ratio (*lvr*) and firm size (*fsz*) are positively associated with the likelihood of corporate failure.

To consolidate the outcomes from the Pearson correlation coefficients, the variance inflation factor (VIF) is used to check for multicollinearity among the explanatory variables in the model. The outcomes from the VIF are displayed in Table 4. Following the studies of Lemma,

Muttakin and Mihret (2022) and Ojeyinka and Matemane [57], there is a multicollinearity threat when the VIF for any variable is greater than 5.0 and the average VIF exceeds 2.0. From the outcomes in Table 4, the highest VIF is 1.41, while the average VIF is estimated to be 1.16. Hence, there is no multicollinearity challenge in the estimated models.

Gender diversity and the corporate failure nexus: Baseline model

The main focus of this paper is to explore the effect of board gender diversity in predicting the possibility of corporate failure among SOEs in South Africa. The study employs logistic binary regression (Table 5) as the baseline model. On the basis of the outcomes from preliminary statistics (lower part), the values of the likelihood ratio (LR) for the three regressions are significant at the 1% level, suggesting the adequacy of the models estimated. We reject the null hypothesis and conclude that the identified explanatory variables sufficiently predict the dynamics of the dependent variable. The value of McFadden R^2 (ranging between 2.8% and 24.9%) is considered moderate and thus confirms the earlier prediction of the LR statistics (Gujarati, and Porter, 2009). Similarly, the percentage (%) of correct predictions (measured by the count R^2) for the three regressions) varies between 58.3% (Model 1) and 76.9% (Model 3). The probability values of the Hosmer–Lemer and Andrews tests are not significant and thus confirm the goodness of fit of the estimated regressions. Thus, all the preliminary tests support the adequacy and fitness of the estimated logistic regressions (Nour et al., 2023), and these provide credence to the estimates from the study.

The magnitude of gender diversity (*gdiv*) assumes the expected sign across the three specifications. The outcome overwhelmingly shows that the proportion of

Table 4 Correlation analysis

	<i>fail</i>	<i>gdiv</i>	<i>ediv</i>	<i>bds</i>	<i>bdi</i>	<i>bdm</i>	<i>roa</i>	<i>fsz</i>	<i>lvr</i>	<i>adq</i>	<i>VIF</i>
<i>fail</i>	1.000	–	–	–	–	–	–	–	–	–	–
<i>gdiv</i>	–0.193***	1.000	–	–	–	–	–	–	–	–	1.07
<i>ediv</i>	0.156**	–0.052	1.000	–	–	–	–	–	–	–	1.09
<i>bds</i>	–0.026	0.146**	–0.098	1.000	–	–	–	–	–	–	1.24
<i>bdi</i>	–0.025	0.014	0.068	–0.040	1.000	–	–	–	–	–	1.04
<i>bdm</i>	0.248***	–0.023	0.020	0.099	0.009	1.000	–	–	–	–	1.14
<i>roa</i>	–0.300***	0.089	–0.014	0.141**	0.053	–0.147**	1.000	–	–	–	1.10
<i>fsz</i>	–0.283***	0.225***	–0.101	0.138**	0.138**	0.234***	0.167**	1.000	–	–	1.41
<i>lvr</i>	0.051	0.087	–0.077	0.001	–0.021	0.089	0.077	0.202***	1.000	–	1.10
<i>adq</i>	–0.074	0.046	–0.239***	0.228***	0.022	–0.144**	0.183***	–0.030	–0.119*	1.000	1.21
<i>Mean VIF</i>		–	–	–	–	–	–	–	–	–	1.16

Note: ***, ** and * indicate 1%, 5% and 10% significance levels, respectively

Table 5 Logit regression results

Variables	(1) fail	(2) fail	(3) fail	odd ratio
<i>gdiv</i>	−3.343*** (1.209)	−3.450*** (1.278)	−2.871* (1.479)	0.057
<i>ediv</i>		2.328** (1.060)	2.121** (1.230)	8.339
<i>bds</i>		−0.001 (0.052)	0.132** (0.065)	1.141
<i>bdi</i>		−0.976 (1.831)	1.106 (2.073)	3.022
<i>bdm</i>		0.136*** (0.039)	0.209*** (0.051)	1.232
<i>roa</i>			−0.051*** (0.016)	0.950
<i>fsz</i>			−0.578*** (0.120)	0.561
<i>lvr</i>			1.399** (0.648)	4.051
<i>adq</i>			0.707* (0.406)	2.028
Constant	01.437*** (0.536)	−0.635 (1.876)	−0.676 (2.145)	0.509
<i>Diagnostic test—Model Evaluation</i>				
MC-Fadden R2	0.028	0.093	0.249	
Likelihood ratio (LR)	8.247	27.92	74.634	
LR-Prob	[0.004]	[0.000]	[0.001]	
H–L stat	3.677	4.206	0.872	
Prob (H–L stat)	[0.299]	[0.122]	[0.832]	
Andrews Stat	3.917	6.388	2.911	
Prob (Andrews stat)	[0.561]	[0.172]	[0.714]	
% of correct Pred (Count R)	58.3	64.4	76.9	
Observations	216	216	216	

Robust standard errors in parentheses (), figures in [] are probability values

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

women directors on boards has a negative and significant influence on the odds of corporate failure. Focusing on the full specification (Model 3), the odds ratio of 0.057 for gender diversity indicates that a higher proportion of female directors is associated with a drastic reduction in the odds of corporate failure. On the other hand, other board attributes, such as ethnic diversity (*ediv*), board size (*bds*) and board meetings (*bdm*), significantly increase the likelihood of corporate failure in the sample SOEs. With respect to the firm-specific variables, firm size (*fsz*) and profitability (*roa*) are found to lower the odds of financial distress, whereas an increase in the leverage ratio is associated with a high probability of

corporate failure. Again, audit quality (*adq*) is not a significant predictor of corporate failure.

Robustness tests

First, we employ a probit regression model (models 1–3 in Table 6) as a robustness check on the outcomes from the logit model. One major distinction between the two binary regressions is embedded in the type of probability distribution they assume. The assumption of cumulative logistic probability characterises the logistic regression model, whereas the probit model rests on the assumption of a cumulative normal distribution (Dibia and Onwuchekwa, 2015). Again, gender diversity has a negative and significant effect on the odds of corporate failure, whereas other corporate governance variables, such as ethnic diversity and the number of board meetings, increase the likelihood of financial failure. Similarly, the impact of board size on firm failure is not consistent, as the risk of firm failure is not influenced by board independence. Likewise, the effect of firm-specific variables on the outcome variable is consistent with earlier findings.

Second, we utilise the FGLS as an additional estimation technique to validate the outcomes of the main regression. The results of the FGLS are reported under Model 4 in Table 6. Again, gender diversity (*gdiv*) significantly reduces the likelihood of corporate failure among the selected SOEs, whereas other explanatory variables maintain their prior impacts on firm failure. For instance, ethnic diversity (*ediv*), board size (*bds*) and board meetings (*bdm*) significantly increase firm failure, whereas firm-specific variables such as return on assets (*roa*) and firm size (*fsz*) are found to mitigate the business failure of the sample SOEs.

Third, following the argument presented in Sect. “Results and discussion of findings”, we conduct another robustness test via the method of moment quantile regression (MMQR) approach to examine the heterogeneous and distributional effects of gender diversity on corporate failure. The results from the MMQR technique are presented in Table 7. The outcomes from Table 7 show the impact of gender diversity on firm failure across different quantiles. As presented in Table 7, board gender diversity (*gdiv*) has a negative effect on business failure in all quantiles examined. However, the impact of gender diversity on corporate failure is significant from the 50th quantile, and this effect persists to the 90th quantile, suggesting that the effect of board gender diversity on business failure is mostly felt at the upper quantiles. On the other hand, the impact of board attributes such as ethnic diversity (*ediv*) and board size (*bds*) on firm failure is positive and statistically significant across the lower quantiles (from the 10–50th quantiles), whereas their effect

Table 6 Robustness tests using probit and FGLS techniques

Probit results					FGLS
Variables	(1)	(2)	(3)	Odd ratio	(4)
	<i>fail</i>	<i>fail</i>	<i>fail</i>		<i>fail</i>
<i>gdiv</i>	– (0.733)	– (0.754)	–1.404* (0.822)	0.246	–0.456* (0.244)
<i>ediv</i>		1.403** (0.637)	1.600*** (0.687)	4.953	0.537** (0.214)
<i>bds</i>		–0.006 (0.032)	0.073* (0.038)	1.076	0.022** (0.011)
<i>bdi</i>		–0.539 (1.112)	0.458 (1.214)	1.581	0.211 (0.368)
<i>bdm</i>		0.083*** (0.023)	0.122*** (0.028)	1.130	0.032*** (0.007)
<i>roa</i>			–0.029*** (0.09)	0.971	–0.009*** (0.002)
<i>fsz</i>			–0.318*** (0.064)	0.728	–0.099*** (0.018)
<i>lvr</i>			0.770** (0.366)	2.160	0.246** (0.097)
<i>adq</i>			0.365 (0.236)	1.441	0.115 (0.072)
Constant	0.887*** (0.325)	–0.421 (1.137)	–0.273 (1.214)	0.761	0.376 (0.381)
<i>Diagnostic test—Model Evaluation</i>					
MC-Fadden R2	0.027	0.093	0.242		
Likelihood ratio (LR)	8.229	27.926	72.359		
LR-Prob	[0.001]	[0.000]	[0.001]		
H–L stat	3.679	4.365	1.862		
Prob (H–L stat)	[0.298]	[0.113]	[0.602]		
Andrews Stat	6.331	6.852	3.572		
Prob (Andrews stat)	[0.275]	[0.144]	[0.623]		
% of correct Pred (Count R)	58.3	64.4	76.39		
Observations	216	216	216		216

Robust standard errors in parentheses (), value in [] are probability values

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

becomes immaterial at the upper quantiles. Consistent with the earlier results, board meetings (*bdm*) have a persistent positive and significant effect on firm failure across all the quantiles investigated. This suggests that an increase in the frequency of director meetings leads to poor financial performance and corporate failure. Firm-specific control variables such as return on assets (*roa*) and firm size (*fsz*) again prove to be significant drivers of business failure among SOEs in South Africa. On the other hand, the effect of the leverage ratio aligns with the results from the main analysis, where an increase in the leverage ratio is associated with a greater likelihood of firm failure. The outcomes are consistent and robust

at different quantiles. Thus, the outcomes from all the robustness tests validate the results from the main analysis and support the reducing effect of gender diversity on the probability of firm failure among the sample SOEs.

Further sensitivity analysis

To deepen our investigation of the role of board gender diversity in predicting corporate failure, we perform sensitivity analyses using the percentage of board women represented. The outcomes from the descriptive analysis (Table 2) show that the proportion of female board representation ranges from 0.143 (minimum value) to 0.75 (maximum value). On the basis of this information, we

Table 7 Method of moment quantile regression

Dependent variables: <i>fail</i>											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	<i>location</i>	<i>scale</i>	<i>q (0.10)</i>	<i>q (0.20)</i>	<i>q (0.30)</i>	<i>q (0.40)</i>	<i>q (0.50)</i>	<i>q (0.60)</i>	<i>q (0.70)</i>	<i>q (0.80)</i>	<i>q (0.90)</i>
<i>gdiv</i>	-0.456* (0.246)	-0.246** (0.115)	-0.106 (0.271)	-0.206 (0.253)	-0.270 (0.246)	-0.318 (0.245)	-0.409* (0.246)	-0.558** (0.262)	-0.680** (0.284)	-0.738** (0.297)	-0.805** (0.317)
<i>ediv</i>	0.537** (0.232)	-0.272** (0.109)	0.925*** (0.257)	0.815*** (0.240)	0.744*** (0.232)	0.690*** (0.232)	0.590** (0.234)	0.424* (0.249)	0.290 (0.269)	0.225 (0.280)	0.151 (0.299)
<i>bds</i>	0.022* (0.011)	-0.014*** (0.005)	0.042*** (0.013)	0.037*** (0.012)	0.033*** (0.011)	0.030*** (0.011)	0.025** (0.012)	0.016 (0.013)	0.009 (0.013)	0.006 (0.014)	0.002 (0.015)
<i>bdi</i>	0.211 (0.368)	-0.064 (0.172)	0.302 (0.405)	0.276 (0.379)	0.260 (0.368)	0.247 (0.364)	0.224 (0.363)	0.185 (0.387)	0.154 (0.424)	0.138 (0.446)	0.121 (0.475)
<i>bdm</i>	0.032*** (0.007)	-0.001 (0.003)	0.033*** (0.007)	0.033*** (0.007)	0.032*** (0.007)	0.032*** (0.007)	0.032*** (0.007)	0.032*** (0.007)	0.031*** (0.008)	0.031*** (0.008)	0.031*** (0.009)
<i>roa</i>	-0.009*** (0.002)	0.001 (0.001)	-0.011*** (0.003)	-0.010*** (0.003)	-0.010*** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)	-0.009*** (0.003)	-0.009*** (0.003)	-0.008*** (0.003)	-0.008** (0.00317)
<i>fsz</i>	-0.099*** (0.010)	0.009 (0.009)	-0.112*** (0.021)	-0.108*** (0.020)	-0.106*** (0.019)	-0.104*** (0.019)	-0.101*** (0.019)	-0.095*** (0.020)	-0.090*** (0.022)	-0.088*** (0.023)	-0.086*** (0.025)
<i>lvr</i>	0.246*** (0.092)	-0.035 (0.043)	0.296*** (0.101)	0.282*** (0.094)	0.273*** (0.092)	0.266*** (0.091)	0.253*** (0.091)	0.231** (0.097)	0.214** (0.106)	0.206* (0.111)	0.196* (0.119)
<i>adq</i>	0.115 (0.074)	0.016 (0.035)	0.092 (0.082)	0.0982 (0.076)	0.102 (0.074)	0.106 (0.073)	0.111 (0.073)	0.121 (0.078)	0.129 (0.085)	0.133 (0.090)	0.138 (0.095)
Constant	0.376 (0.417)	0.825*** (0.195)	-0.798* (0.464)	-0.463 (0.432)	-0.249 (0.416)	-0.086 (0.423)	0.216 (0.432)	0.718 (0.460)	1.126** (0.486)	1.322*** (0.500)	1.547*** (0.536)
Observations	216	216	216	216	216	216	216	216	216	216	216

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

create three dummy variables to proxy for gender diversity. We use a dummy variable (*fem_1*), where a firm takes a value of 1 if the proportion of female directors is less than 25% and zero otherwise (Model 1). In Model 2, a dummy variable (*fem_2*) is employed where one (1) is assigned for a firm if the ratio of female directors to total board size is between 25 and 49% and zero otherwise, whereas Model 3 depicts the results when a dummy variable of 1 is given to a firm for a particular year in which women on board account for a minimum of 50% of board size (*fem_3*). The outcomes from the sensitivity analysis are displayed in Table 8. With respect to the variable of interest, the results from Model 1 reveal that gender diversity has no significant effect on the probability of corporate failure when women account for less than 25% of the board size. On the other hand, when the proportion of women in the boardroom is between 25 and 49%, gender diversity is discovered to increase the odds of financial failure, suggesting that an increase in gender diversity is associated with a greater occurrence of firm failure within these ratios. Consistent with the findings from the main results, evidence from Model 3 confirms the plummeting effect of gender diversity on the

likelihood of corporate failure when women’s representation attains a threshold of a minimum of 50% to the board size. The implication of this finding is that for women to make substantial contributions to a firm’s long-term survival, their board composition must not be less than 50%.

Controlling for selection bias

Given the process employed in selecting the sampled firms, we anticipate the possibility of selection bias. Besides, scholars such as Gerged et al. (2022), Muhammad and Migliori (2023) and Al-Haddad and Gerged (2024) argue that studies on corporate governance and financial distress are likely to suffer from self-selection bias. To address this, we re-estimate Eq. 2 using the Heckman two-stage least squares method. The approach involves the estimation of the regression model in two stages. For conciseness, we present the second-stage regression where firm failure is regressed on gender diversity, control variables and the Inverse Mills Ratio (IMR) generated from the first-stage regression. The purpose of the IMR is to correct for the likelihood of selection bias in the relationship between gender diversity and corporate firm failure. The outcomes from the Heckman

Table 8 Sensitivity analysis results

VARIABLES	(1)	(2)	(3)
	Female (below 25%)	Female (26%–49%)	female (50% and above)
<i>fem_1</i>	−0.465 (0.479)	–	–
<i>fem_2</i>	–	0.522** (0.229)	–
<i>fem_3</i>	–	–	−0.663** (0.264)
<i>ediv</i>	1.459** (0.704)	1.498** (0.697)	1.804** (0.707)
<i>bds</i>	0.061 (0.038)	0.063* (0.038)	0.075* (0.038)
<i>bdi</i>	0.282 (1.266)	0.055 (1.270)	−0.006 (1.268)
<i>bdm</i>	0.119*** (0.028)	0.116*** (0.029)	0.120*** (0.029)
<i>roa</i>	−0.031*** (0.009)	−0.030*** (0.009)	−0.029*** (0.009)
<i>fsz</i>	−0.309*** (0.027)	−0.286*** (0.062)	−0.286*** (0.062)
<i>lvr</i>	0.022 (0.027)	0.028 (0.027)	0.034 (0.027)
<i>adq</i>	0.278 (0.229)	0.226 (0.232)	0.219 (0.233)
Constant	−0.234 (1.200)	−0.724 (1.180)	−0.565 (1.171)
Diagnostic test—Model Evaluation			
MC-Fadden R2	0.222	0.236	0.241
Likelihood ratio (LR)	66.472	70.796	72.033
LR-Prob	[0.004]	[0.000]	[0.000]
H–L stat	3.211	1.885	9.164
Prob (H–L stat)	[0.362]	[0.597]	[0.329]
Andrews Stat	8.376	5.691	13.846
Prob (Andrews stat)	[0.137]	[0.337]	[0.180]
% of correct Pred (Count R)	73.15	73.61	73.15
Observations	216	216	216

Robust standard errors in parentheses (), value in [] are probability values
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

two-stage model are displayed in Table 9. The coefficient of the IMR is not statistically significant, implying the rejection of the null hypothesis that selection bias is present in the model. This implies that the outcomes from the logistic model are not susceptible to selection bias. Considering the outcomes from Table 9, the effect of gender diversity on corporate failure is negative and significant at 5% level. This implies that gender diversity consistently reduces the likelihood of corporate failure

Table 9 Heckman two-stage least square

VARIABLES	<i>fail</i>
<i>gdiv</i>	−0.602** (0.251)
<i>ediv</i>	0.566** (0.258)
<i>bds</i>	0.0191 (0.0145)
<i>bdi</i>	0.387 (0.438)
<i>bdm</i>	0.0301*** (0.00739)
<i>roa</i>	−0.00945*** (0.00282)
<i>fsz</i>	−0.0916*** (0.0231)
<i>lvr</i>	0.260** (0.112)
<i>adq</i>	0.0829 (0.0751)
IMR	0.239 (0.427)
Constant	0.242 (0.406)
Observations	216

Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

among the sampled SOEs. Similarly, most of the control variables retain their initial effect on the outcome variable. Therefore, the outcomes are robust to selection bias.

Discussion of results

Drawing from the lens of agency and resource dependency theories, this study addresses a major lacuna in governance studies by investigating the criticality of gender diversity on the likelihood of firm failure among eighteen (18) SOEs in South Africa. The study covers the period between 2011 and 2022. To control for the attribute of the outcome variable, we employ a binary logistic regression model as the main estimation technique, while the probit model, feasible generalised least squares (FGLS), method of moment quantile regression (MMQR) and Heckman two-stage least squares are utilised as robustness tests. The study also performs a sensitivity analysis on the proportion of female directors to the board size to provide a deeper investigation into the optimal ratio of board female representation that can minimise the likelihood of corporate failure in the context of South African SOEs. Overall, the study reveals a negative relationship between the ratio of women on boards and the odds of

corporate failure. The result is consistent with different econometric techniques and robust to different specifications. This confirms the theoretical predictions and reiterates the tenets of agency and resource dependency theories that gender diversity is a crucial governance mechanism for reducing agency costs and aligning the interests of business owners and managers of corporate firms. This finding confirms the acceptance of the study's hypothesis that an increase in gender diversity mitigates the odds of firm failure. Similarly, prior studies have shown that gender diversity is a significant predictor of financial failure (see [9, 27, 43, 56, 82]). The result is also in tandem with the studies of Mittal and Lavina (2018) and Garcia and Herrero (2021), who find that an increase in gender diversity reduces the likelihood of bankruptcy. Our results also confirm the outcome of Singh and Arora [67], who argue that gender diversity fosters resilience to financial distress among listed firms in India. On this basis, we conclude that board gender diversity serves as a strong corporate governance mechanism to improve firm performance and mitigate the risk of corporate failure. The outcome of the study is further complemented by the results of robustness tests where gender diversity is associated with a reduction in the probability of financial failure of SOEs, especially at the upper quantiles. This implies that the inclusion of women directors on corporate boards strengthens board effectiveness and guides board decisions on matters that improve firm financial outcomes and prevent the possibility of firm failure. Moreover, the study reveals that a minimum of 50% female directors are required for their presence to mitigate the occurrence of corporate failure. The outcome of this study provides solid support for the criticality of women directors as an effective apparatus to promote the financial health and long-term survival of South African SOEs. Thus, the results support the economic benefit and importance of female directors in preventing the corporate failure of state-owned enterprises in South Africa.

With respect to the control variables, the study reveals that corporate governance indicators such as ethnic diversity and the frequency of board meetings increase the odds of corporate failure for the sample SOEs. The outcomes validate the results from the *t* test for differences in means, where the failed firms have a higher percentage of black directors and a higher frequency of board meetings than their non-failed counterparts do. This result is in tandem with the findings of Appiah (2019), who discovered that frequent meetings reduce firm performance and, by extension, aggravate the probability of the failure of listed firms in Africa. In the same way, the results confirm the conclusion of Huse (2007), who finds that long and excessive meetings constrain board effectiveness and thus exacerbate the possibility of

firm failure. This positive impact of board meetings on the likelihood of corporate failure might be attributed to the increase in costs (including board sitting allowances and administrative costs) associated with more frequent meetings, which put additional financial pressure on firms.

Among the firm-specific variables, return on assets (profitability) and firm size significantly diminish the tendency for corporate failure, suggesting that better financial performance is likely to prevent the likelihood of corporate failure. In addition, the findings are consistent with the definition of corporate failure adopted in this study, where a firm is deemed to fail if it incurs loss for three consecutive years. The results are in line with our expectation that an increase in profitability precludes business failure. The findings are congruent with the outcomes of Cho et al. [19] and Guizani and Abdalkrim [27], who discovered that profitable firms are less likely to experience bankruptcy and financial distress risk. Similarly, the negative and significant relationship between firm size and corporate failure agrees with the prediction of Cho et al. [19] that larger firms benefit from economies of scale, which can significantly improve their financial performance and hence mitigate the probability of corporate failure. On the other hand, the effect of the leverage ratio on the likelihood of corporate failure is positive and significant, suggesting that a higher leverage ratio increases the likelihood of corporate failure. The outcome is generally in concordance with findings from prior studies [27, 56, 79]. For instance, a higher leverage ratio implies that more of the firm's activities are financed by debt. Thus, an increase in the leverage ratio is associated with an increase in the cost of debt, which might erode firm profitability and consequently expose firms to a financial crisis.

Conclusion and policy recommendations

The present study examines the significance and importance of women's representation on boards on the likelihood of corporate failure among South Africa. Unlike prior studies, our study concentrates on the gender diversity–firm failure nexus in the context of state-owned enterprises in the context of an emerging market—South Africa. The study also makes a fundamental contribution to the literature on the gender diversity–corporate failure nexus by using a battery of estimation techniques to control for various econometric pitfalls that have been neglected in the governance literature.

The key finding from the study reveals that female representation on boards significantly reduces the odds of corporate failure among SOEs in South Africa. The results support the prediction of the critical mass, agency and resource dependency theories that gender diversity

is a crucial corporate governance mechanism that can be utilised to increase board effectiveness, mitigate agency costs and prevent the incidence of corporate failure. In the same way, the result resonates, reiterates and provides a boost for the recommendation of the King IV code of corporate governance in South Africa on the importance of gender-diversified boards on corporate decisions and firm performance. The outcome from the sensitivity analysis offers insight into the minimum ratio of women (at least 50% of the board size) that is required for gender diversity to significantly reduce the likelihood of financial failure among the selected SOEs. In summary, the results of this study provide concrete support for the economic benefit of female directors in preventing the likelihood of financial failure among SOEs in South Africa. For the control variables, the study finds that an increase in profitability and firm size precludes the possibility of firm failure, whereas board ethnic diversity and the frequency of board meetings are associated with a surge in corporate failure.

On this basis, the paper offers some policy recommendations to the managers of SOEs and the regulators of South African SOEs in implementing sound governance frameworks to bolster the performance of SOEs and reduce the possibility of financial distress in the public sector.

- Given the importance of female board representation, as documented in this study, regulators of SOEs in South Africa are advised to promote gender inclusion in the composition of SOE boards to optimise the benefits that a gender-diversified board offers.
- Additionally, regulators should ensure the strict monitoring of SOE boards to conform to the prescription of the King IV governance code on board gender diversity. Presently, there are no mandatory specific quotas for women's representation on corporate boards in South Africa, and regulators might follow some developed economies, such as Norway and France, to specify a specific threshold in terms of female board representations for South African firms.
- With respect to the findings from the study, custodians of corporate governance in South Africa are encouraged to ensure that women directors form a

critical mass of at least 50% of the board size to tap into the full benefit of gender diversity as a mechanism to promote firm continuity and survival. However, when appointing women to corporate boards, it is important to consider other cognitive abilities, such as the skills, knowledge, expertise and experience of women, to make positive contributions to board decisions on crucial matters that affect the long-term survival of firms.

This study makes a significant contribution to the economic benefits of female board representation in preventing corporate failure in the context of SOEs in South Africa and in the quest to achieve Sustainable Development Goal 5. However, a number of limitations can be identified with this study. First, while our sample encompasses the majority of significant South African SOEs, the relatively small number of entities is an inherent limitation of studying this sector. Future research with larger datasets from multiple emerging economies could help validate these findings. Second, the findings of the study may not be generalizable to other firms, such as privately owned firms in South Africa. Hence, a similar study might be carried out on privately owned companies listed in South Africa. Third, other attributes of women (such as education, experience and skills) that might affect firm failure were not considered in this study. Future studies might consider some of these cognitive skills and explore their effects on the likelihood of corporate failure. Fourth, this study can be replicated for SOEs in other emerging economies, especially those from Africa, given the differences in the regulatory environment. Lastly, owing to the binary nature of the dependent variable, the study could not subject the outcome from the study to potential endogeneity concerns, which might affect the relationships among the target variables. As other sources of data become readily available, future studies that account for endogeneity in the link between the focal variables are needed.

Appendix

See Table 10.

Table 10 Sample firms

Failed SOEs	
1	Broadband Infrastructure Company (Pty) Ltd
2	ESKOM
3	Independent Development Trust (IDT)
4	SA Broadcasting Corporation Limited
5	SA Forestry Company Limited
6	SA Nuclear Energy Corporation Limited
7	SA Post Office Limited
8	South African Airways Limited
9	Trans-Caledon Tunnel Authority
Non-failed SOEs	
1	Air Traffic and Navigation Services Company
2	Airports Company (ACSA)
3	Alexkor Limited
4	CEF (Ply) Ltd. (formerly Central Energy Fund)
5	Development Bank of Southern Africa (DBSA)
6	Industrial Development Corporation of South Africa Limited (IDC)
7	Land and Agricultural Development Bank of South Africa
8	Telkom SA Limited
9	Transnet Limited

Acknowledgements

Not applicable

Author contributions

O.M. and N.V.M helped in conceptualisation and sourced for data. O.T.A. contributed to data analysis, interpretation and discussion. R. M. helped in design of the work, conclusion and recommendations. All authors read and approved the final manuscript.

Funding

Not applicable.

Data availability

No datasets were generated or analysed during the current study.

Declarations**Ethics approval and consent to participate**

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 7 May 2025 Accepted: 9 November 2025

Published online: 18 November 2025

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