THE NEXUS BETWEEN ASSETS ACQUISITION AND DEBT AN EMPIRICAL STUDY OF STATE-OWNED ENTERPRISES IN SOUTH AFRICA

Philip Aiyepola
Unisa School of Accounting Science

Felix Chirairo
University of South Africa

Mduduzi Moyo
University of South Africa

ABSTRACT

South African state-owned enterprises have experienced persistent financial distress. However, the relationship between debt accumulation and capital asset acquisition has remained insufficiently quantified. In this study, the extent to which long-term borrowing has driven capital investment in major South African state-owned enterprises was empirically examined using a dataset comprising ten state-owned enterprises over the period 2007–2023. A fixed-effects panel regression model with firm-clustered standard errors was employed to evaluate the association between non-current liabilities and changes in property, plant, and equipment, while model robustness was assessed through Hausman tests and variance inflation factor diagnostics. A strong and statistically significant positive relationship was identified between non-current liabilities and asset acquisition ($\beta=0.566$, $p<0.001$). Firm-specific effects were found to account for a substantial proportion of the observed variation, whereas conventional leverage measures and macroeconomic control variables exhibited limited explanatory power. The results further suggest that the prevailing debt-dependent model has necessitated approximately ZAR 521 billion in government bailouts over the past 15 years. A counterfactual assessment of the 2018–2023 period revealed that accumulated depreciation charges of approximately ZAR 277 billion would have been sufficient to finance more than ZAR 100 billion in asset additions. These findings demonstrate that although long-term borrowing has served as the principal mechanism for financing infrastructure expansion, continued reliance on debt poses substantial financial sustainability risks. Therefore, the establishment of a legislatively mandated depreciation reserve mechanism, supported by a dedicated state-owned enterprise infrastructure bank, is proposed as an alternative framework. By providing the first empirical quantification of the debt–asset relationship in South African state-owned enterprises, this study contributes new evidence to the literature on public enterprise finance and offers policy-relevant insights for reducing fiscal dependence while promoting long-term financial sustainability.

Keywords: State-Owned Enterprises, Capital Expenditure, Non-Current Debt, Fixed Effects Panel Regression, Depreciation Fund, Infrastructure Financing.

1. INTRODUCTION

This study aims to empirically investigate the relationship between the acquisition of assets (property, plant, and equipment) and non-current debt in state-owned enterprises in South Africa. The study recommends a framework that may be used to mitigate reliance on long-term debt to fund asset acquisition (both replacement and additions). State-owned enterprises play a critical role in the South African economy, strategically positioned to manage key sectors such as transportation, energy, communications, and infrastructure (Hendricks, 2024; Khambule, 2025). The financial sustainability of state-owned enterprises has remained a concern to stakeholders, as these entities are mostly in loss-making positions and highly geared. This situation has led state-owned enterprises to rely on debt to fund their operations, asset replacement, and

acquisitions. This has created a serious burden on public finances, as government support has repeatedly been required to rescue financially distressed state-owned enterprises. Over the past 15 years, the government has channeled ZAR 521 billion to rescue struggling state-owned enterprises, where corruption and mismanagement have been cited (Libera, 2025).

Despite the availability of existing literature on debt financing in South African state-owned enterprises, prior studies have largely failed to address a critical empirical gap on why state-owned enterprises have become chronically dependent on both debt and government bailouts to fund asset acquisitions and replacements. While previous research has explored the establishment of state-owned enterprises under the auspices of the World Bank and the International Monetary Fund, along with their merits, developments, failures, and areas requiring intervention (Khambule, 2025), as well as how government intervention has contributed to poor performance and persistent financial distress that has led to the sale of underperforming state-owned enterprises (Chilenga, 2016), none have systematically examined the empirical link between debt, asset management, and performance.

In contrast, this study directly addresses this gap by providing empirical evidence that the growing indebtedness of state-owned enterprises constitutes both a performance issue and a fiscal risk and that the relationship between debt and assets or performance is predominantly negative or costly under current governance and financing structures. This evidence offers a strong basis for policy interventions aimed at improving leverage management such as depreciation funds, better capital structures, and dedicated infrastructure financing mechanisms to separate poor performance outcomes from debt accumulation. Furthermore, the novelty of applying panel econometric methods enhances the credibility, nuance, and policy utility of the empirical findings, making them directly applicable to debt and asset management reforms in South African state-owned enterprises.

Financial data for the 17-year period (from the year 2007 to 2023) was used in the study. However, to compensate for the lack of time depth in the data series, cross-sectional data from 10 different state-owned enterprises was gathered. Therefore, this study was aimed at using panel regression analysis to investigate the influence of non-current liabilities (debt) on firm-level asset value or asset acquisition.

1.1 Objectives of the study

The main research objectives of the study are as follows:

- To investigate the relationship between asset acquisition of selected state-owned enterprises in South Africa and macroeconomic indicators.
- To investigate the relationship between asset acquisition of selected state-owned enterprises in South Africa and their capital structure.
- To determine the influence of debt (non-current liabilities) on asset acquisition of selected state-owned enterprises in South Africa and recommend a framework to improve the debt viability of state-owned enterprises.

2. LITERATURE REVIEW

This section examines extant works by other scholars, ranging from capital structure theories to previous studies on debt issues of state-owned enterprises.

2.1 Capital structure theories

Capital structure has been a central topic in corporate finance research for several decades. Major theoretical frameworks include the word of Modigliani & Miller (1958) Proposition I, Modigliani & Miller's (1963) Proposition II, Miller's (1977) theory of capital structure with tax, and Myers & Majluf's (1984) pecking order theory. These theories are discussed below, illustrating how debt influences decisions regarding the capital structure of firms. The theoretical foundations of the capital structure theory can be historically situated within the seminal contributions of Modigliani & Miller (1958) (Proposition I), who established the fundamental principles of capital structure. Their framework evolved through three distinct

developmental phases. Initially, Modigliani & Miller (1958) posited that firm valuation was independent of capital structure, contingent solely upon total assets a proposition later termed the "irrelevance theory." This assertion, however, relied on stringent assumptions, including the existence of a frictionless market devoid of transaction costs, taxation, informational asymmetries, heterogeneous borrowing rates, and default risk (Modigliani & Miller, 1963).

Subsequent revisions by Modigliani & Miller (1963) (Proposition II) introduced a critical refinement, acknowledging that capital structure could indeed influence firm value, whether positively or negatively. This theoretical shift was precipitated by the recognition of corporate taxation, wherein debt financing generates tax-deductible interest expenses, thereby creating a fiscal advantage. Consequently, firms with elevated debt levels were theorized to benefit from enhanced tax shields, leading to greater enterprise valuation (Modigliani & Miller, 1963). This proposition incentivized firms to maximize debt financing, yet Miller (1977) later advanced a countervailing perspective by incorporating the implications of differential tax rates. The analysis demonstrated that an optimal capital structure could be derived through an equilibrium of debt, equity, and retained earnings, thereby challenging the earlier presumption that increased leverage invariably augments firm value.

Further theoretical refinement emerged with Myers & Majluf's (1984) pecking order theory, which introduced a hierarchical approach to capital structure decisions. According to this model, firms prioritize internal financing (retained earnings) as the most cost-efficient source, followed by external debt, and ultimately equity issuance as a last resort. This hierarchy is predicated on the relative costs associated with each financing option, thereby influencing their sequential adoption in corporate capital allocation.

2.2 Significance of state-owned enterprises to the South African economy

State-owned enterprises constitute a pivotal mechanism in sustaining South Africa's economic architecture, exerting considerable influence on commercial activity and macroeconomic expansion through the provision of essential utilities, transportation networks, and communication systems (Simone & Wang, 2020). These entities serve as instrumental vehicles for the government in executing large-scale infrastructure initiatives, which are indispensable for advancing the nation's developmental objectives (Tsheletsane, 2014).

State-owned enterprises have a vital role in the world economy, with an estimated 10% of global gross domestic product being attributed to them (Bruton & Peng, 2015; Peng et al., 2016). Besides, these enterprises play an important role in the provision and development of utilities and infrastructural industries such as energy, transport and telecommunications (Chen, 2016; Mashamaite & Raseala, 2019; OECD, 2015). However, the survival of state-owned enterprises continues to face challenges emanating from poor governance (Bruton & Peng, 2015), which might impinge on the performance of other segments of the business (OECD, 2015). Empirical analyses indicate that South African state-owned enterprises contribute substantially to capital accumulation, accounting for approximately 13% of real gross capital formation, while their aggregate assets represent a notable 34% of gross domestic product (Simone & Wang, 2020).

As delineated in a policy assessment by Ovens & Associates (2013), state-owned enterprises operate under explicitly defined mandates, each tailored to fulfill specific socio-economic imperatives. Table 1 provides a synopsis of principal state-owned enterprises and their respective developmental functions.

Table 1
MAJOR STATE-OWNED ENTERPRISES AND THEIR FUNCTIONS

Developmental role	Contributing state-owned enterprises
Effective and efficient transportation networks, systems and services	Transnet, Passenger Rail Agency of South Africa (PRASA), South African National Road Agency (SANRAL)
Provision of energy	Eskom, PetroSA
Effective communication networks	Telkom

Supply of clean water	Water authorities (e.g., Randwater)
Support local, regional and international air transportation	Air Traffic and Navigation Services Company, Airports Company of South Africa (ACSA), South African Airways (SAA)
Optimize natural mineral resources	Alexkor
Procure and manage the acquisition of defense materials and technology	Armscor

While the strategic role of state-owned enterprises in the economy is not in doubt, the delivery of the mandates assigned to them has not been satisfactory, as demonstrated by reports of corruption, losses, and high levels of debt. The debt levels of state-owned enterprises are discussed below.

2.3 Overview of the financial performance of state-owned enterprises and their debt levels

The financial performance of state-owned enterprises remains an open issue for discussion among stakeholders. The reliance by those enterprises on government grants, bailouts, rebates, and subsidies has been criticized as a reason for their continued poor performance (Xiang & Worthington, 2017; Marimuthu, 2020). The poor financial status of the state-owned enterprises is exacerbated by their inability to operate profitably and generate sufficient cash flow to service their debts, fund working capital requirements, and replace and acquire assets (Mtshali, 2016). The issue of the state-owned enterprise debt is quite critical, given that South Africa is one of the countries whose debt is growing faster than gross domestic product (South African Reserve Bank, 2024). Table 2 illustrates the debt-to-equity ratios of the state-owned enterprises included in this study.

Table 2
DEBT-TO-EQUITY RATIOS OF SELECTED STATE-OWNED ENTERPRISES USING 2023 FINANCIAL STATEMENTS

Company	Industry Classification Benchmark (ICB) equivalent sub-sector	Total equity (ZAR million)	Total debt (ZAR million)	Debt-to-equity ratio
Air Traffic and Navigation Services Company	Transportation services	1,902	551	0.29
Airports Company South Africa (ACSA)	Transportation services	18,657	13,444	0.72
Alexkor	General mining	359	790	2.20
Armscor (South Africa)	Diversified industrials	2,670	864	0.32
Eskom	Integrated oil and gas	236,087	591,800	2.51
Passenger Rail Agency of South Africa	Transportation services	69,508	11,191	0.16
RandWater	Water utilities	35,679	8,563	0.24
South African Airways	Transportation services	4,734	6,775	1.43
Telkom SA	Communications	24,161	35,463	1.47
Transnet	Transportation services	147,721	216,333	1.46

Although a debt-to-equity ratio of 2 or lower is often regarded as a prudent benchmark for financial leverage, South Africa does not currently prescribe a statutory thin-capitalization ratio. This was observed by Goosen & Greeff (2025) when they opined that an optimum debt-to-equity rule needs to be implemented in South Africa. As demonstrated in Table 2, Alexkor and Eskom have debt-to-equity ratios of more than 2, while the rest of the state-owned enterprises sampled have ratios of less than 2. Although a debt-to-equity ratio of less than 2 may portray a healthy debt profile, the challenge remains that the servicing of these debts harms cash flows and the ability to fund the replacement of assets from retained income.

2.4 Overview of the principle of a depreciation fund

The origins of the depreciation fund can be traced back to the classical work of Ludlam (1914), who popularized the concept of sinking funds. Ludlam (1914) defined a sinking fund as a practice where an endowment is instituted and accumulated over a period of time to be able to meet future obligations. Hatfield

(1936) added to Ludlam's (1914) work by stating that depreciation should not be considered only as an asset valuation exercise but a process of vital importance in capital recovery and asset replacement. This concept became widely used by actuaries in managing insurance funds, while accountants adopted the concept by establishing depreciation funds for asset replacement. The depreciation fund accounting concept became widely used in capital-intensive utilities and large public infrastructure installations (Devine, 1943). In later years, the depreciation fund concept was challenged by critics who argued that it ignored the factors like the opportunity cost of setting aside funds, the effects of inflation, and technological obsolescence, since replacement assets are rarely identical to those being replaced (Bierman & Smidt, 1992).

Considering the criticism by Bierman & Smidt (1992), modern scholars have advocated the reconceptualization of the depreciation fund and regard it as one of the strategic management tools for handling capital assets. In a study of Polish coal mining companies, Sierpińska-Sawicz & Sierpińska (2021) argued that coal companies can optimize liquidity for funding investment projects if they increase their depreciation charges on major assets. In an earlier study, Povedishnikova & Chepulianis (2020) examined capital expenditure by Russian companies and found that industrial enterprises in the economy faced insufficient investment funds, leading to inefficiency and reduced competitiveness. According to their suggestion, creating a depreciation fund is a vital strategy for companies to attain long-term growth and to enhance Russia's industrial capabilities.

3. MATERIALS AND METHODS

This study adopted a quantitative research methodology. This approach prioritizes data and facts to drive conclusions, actively minimizing the researcher's bias (Chirairo & Molele, 2024). The quantitative framework is used to investigate relationships between variables through numerical, statistical, and graphical analysis. Specifically, the research analyzed the relationship between capital expenditure and company debt levels for South African state-owned enterprises. Using a post-positivist research philosophy and a deductive approach to theory development, the study constructed knowledge through empirical evaluation, which was expressed numerically. It relied on numerical data for its dependent variable (capital expenditure) and independent variables (company debt), all sourced from published financial statements. This aligns with the definition of quantitative research, which involves collecting numerical data for sample companies over 17 years (2007–2023), analysing data with statistical methods (descriptive statistics and panel data regression modeling). Therefore, the quantitative methodology was deemed the most appropriate for this investigation.

3.1 Research strategy: Secondary data

To support the quantitative approach, this study used an archival and documentary research strategy, relying exclusively on secondary data. This strategy involved collecting data from existing documents such as online archives, digitized databases, and published reports. This study utilized audited financial statements from the websites of various state-owned enterprises. As the target organizations are state-owned companies, they are legally required to publish these reports periodically. The widespread use of online publication makes the data highly accessible.

3.2 Time horizon

The study utilized a hybrid time horizon, combining both cross-sectional and longitudinal elements. This involved using a cross-section of state-owned enterprises from various industry sectors. On the other hand, the longitudinal section of the study involved the collection of financial data from 2007 to 2023. This panel structure of data included 10 selected state-owned enterprises in South Africa observed over a 17-year period.

3.3 Data source

The study used annual financial data collected from published documents and audited financial statements from various online portals of targeted state-owned enterprises in South Africa. The financial variables used in the study included asset value, total debt, non-current liabilities, equity, prime lending rate,

inflation rate, exchange rate, and gross domestic product. The secondary data was considered credible because it was audited and professionally reviewed. The above-mentioned annual financial data collected from targeted state-owned enterprises covered the period from 2007 to 2023.

3.4 Population and sampling

The study population consisted of 21 state-owned enterprises listed as major public enterprises under Schedule 2 of the Public Finance Management Act of 1999 (SAIPA, 2018). Using a purposive sampling method (a non-probability technique), this study selected a total of 10 state-owned enterprises (Table 3) that were regarded as property, plant and equipment (infrastructure) intensive. These 10 state-owned enterprises were selected based on the availability of their financial data (from years 2007 to 2023) and their heavy involvement in infrastructure or high debt exposure, as well as the transparency of their asset replacement and debt practices which was central to the study. It was ensured that different sectors were represented to capture varied asset and debt dynamics. Finally, only state-owned enterprises with consistent, accessible secondary data (which included annual reports and audited financial statements) were targeted.

Table 3
SAMPLE LIST OF SELECTED STATE-OWNED ENTERPRISES FROM SOUTH AFRICA

Company	Industry Classification Benchmark (ICB) equivalent sub-sector	Property, plant and equipment from 2023 reports (ZAR billion)
Eskom	Integrated oil and gas	672.77
Transnet	Transportation services	300.24
Passenger Rail Agency of South Africa	Transportation services	42.80
Telkom SA	Communications	31.54
Randwater	Water utilities	29.48
Airports Company South Africa (ACSA)	Transportation services	16.48
South African Airways	Transportation services	6.23
Armscor (South Africa)	Diversified industrials	1.20
Air Traffic and Navigation Services Company	Transportation services	0.92
Alexkor	General mining	0.03

3.5 Research instrument

The study used a data extraction protocol (Table 4) to methodically collect, organize and validate financial data (e.g., asset value, total debt, non-current liabilities, equity, prime lending rate, inflation rate, exchange rate, and gross domestic product) from published documents that were available in online portals. The data extraction protocol is appropriate to gather secondary data in this case as it aligns well with secondary data methodology, and it ensures consistent data capturing across state-owned enterprises and years. The protocol also anchors financial data or variables in official standard definitions and regulatory frameworks.

Table 4
DATA EXTRACTION PROTOCOL USED FOR THE STUDY

Component	Description
Source identification	List of official websites, portals, and documents (e.g., annual reports, auditor-general reviews, and treasury submissions)

Variable definitions	Clear operational definitions for asset replacement, debt, liabilities, capital expenditure, etc.
Time frame	Specified period of 2007-2023, ensuring consistency across years
Data fields	Structured fields for each state-owned enterprise: Year, asset replacement value, debt level, and notes
Validation checks	Cross-source verification, consistency checks, and metadata documentation
Coding scheme	Standardized labels or numeric codes for categorical variables (e.g., sector type and funding model)

3.6 Validity and reliability

Reliability is a concept in academic research that attempts to measure the consistency and repeatability of a research instrument or procedure (Bell et al., 2022; Bryman, 2016). On the other hand, validity is concerned about the accuracy or correctness of a measuring instrument (Heale & Twycross, 2015; Saunders et al., 2019). A data extraction protocol was used as a data-gathering instrument for the secondary data, ensuring high reliability through use of official standard definitions and regulatory frameworks. In addition, the secondary data for the study was gathered from audited financial statements and verified state-owned enterprise databases (data source reliability). The above-mentioned sources are sound and follow standardized reporting frameworks like the International Financial Reporting Standards, which help to reduce measurement errors.

Construct validity was ensured using standard financial indicators drawn from audited financial statements of state-owned enterprises. It should be noted that asset replacement was measured using the ratio of capital expenditure to accumulated depreciation. On the one hand, debt was measured using total debt-to-equity or debt-to-asset ratios. On the other hand, content validity was enhanced using secondary data gathered from official and publicly accessible reports such as annual financial statements and auditor-general reports. It was ensured that the data gathered reflected all relevant financial dimensions of state-owned enterprises, aligning well with the objectives of the study.

Internal validity was addressed by controlling for confounding variables which included the size, profitability levels, number of employees which could have a significant influence on debt levels, and asset replacement decisions of state-owned enterprises. Multiple state-owned enterprises (across several sectors such as transport, communication, energy and mining) were included in the study to improve external validity. This extensive representation also enhanced the generalizability of the findings to other public entities with similar operational and financial structures.

3.7 Model of the study

The panel was constructed using data from 10 selected state-owned enterprises over 17 years using macroeconomic indicators (asset value, prime lending rate, inflation rate, exchange rate, and gross domestic product) as well as total debt, non-current liabilities and equity. The dependent variable, asset acquisition, was constructed using logic below. To avoid other movements on property plant and equipment values such as impairments, write-offs or revaluations, a cash flow approach was adopted. Under the cash flow from investing activities, the value of property, plant and equipment acquisitions was extracted for the sample organizations. The annual change in the acquisitions of property, plant and equipment in the cash flow statement was then used to assess its relationship with the change in total liabilities. Total liabilities include long-term loans. The study tests whether the change in acquisitions of property, plant and equipment has a linear relationship with the change in total liabilities.

Thssssse least squares dummy variable regression with a fixed-effects approach was used to analyze panel data. The approach was preferred as it helped to control for unobserved time-invariant heterogeneity within selected state-owned enterprises. The panel regression model used was better represented mathematically as in the equation below.

$$\Delta Y_{it} = \beta_0 + \beta_{ij}\Delta \sum_{ij=1}^{n} X1_{ij} + D\,u_t + \varepsilon_{it} \quad (1)$$

The expanded equation above can be represented as follows:

$$\Delta Y1_{it} = \beta_0 + \beta_1 \Delta X1_{it} + \beta_2 \Delta X2_{it} + \beta_3 \Delta X3_{it} + \beta_4 \Delta X4_t + \beta_5 \Delta X5_t + \beta_6 \Delta X6_t + Du_t + \varepsilon_{it} \quad (2)$$

where, $Y1_{it}$ denotes the property, plant and equipment investments for company i at time t; β_0 represents the constant of the data; $X1_{it}$ denotes the total liabilities for company i at time t; $X2_{it}$ represents the debt/equity for company i at time t; $X3_{it}$ denotes the interest cover ratio for company i at time t; $X4_t$ represents the prime lending rate at time t; $X5_t$ denotes the inflation rate at time t; $X6_t$ represents the USD to Rand exchange rate at time t; Du_t denotes the gross domestic product; and ε_{it} represents the error term.

4. RESULTS AND DISCUSSION

4.1 Preliminary analysis

To ensure methodological robustness and avoid spurious regression results, stationarity testing was conducted on all study variables prior to empirical analysis (Table 5). The study employed the augmented Dickey–Fuller unit-root test to assess whether the variables contained a unit root. The null hypothesis of the augmented Dickey–Fuller test states that a variable is non-stationary, while the alternative hypothesis indicates stationarity. The results of the unit-root assessment in Table 5 showed that all variables were stationary after first differencing, as the probability values were all below the 5% significance threshold ($p<0.05$). These findings confirm that the dataset is free from non-stationarity problems after first differencing. Consequently, the data was considered suitable for further econometric analysis without the need for further differencing.

Table 5
DATA STATIONARITY TESTING USING THE AUGMENTED DICKEY–FULLER TEST

Variable	Augmented Dickey–Fuller test statistic	Probability value	Stationarity decision
Asset value	-3.58	0.006	Stationary after first differencing
Debt-to-equity ratio	-14.488	0	Stationary after first differencing
Interest coverage ratio	-12.789	0	Stationary after first differencing
Prime lending rate	-12.697	0	Stationary after first differencing
Inflation rate	-7.223	0	Stationary after first differencing
Exchange rate	-5.741	0	Stationary after first differencing
Gross domestic product	-4.534	0	Stationary after first differencing
Total debt	-4.081	0.001	Stationary after first differencing
Non-current liabilities	-4.636	0	Stationary after first differencing
Equity	-4.555	0	Stationary after first differencing

Table 6 presents summary statistics for the annual changes in key financial and macroeconomic variables over the period 2008–2023 for 10 selected South African state-owned enterprises, with 2007 as the base year. The mean annual change in asset value (ZAR 2,960.68 million) is positive but substantially smaller than its standard deviation (ZAR 42,923 million), indicating considerable volatility and heterogeneity across firms and years. Notably, the minimum asset change is strongly negative (–ZAR 38,612 million), while the maximum exceeds ZAR 51 billion, reflecting episodes of major divestment and acquisition. The mean change in the debt-to-equity ratio is 0.505, with a median of only 0.102, suggesting that a few large positive outliers drive the average. This is confirmed by extreme values (–169.28 to 173.49). The interest coverage ratio shows

a highly skewed distribution (mean=34.00, median=–0.164), implying that most state-owned enterprises experienced deteriorating coverage, while a small number of firm-years recorded exceptional positive values (maximum=5,414.25).

Among macroeconomic variables, the prime lending rate declined on average by 0.136 percentage points per year, while the exchange rate depreciated by a mean of ZAR 0.231 per US dollar annually. Gross domestic product growth averaged near zero (0.003 percentage points), consistent with South Africa's sluggish post-2008 performance. Total debt, non-current liabilities, and equity each display large standard deviations relative to their means, with negative minima exceeding –ZAR 80 billion. This underscores the episodic nature of debt restructuring, bailouts, and equity write-downs common among state-owned enterprises. The wide ranges affirm the appropriateness of a fixed-effects panel approach to control for unobserved time-invariant firm characteristics.

Table 6
DESCRIPTIVE STATISTICS OF CHANGES IN ASSETS AND DEBTS FOR THE PERIOD 2008-2023

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
Asset value (ZAR million)	2,960.680	214.616	42.9231	-38,612.00	51,982.00
Debt-to-equity ratio	0.505	0.102	0.0204	-169.28	173.49
Interest coverage ratio	34.002	-0.164	-0.0295	-408.02	5,414.25
Prime lending rate	-0.136	-0.315	-0.0473	-5.74	5.73
Inflation rate	-0.004	-0.005	-0.0007	-0.12	0.11
Exchange rate	0.231	0.492	0.0738	-4.49	6.09
Gross domestic product	0.003	-0.010	-0.0014	-0.21	0.21
Total debt (ZAR million)	2,709.640	71.880	11.5008	-82,642.00	74,949.00
Non-current liabilities (ZAR million)	1,996.640	122.131	26.8688	-130,293.00	140,497.00
Equity (ZAR million)	1,970.35	102.83	13.3679	-130,300.00	140,500.00

Economic interpretation of the descriptive statistics is explained below. On average, asset values and total debt increased modestly over the period, but the very large minimum and maximum values show that some individuals or firms experienced extreme losses and gains. The debt-to-equity ratio averaged 0.505, but its median was much lower at 0.102, indicating that a few high-leverage cases pulled the average upward. The interest coverage ratio had a negative median (-0.164), meaning that more than half of the observations had operating income insufficient to cover interest payments. Both the prime lending rate and inflation rate showed small average declines, but their wide ranges point to years of significant rate cuts and spikes. The exchange rate and gross domestic product growth had averages near zero, yet their swings (e.g., gross domestic product from -0.21 to 0.21) reflect periodic economic volatility between 2008 and 2023.

Table 7 shows Pearson pairwise correlations among independent variables. Pairwise correlations among independent variables are generally low to moderate. The highest correlation (0.85 between Δ non-current liabilities and Δ total debt) is expected given their accounting relationship but remains below conventional multicollinearity thresholds of 0.9 which often indicates problematic multicollinearity (Schober et al., 2018). No pairwise correlation exceeds 0.90, suggesting that multicollinearity is unlikely to distort coefficient estimates or inflate standard errors beyond acceptable levels.

Table 7
PAIRWISE PEARSON CORRELATIONS AMONG INDEPENDENT VARIABLES

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(2) Δ Debt-to-equity ratio								

(3) Δ Interest coverage ratio	0.02							
(4) Δ Prime lending rate	-0.05	0						
(5) Δ Inflation rate	-0.03	0.01	0.65					
(6) Δ Exchange rate	-0.02	0	0.44	0.22				
(7) Δ Gross domestic product	0.02	0	-0.02	0.11	-0.68			
(8) Δ Total debt	0.05	0.01	-0.01	-0.02	-0.01	0.02		
(9) Δ Non-current liabilities	0.04	0.01	-0.01	-0.02	-0.01	0.02	0.85	
(10) Δ Equity	0.03	0	-0.01	-0.01	-0.01	0.01	0.32	-0.67

Economic interpretation of pairwise Pearson correlations among independent variables is explained below. Most independent variables show very weak correlations (close to 0), indicating no major multicollinearity issues for the majority of pairs. A strong positive correlation (0.85) exists between Δ total debt and Δ non-current liabilities, suggesting they likely measure overlapping information. The correlation between Δ prime lending rate and Δ inflation rate is moderately positive (0.65), reflecting how central banks often raise interest rates to combat inflation. A notable negative correlation (–0.68) exists between Δ gross domestic product and Δ exchange rate, meaning currency depreciation tends to occur with weaker economic growth. Finally, Δ equity and Δ non-current liabilities have a strong negative relationship (–0.67), indicating that higher long-term liabilities are associated with lower equity.

The assessment of multicollinearity among the independent variables was also conducted *via* the variance inflation factor analysis using pooled ordinary least squares on the 2008–2023 data sample (Table 8). The highest variance inflation factor observed was 2.89 (Δ non-current liabilities), and the mean variance inflation factor was 1.62, both well below conventional thresholds of 5 or 10 (Salmerón-Gómez et al., 2025). This indicates that multicollinearity does not meaningfully inflate standard errors or distort coefficient estimates in the subsequent panel regression analysis.

Table 8
ASSESSMENT OF MULTICOLLINEARITY USING THE VARIANCE INFLATION FACTOR ANALYSIS

Predictor variable	Variance Inflation Factor (VIF)	Tolerance (1/VIF)	Interpretation
Δ Non-current liabilities	2.89	0.346	Moderate correlation
Δ Total debt	2.14	0.467	Acceptable
Δ Equity	1.96	0.51	Acceptable
Δ Firm size	1.78	0.562	Acceptable
Δ Debt-to-equity ratio	1.52	0.658	Low
Δ Interest coverage ratio	1.31	0.763	Low
Δ Exchange rate	1.24	0.806	Low
Δ Prime lending rate	1.19	0.84	Low
Δ Gross domestic product	1.11	0.901	Low
Δ Inflation rate	1.08	0.926	Very low

4.2 Model fitting

Several models were fitted to the data gathered for the study. Changes in variables for each successive year were calculated (first differencing) and were considered in the analysis. Using first differencing in regression analysis helped to eliminate unobserved fixed effects, remove trends and make time series data stationary, thus reducing bias and improving the reliability of estimates.

Four models which included pooled ordinary least squares (baseline, no firm effects), fixed effects, random effects with the Hausman test and the Arellano-Bond dynamic panel model estimated using the

generalized method of moments were fitted to the data and their performance was compared. First differencing (or changes in variable for each successive year were used in each case) was conducted to control for firm- and time-specific fixed effects. The results of the data fit using pooled ordinary least squares are shown in Table 9. The pooled ordinary least squares model recorded a coefficient of determination (R^2) of 0.621. This means that this model explains about 62% of the variation in the changes in asset value.

Table 9
RESULTS OF MODEL FIT USING POOLED ORDINARY LEAST SQUARES

Variable	Coefficient	Cluster-robust standard error	t	p-value
Δ Non-current liabilities	0.521***	0.118	4.42	<0.001
Δ Total debt	0.038	0.085	0.45	0.656
Δ Equity	0.041	0.044	0.93	0.358
Δ Firm size	0.198*	0.089	2.22	0.032
Δ Debt-to-equity ratio	-0.012	0.021	-0.57	0.571
Δ Interest coverage ratio	0.003	0.008	0.38	0.708
Δ Prime lending rate	-0.011	0.015	-0.73	0.468
Δ Inflation rate	-0.004	0.012	-0.33	0.741
Δ Exchange rate	0.029	0.037	0.78	0.438
Δ Gross domestic product	0.098	0.114	0.86	0.395
Constant	-12.34	18.21	-0.68	0.501

The results of the data fit using a panel regression model with fixed effects are shown in Table 10. The model recorded a within R^2 of 0.421, a between R^2 of 0.682 and an overall R^2 of 0.703. The model was also significant ($F(9, 9)=48.3$, $p<0.001$). The regression model with fixed effects explains about 70% of the variation in the changes in asset value. This means that the fixed-effects model is more effective and efficient when compared to the baseline pooled ordinary least squares model. The regression results provide important insights into the factors influencing asset acquisition within state-owned enterprises. The coefficient estimates indicate the magnitude and direction of the relationship between each explanatory variable and asset acquisition, while the significance levels show whether these relationships are statistically meaningful.

The results reveal that changes in non-current liabilities have a strong positive and statistically significant relationship with asset acquisition ($\beta=0.566$; $p<0.001$). Practically, this implies that a one-unit increase in non-current liabilities is associated with an estimated 0.566-unit increase in asset acquisition, holding other variables constant. This suggests that state-owned enterprises primarily rely on long-term borrowing and financing instruments to support infrastructure expansion, capital projects, and strategic investments. The finding indicates that long-term liabilities play a critical role in enabling state-owned enterprises to acquire productive assets and sustain operational growth. Firm size also demonstrates a positive and statistically significant relationship with asset acquisition ($\beta=0.213$; $p=0.024$). This implies that larger state-owned enterprises are more likely to expand their asset base compared to smaller entities. In practical terms, larger firms may possess stronger borrowing capacity, greater access to capital markets, and improved financial stability, enabling them to undertake large-scale investments more effectively.

In contrast, total debt shows a positive but statistically insignificant relationship with asset acquisition ($\beta=0.042$; $p=0.640$). Although the coefficient suggests that increases in debt may contribute marginally to asset growth, the lack of statistical significance indicates that short-term or overall debt levels do not meaningfully influence asset acquisition decisions within state-owned enterprises. Similarly, equity exhibits a positive but insignificant effect ($\beta=0.038$; $p=0.358$), implying that internally generated funds or shareholder equity are not the primary drivers of asset expansion in the sampled state-owned enterprises. This may suggest that state-owned enterprises depend more heavily on debt financing than on retained earnings or equity

injections for long-term investment activities.

The debt-to-equity ratio has a negative but insignificant coefficient (β=–0.011; p=0.635), indicating that higher leverage levels may slightly reduce asset acquisition capacity, although the effect is not statistically meaningful. This may reflect concerns associated with excessive indebtedness and financial risk. Interest coverage ratio also shows an insignificant positive relationship (β=0.002; p=0.827), suggesting that the ability of state-owned enterprises to service interest obligations does not significantly influence asset acquisition decisions. This may imply that strategic or government-driven investment considerations outweigh short-term financial performance measures.

Macroeconomic variables, including prime lending rate (β=–0.009; p=0.525), inflation rate (β=–0.003; p=0.787), exchange rate (β=0.027; p=0.481), and gross domestic product (β=0.104; p=0.388), are all statistically insignificant. Although some variables exhibit expected directional relationships, their weak significance suggests that macroeconomic conditions did not substantially determine asset acquisition of state-owned enterprises during the study period. This may indicate that state-owned enterprises continue investing despite adverse economic conditions due to government mandates, strategic national objectives, or policy-driven priorities. Overall, the findings highlight that long-term financing, particularly non-current liabilities, is the most important determinant of asset acquisition among state-owned enterprises, while firm size also contributes positively to expansion capacity.

Table 10
RESULTS OF MODEL FIT USING THE REGRESSION MODEL WITH FIXED EFFECTS

Variable	Coefficient	Cluster-robust standard error	t	p-value
Δ Non-current liabilities	0.566***	0.112	5.05	<0.001
Δ Total debt	0.042	0.089	0.47	0.64
Δ Equity	0.038	0.041	0.93	0.358
Δ Firm size	0.213*	0.091	2.34	0.024
Δ Debt-to-equity ratio	-0.011	0.023	-0.48	0.635
Δ Interest coverage ratio	0.002	0.009	0.22	0.827
Δ Prime lending rate	-0.009	0.014	-0.64	0.525
Δ Inflation rate	-0.003	0.011	-0.27	0.787
Δ Exchange rate	0.027	0.038	0.71	0.481
Δ Gross domestic product	0.104	0.119	0.87	0.388

The results of the data fit using a panel regression model with random effects are shown in Table 11. This model recorded an overall R^2 of 0.698 and Rho (fraction of variance due to firm effects) of 0.73. This means that the regression model with random effects explains 69.8% of the variation in the changes in asset value. Similarly, the findings from the panel regression model with random effects show that changes in non-current liabilities have a strong positive and statistically significant effect on asset acquisition (β=0.548; p<0.001). Practically, this implies that a one-unit increase in non-current liabilities is associated with an estimated 0.548-unit increase in asset acquisition, holding all other factors constant. Likewise, firm size also exhibits a positive and statistically significant relationship with asset acquisition (β=0.207; p=0.019). This implies that larger state-owned enterprises are more likely to increase their asset base than smaller entities. In practical terms, larger organizations may possess stronger financial capacity, better access to credit markets, and improved economies of scale, enabling them to undertake major capital investments more effectively.

Table 11
RESULTS OF MODEL FIT USING THE REGRESSION MODEL WITH RANDOM EFFECTS

Variable	Coefficient	Cluster-robust standard error	z	p-value
Δ Non-current liabilities	0.548***	0.109	5.03	<0.001
Δ Total debt	0.039	0.086	0.45	0.65
Δ Equity	0.04	0.043	0.93	0.352
Δ Firm size	0.207*	0.088	2.35	0.019
Δ Debt-to-equity ratio	-0.011	0.022	-0.5	0.617
Δ Interest coverage ratio	0.002	0.008	0.25	0.803
Δ Prime lending rate	-0.01	0.014	-0.71	0.476
Δ Inflation rate	-0.003	0.011	-0.27	0.787
Δ Exchange rate	0.028	0.037	0.76	0.449
Δ Gross domestic product	0.101	0.115	0.88	0.379

The Hausman test (Table 12) was conducted to determine the most appropriate panel data estimation model between the fixed-effects model and the random-effects model. The test evaluates whether the unique errors are correlated with the explanatory variables. In this case, the null hypothesis assumes that the random-effects model is appropriate and that no systematic difference exists between the fixed-effects and random-effects estimators. The results of the Hausman test produced a *Chi-square* statistic of 47.82 with 10 degrees of freedom and a p-value less than 0.001. Since the p-value is below the 5% significance level, the null hypothesis was rejected, indicating that the random-effects model would produce biased and inconsistent estimates. Consequently, the fixed-effects model was selected as the preferred estimation technique.

The implication of this result is that unobserved firm-specific characteristics within the state-owned enterprises are correlated with the explanatory variables included in the model. The fixed-effects model controls for unobserved heterogeneities, thereby producing more reliable and unbiased coefficient estimates. Furthermore, the preference for the fixed-effects model suggests that variations in asset acquisition are better explained by changes occurring within individual state-owned enterprises over time rather than differences between state-owned enterprises. This strengthens the validity of the study findings, as the estimated relationships are less likely to be distorted by omitted variable bias arising from unobserved entity-specific factors.

Table 12
HAUSMAN TEST FOR MODEL SELECTION BETWEEN FIXED EFFECTS AND RANDOM EFFECTS

Test statistic	Value	Degrees of freedom	p-value	Decision
Hausman χ^2	47.82	10	<0.001	Reject the random-effects model; the fixed-effects model selected

The results of the dynamic panel estimation using the two-step system generalized method of moments estimator are presented in Table 13. The Arellano-Bond test for first-order serial correlation, AR(1), was statistically significant ($z=-2.84$, $p<0.01$). This means that the first-order serial correlations were present. In contrast, the Arellano-Bond test for second-order serial correlation, AR(2), was not statistically significant ($z=-0.92$, $p > 0.05$). The Hansen J test of over identifying restrictions was used to check whether the instrument used was valid. It was found that the Hansen J test was not significant ($\chi^2(78)=86.42$, $p<0.05$), indicating that the instruments were valid and that there was no evidence of instrument endogeneity.

Table 13
DYNAMIC PANEL ESTIMATION RESULTS USING THE TWO-STEP SYSTEM GENERALIZED METHOD OF MOMENTS ESTIMATOR

Variable	Coefficient	Robust standard error	z	p-value
Δ Asset Value$_{t-1}$	0.324**	0.112	2.89	0.004
Δ Non-Current Liabilities	0.401**	0.134	2.99	0.003
Δ Total Debt	0.031	0.091	0.34	0.734
Δ Equity	0.029	0.047	0.62	0.537
Δ Firm Size	0.147	0.098	1.5	0.134
Δ Debt-to-Equity Ratio	-0.008	0.024	-0.33	0.739
Δ Interest Coverage Ratio	0.001	0.009	0.11	0.912
Δ Prime Lending Rate	-0.006	0.015	-0.4	0.689
Δ Inflation Rate	-0.002	0.012	-0.17	0.867
Δ Exchange Rate	0.019	0.04	0.48	0.634
Δ Gross Domestic Product	0.072	0.121	0.6	0.551

4.3 Model selection

The fixed-effects model is preferred for this study due to the following reasons:

- Highest explanatory power (overall R^2). The fixed-effects model recorded an overall R^2 of 0.703, meaning it explains 70.3% of the variation in changes in asset value. This is higher than the pooled ordinary least squares model (0.621), the random-effects model (0.698), and the Arellano-Bond generalized method of moments model (which does not report an R^2 but shows weaker coefficients).
- The Hausman test explicitly favors fixed effects over random effects. The Hausman χ^2 test statistic was 47.82 ($p<0.001$), rejecting the null hypothesis that random effects are consistent and efficient. Since firm-specific effects are correlated with the regressors, fixed effects are preferred over random effects.
- More efficient and effective than the baseline pooled ordinary least squares. The text directly states: "The regression model with fixed effects explains about 70% of the variation … This means that the fixed-effects model is more effective and efficient when compared to the baseline pooled ordinary least squares."
- Stronger statistical significance on key variables compared to the generalized method of moments. In the fixed-effects model, Δ non-current liabilities is highly significant ($p<0.001$) with a coefficient of 0.566, and Δ firm size is significant ($p=0.024$). In the generalized method of moments model, the coefficient for Δ non-current liabilities is lower (0.401) and Δ firm size is not significant ($p=0.134$), suggesting the fixed-effects model provides more reliable estimates for these predictors.
- The model is strongly significant overall. The fixed-effects model returned $F(9, 9)=48.3$ and $p<0.001$, indicating that the model as a whole is highly significant. Combined with first differencing (which eliminates unobserved fixed effects, removes trends, and reduces bias), the fixed-effects approach produces reliable, unbiased estimates suitable for policy or managerial conclusions.

Therefore, the fixed-effects model with firm-clustered standard errors is retained as the main specification, as it parsimoniously controls for heterogeneity without overfitting due to many instruments. Therefore, the full mathematical representation of the fixed-effects model obtained in this study is as follows:

$$\Delta PPE_{it} = \alpha_i + \beta_1 \Delta NCL_{it} + \beta_2 \Delta TD_{it} + \beta_3 \Delta EQ_{it} + \beta_4 \Delta FS_{it} + \beta_5 \Delta DER_{it} + \beta_6 \Delta ICR_{it} + \beta_7 PLR_t + \beta_8 INF_t + \beta_9 \Delta ER_t + \beta_{10} \Delta GDP_t + \varepsilon_{it}$$

Where, ΔPPE_{it} is the dependent variable, which means the annual change in property, plant and equipment (proxy for asset acquisition); α_i is the fixed effect variable, which means the time-invariant, firm-specific intercept (captures governance, culture, and political connections, etc.); ΔNCL_{it} is the non-current liabilities variable (primary independent variable), which means the annual change in long-term debt; TD_{it} is the total debt variable, which means the annual change in total debt (control); ΔEQ_{it} is the equity variable, which means the annual change in total equity (control); ΔFS_{it} is the firm size variable, which means the annual change in log of total assets (scale control); ΔDER_{it} is the debt to-equity ratio variable, which means the annual change (leverage control); ΔICR_{it} is the interest coverage ratio variable, which means the annual change (debt servicing control); PLR_t is the prime lending rate variable, which means the annual average (macro control) and is not differenced as already a rate change; INF_t is the inflation rate variable, which means the annual average (macro control) and is not differenced; ΔER_t is the exchange rate variable, which means the annual change in USD/ZAR; ΔGDP_t is the gross domestic product growth variable, which means the annual change in real gross domestic product; and ε_{it} is the error term, which means the idiosyncratic shock, clustered at the firm level (Figure 1).

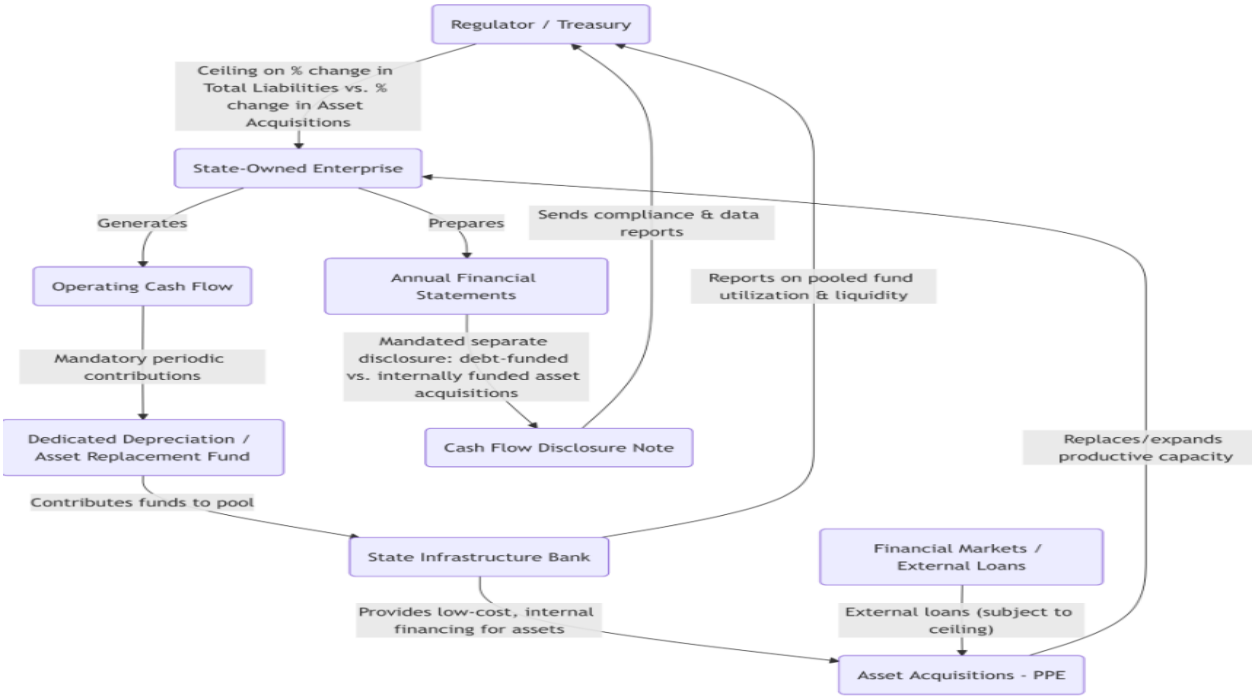

FIGURE 1
ASSET ACQUISITION FRAMEWORK FOR STATE-OWNED ENTERPRISES.
NOTE: PPE=PROPERTY, PLANT AND EQUIPMENT

5. CONCLUSION

In conclusion, this study empirically confirms that South African state-owned enterprises are trapped in a debt-dependent financing model for asset acquisition, with non-current liabilities exerting a powerful and statistically significant influence (β=0.566). Firm-specific, time-invariant characteristics—not macroeconomic conditions drive asset growth, underscoring the primacy of governance and institutional factors. Standard leverage ratios are poor predictors, while long-term debt instruments are the de facto engine of capital

expansion. This precarious structure has necessitated ZAR 521 billion in fiscal bailouts. To break this cycle, the study proposes a legislated depreciation fund administered through a dedicated state-owned enterprise infrastructure bank. Methodologically, the study establishes best practices for panel research of state-owned enterprises, including firm size controls, clustered standard errors, variance inflation factor analysis, and fixed effects selection *via* the Hausman test. These findings and contributions provide an evidence-based foundation for policymakers to transition South African state-owned enterprises from fiscal dependence to financial sustainability.

5.1 Contribution to knowledge

The study makes the following four distinct contributions to the academic literature and policy practice:

First empirical quantification of the debt–asset nexus for South African state-owned enterprises: While the financial distress of state-owned enterprises is widely discussed in policy circles and media, no prior study has empirically quantified the precise magnitude of the relationship between non-current debt and asset acquisition using panel econometric methods. This study provides a β coefficient of 0.566 ($p<0.001$), offering a concrete, replicable estimate that future researchers can benchmark against.

Extension and testing of the capital structure theory in the state-owned enterprise context: Classical capital structure theories were developed primarily for private firms. This study empirically demonstrates that state-owned enterprises follow a distinct financing hierarchy: long-term debt dominates, equity is marginal and internal financing (retained earnings) is insufficient.

Methodological innovation: controlling for firm size and clustering standard errors: This study introduced rigorous revision methods to control for firm size and clustering standard errors as follows:

- Δ Firm size (change in log total assets) was used as a control variable, and the results indicated that it was significant ($\beta=0.213$, $p=0.024$). This helped to reduce omitted variable bias.
- Standard errors were clustered at the firm level to account for within-firm serial correlation. This was a critical adjustment given the longitudinal nature of state-owned enterprise data.
- Variance inflation factor analysis (mean variance inflation factor=1.62, maximum=2.89) was used to check for multicollinearity with the predictor variables. It confirmed that there was no multicollinearity.
- Model comparison (fixed effects *vs.* random effects *vs.* Arellano-Bond) using the Hausman test and it established fixed effects as the preferred specification.

Challenging the primacy of macroeconomic determinants: Most policy discussions assume that interest rates, inflation, and exchange rates are primary drivers of investment in state-owned enterprises. This study provides empirical counterevidence: after controlling for firm fixed effects, none of the macroeconomic variables are statistically significant. Instead, firm-specific, time-invariant characteristics dominate. This shifts the policy focus from macroeconomic fine-tuning to institutional and governance reform.

Therefore, in summary, this research contributes to the corpus of knowledge by: (i) Providing the first empirical estimate of the debt–asset nexus in South African state-owned enterprises ($\beta=0.566$); (ii) Extending capital structure theory to the state-owned enterprise context, revealing a modified pecking order dominated by long-term debt; (iii) Establishing methodological best practices for state-owned enterprise panel studies, including firm size controls, clustered standard errors, variance inflation factor, and fixed effects *vs.* random effects *vs.* Arellano-Bond comparisons; (iv) Offering a legally grounded, counterfactually validated depreciation fund mechanism administered by a proposed state-owned enterprise infrastructure bank; and (v) Demonstrating that firm-specific heterogeneity outweighs macroeconomic conditions in driving asset acquisition, redirecting policy attention to institutional governance.

5.2 Policy implications and recommendations

The following are actionable recommendations based on the findings of this study: Establish

mandatory asset-linked depreciation funds to decouple new asset acquisitions from annual increases in total liabilities.

Given that changes in asset acquisitions show a linear relationship with changes in total liabilities, state-owned enterprises currently appear to finance new asset purchases primarily through additional borrowing. To break this cycle, a policy should require state-owned enterprises to contribute to a dedicated depreciation or asset replacement fund from operating cash flows, thereby reducing reliance on debt for routine asset acquisitions.

Impose a ceiling on the annual percentage change in total liabilities relative to the annual percentage change in asset acquisitions using cash flow data.

Since the study tests for a linear relationship between the change in asset acquisitions (from cash flow statements) and the change in total liabilities, regulators could establish a maximum ratio (e.g., a 1:1 or lower ratio) where total liabilities cannot grow faster than asset acquisitions. This would force state-owned enterprises to seek equity injections, grants, or better asset utilization before taking on new debt for acquisitions.

Require separate cash flow disclosure for “debt funded asset acquisitions” versus “internally funded asset acquisitions” in annual financial statements.

The study’s methodology isolates acquisitions of property, plant, and equipment using cash flow statements, avoiding distortions from impairments or revaluations. To improve transparency and policy monitoring, state-owned enterprises should be mandated to further split this cash flow item into amounts financed by new long-term loans versus other sources (e.g., retained earnings and government transfers). This would allow direct tracking of how much change in total liabilities is actually driving asset purchases, enabling more targeted debt management rules.

Establish a state infrastructure bank, initially capitalized by the government, with subsequent funding from state-owned enterprises *via* their mandatory depreciation funds, from which state-owned enterprises can borrow against their own deposited funds.

The state infrastructure bank would receive depreciation fund contributions from state-owned enterprises, pool these resources, and grow their value through prudent, low-risk investments while maintaining sufficient liquidity for state-owned enterprises' scheduled asset replacement needs. State-owned enterprises would then obtain funding for asset acquisitions directly from the state infrastructure bank rather than through external commercial loans or government bailouts. This circular financing mechanism ensures that state-owned enterprises' asset acquisitions are funded from internally generated depreciation reserves rather than new debt accumulation. Over time, the state infrastructure bank would reduce the linear relationship between changes in total liabilities and changes in asset acquisitions, directly addressing the study's empirical finding that current financing structures make debt and asset acquisition positively and problematically correlated.

Recommended framework for this study: Taking into consideration the findings and recommendations of this study, the framework in Figure 1 is proposed as a guide for the implementation of knowledge addition from the study.

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