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Article

The Role of Derivatives Use on Firms' Capital Cost and Financial Stability: Evidence from South African Listed Non-Financial Firms

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Abstract: Derivatives products have become essential in portfolio diversification, price discovery and risk hedging. Derivatives are complex instruments; their role is twofold, risk management and speculation, and their actual Impact on the underlying assets' behaviours are not well understood. Little is documented empirically on how these instruments' two-edged roles influence firms' financing decisions, firm risk exposures, and stability. Given the growing interest in using derivatives in risk management and portfolio engineering, this study examines the practical impact of derivatives usage on the underlying firm's financing policy and stability. The paper uses data from South African listed non-financial firms for the period 2000 to 2019. The study employs a dynamic panel model estimated with System Generalised Methods of Moments (GMM). The initial analysis shows that derivatives use reduces the cost of capital and increases firm stability. However, further in-depth analysis provides evidence that extensive use of derivatives increases firms' capital costs and negatively impacts financial stability. These findings imply that the risk embedded in derivatives' speculation dominates their risk management function. The results are subjected to numerous controls for robustness, including financial leverage, firm size, cashflows and asset tangibility.

Keywords: derivatives use; hedging; cost of capital; WACC; cost of equity; GMM; earnings stability

JEL Classification: G10; G32

1. Introduction

The traditional objective of a profit-oriented firm is to maximise shareholder value. Value maximisation objectives can be passively pursued through investments that generate positive Net present value (NPV) - projects that have a higher return than demanded by the providers of capital (cost of capital). The success of a firm's investment policy is heavily reliant on the cost of funding the firm can secure. The lower the financing cost, the higher the expected value from investments. The traditional sources of funding are debt and equity. Financial theory reveals that the interactions of managers, bondholders and shareholders generate frictions which induce underinvestment and overinvestment (Myers & Majluf, 1984), affecting the traditional value maximisation objective of the firm. The rapid increase in market integration of economies and equity markets leading to increased international investment and diversification driven by globalisation and the development of new information technologies has exposed firms to a multiplicity of risks exposures to domestic and international operations. The increase in risks results in shareholders and bondholders demanding a higher return on their investments and hence, an increase in financing costs and low-value generation. South Africa, rated as one of the most promising emerging markets (imf.org, 2020), has a notable

dearth of private investment, which has been pointed out as one of the reflectors of economic stagnation (Viegi & Dadam, 2018). In addition, there is a rapid increase in country risks and political and economic uncertainty, which eroded business & consumer confidence accelerating the cost of raising funds for firms and lowering investment.

Additionally, high currency volatility and inflation have further hindered economic growth. High crime levels, civil unrest, imprecise policy, and structural reforms hinder investor potential and negatively impact firm operations. The recent financial crises, pandemics such as COVID-19, and conflicts like the Russia-Ukraine conflict add a new dimension to firm and country risks. In theory, an increase in risks should compel investors to demand a higher return on invested capital. However, if this risk is properly managed, how should investors react? There is a dynamic progression in firm risk management and risk-taking. The developments and progression in risks faced by firms and economies pause questions on these risks' role in the interaction of risk management, investment and firm financing policy.

Different approaches have been developed over the years to manage the evolving risks faced by Morden firms. Among these approaches is the evolution of derivatives instruments that have been used not only as a source of risk management tools but also actively used in speculation and leverage to maximise firm value. Derivatives instruments are one of the most complex financial assets that have attracted a lot of attention in recent empirical research. The complexity of derivatives stretches from their valuation to their practical Impact on the underlying assets. The fact that derivatives are valueless on their own and drive their worth on the value of the underlying assets makes them complex instruments to properly value and understand their real Impact on the underlying asset's behaviour. It is unclear whether derivatives have become the chief contributor to the stability or volatility of the world financial systems in the literature.

The globalisation of world markets, financial asset price volatility, and advances in economic theories and technology contribute to the explosive growth and innovation of derivatives and other structured products (Allayannis et al., 2012). In 2020 the gross market value of derivatives experienced a 33% increase, mainly due to the effects of the COVID-19 Pandemic that prompted market turmoil and strong policy responses as firms engaged in active risk management. The significant difference between the notional and gross market value on traded derivatives can introduce substantial market risk and volatility. The world statistics reflect that derivatives instruments are fast-growing, and their importance and role in financial markets cannot be ignored. Considering recurring pandemics, technological advancements, climate transition & acute risks and panic about other unseen developments, the world financial markets may continue to see a rise in derivatives products to manage risks. The enormous expansion of derivatives raises many unanswered questions, explicitly relating to their influence on the economic and financial system growth, crises and stability. Despite the terror and criticism through which derivatives are ordinarily considered, these markets perform several economic functions. Sajjad et al. (2013), posit that if derivatives instruments are appropriately managed, they enhance colossal economic benefits. For instance, boosting market liquidity and mobilising the required capital for economic growth, permitting investors to unbundle and restructure numerous risks-interest rates, foreign exchange, default, and market risk facilitating international capital flows and generating extra opportunities for portfolio diversification. Little has been done in literature to analyse how derivatives affect firms cost of financing.

In literature, a substantial theoretical and empirical analysis of the drivers of the cost of capital and firm investment has appeared over the years. Still, it is never sufficient due to the evolving nature of the global economy and financial markets. The proponents of the Capital structure theory, Modigliani & Miller (1958), traditionally argued that in a perfect market, how the firm is financed does not matter; hence the cost of financing will also be irrelevant in value generation. However, market inefficiency and information asymmetry are inevitable in the real world. Considerable theory

advances have been made. Market imperfections, asymmetric information, behavioural issues, and financial market advancement from globalisation have revolutionised economic theory. In theory, the main driver of the required return demanded by shareholders is the level of risks embedded in the investment (Sharpe, 1977). An increase in risk should lead equity holders and bondholders (suppliers of funds) to demand a higher return for investments in high-risk projects.

Holman et al. (2013) And Correia et al. (2012) revealed evidence in South Africa showing that South African firms' use of derivatives for risk management is increasing. To this end, the use of derivatives to manage risk is supposed to add market value, reduce financing costs and ultimately increase shareholder wealth. The role of derivatives is twofold: a risk management tool and a speculative investment. Risk management applications should lead to a lower cost of capital, while the speculative function should lead to a higher cost of capital. This raises the question of which function, investors perceive as a dominant force. Previous studies on derivatives use worldwide mainly focused on the role of derivatives on firm investment and performance with no consideration of financing, the primary underlying factor of firm investment and value creation. The role of derivatives on firm financing remains unclear; more specifically, the Impact of derivatives on different financing choices has not been investigated. This study closes this gap by examining the Impact of the extent of derivatives use on firm financing policy. The study employed a dynamic panel data model estimated with the system GMM technique. The initial analysis indicates that using derivatives reduces capital costs and improves firms' earnings stability. However, further analysis suggests that excessive dependence on derivatives may, in fact, lead to higher capital costs and adversely affect overall stability within these firms. The findings have significant implications for the speculative nature of derivatives. When firms take on risks with the expectation of significant returns, this speculative element tends to outweigh the intended purpose of derivatives as risk management tools. Consequently, firms become more exposed to vulnerabilities as the pursuit of potential gains overshadows the core objective of mitigating risks. This research underscores the importance of adopting a balanced approach when integrating derivatives into business practices. Understanding the delicate equilibrium between speculation and risk management is of utmost significance for firms looking to harness the benefits of derivatives while safeguarding their overall financial well-being. The rest of the study is organised as follows; section 2 presents the literature review, section 3 details the methodology and Section 4 discusses the study's findings.

2. Literature review

Many academic studies have been done on firm financing policy, and many capital structure theories have evolved. In addition, several theories and studies on corporate risk management policies exist. However, little has been done in the literature to examine the interaction of these essential corporate financial strategic pillars. This study fills this gap. Modigliani and Miller (1958) (M&M) pioneered the capital structure theory by initially assuming a frictionless market. They showed that a firm's overall cost of capital is a weighted average of its component costs (debt and equity). M&M argued that the Weighted Average Cost of Capital (WACC) is independent of its capital structure. According to M&M, introducing cheaper debt into the capital structure increases the overall riskiness of the firm, and equity holders will demand a higher premium for their invested capital; this offsets any benefit from cheaper debt, and hence WACC remains unchanged (Aivazian et al., 2005). M&M argue that in such a perfect world, firm financing and value solely depend on its income generation ability (Antoniou et al., 2008). The irrelevancy proposition implies that risk management is irrelevant and hedging does not add any value.

In the real world, there are transaction costs, taxes, and information asymmetry are inevitable, hence the lack of applicability of the irrelevance proposition. Modigliani & Miller (1963) later show

that debt financing reduces the cost of capital in the presence of an interest tax shield. Stressing the existence of market frictions, several studies such as Myers & Majluf (1984) and Jensen & Meckling (1976) challenged the irrelevance proposition, and variations of the capital structure theory were developed based on the existence of asymmetric information, imperfect markets and agency costs. According to the trade-off theory, an optimal capital structure that maximises firm value can be identified at the point where WACC is at its minimum (Myers, 2001). The optimal point is a trade-off between debt financing costs and debt benefits (tax shield). Thus, the benefits of debt initially outweigh the costs- reducing the cost of capital up to the optimal point. Beyond the optimal point, the costs outweigh the tax shield benefits and increase WACC. According to the Pecking order theory, firms always seek to minimise the cost of capital when seeking external financing; hence cheaper internal financing will be preferred to external financing (Myers & Majluf, 1984). The recent addition to the capital structure puzzle, the market timing hypothesis, contends that to take advantage of any mispricing in the financial markets, financial managers move in and out of financial markets to ride on any mispricing and reduce the overall cost of capital; predicting that firms increase debt when it ultimately reduces the overall financing cost.

From a risk management perspective, Diamond (1984) shows that derivatives hedging strategies in financing decisions create value for firms. Smith & Stulz (1985) and Froot et al. (1993) risk management paradigm further strengthened this argument by demonstrating that hedging with derivatives reduces cash flow volatility and financial distress costs and increases the capability to raise capital, thereby increasing the firm's value. Froot et al. (1993) revealed that debt financing enhances firm value through hedging to reduce company risk, and firms maximise expected returns through hedging. Shim's (2002) risk management and cost of capital model posit that firms that use derivatives instruments for hedging free up excess capital (called risk capital) since such firms do not need much of their own capital to guarantee credit needs. This shows the risky nature of derivatives instruments- as much as they are used to hedge risk, they also introduce an additional risk component. This study thus seeks to evaluate how investors view the role of these instruments. Doherty (2005) examined Shimpi's risk management and cost of capital model. While Doherty agrees that using hedging instruments can free up a company's capital and impact its cost of capital, he argues that Shimpi's proposed model may undervalue the new cost. This undervaluation could potentially lead to wrong decisions by a company's management team, such as proceeding with value-destructive projects. In addition, they argue that this could create arbitrage opportunities since investors make use of the conventional WACC calculation methodology. Tavares & Sheng (2007) proposed a foreign currency exposure estimation that could improve risk management policies.

Empirically, very few studies have directly analysed the Impact of derivatives use and hedging on firms' cost of capital. Coutinho et al. (2012) Investigated the role of FX derivatives on Brazilian firms' capital cost. They found a positive relationship between derivatives use and the cost of capital. After considering the Total average cost of capital that includes risk capital freed up by derivatives, they document that derivatives use as a risk management tool reduces the firm's capital cost. In addition, Rossi (2009) revealed that Brazilian firms, vulnerable to floating FX market risks, rely heavily on derivatives to minimise their indirect exposure and manage potential volatilities in their cash flows. Supporting the view that derivatives help reduce cash flow risk and lower costs. Nguyen et al. (2018) and Kim et al. (2017) note that derivatives use is a value-increasing strategy through the reduction of costs and risks brought about by market imperfections. Many studies note that derivatives can reduce firm costs -however focusing on the general operating costs of a firm, none of the studies has directly focused on their Impact from a financing cost perspective. Using Canadian firms, Paligorova & Staskow (2014) found that firms can smooth their earnings through derivatives, supporting the view that corporate hedging enhances firm value, bringing about higher profits and reducing earnings volatility. Derivatives allow firms to manage their balance sheets actively by

holding less cash and accessing external financing in the capital markets. Studies by Bartram et al.(2011), Allayannis et al. (2012), and Ayturk et al. (2016) found a positive relationship between derivatives hedging and firm value. There is scanty empirical evidence on the role of derivatives on different component capital costs. Does the derivatives risk management function reduce the cost of capital, or does the additional risk introduced by these instruments (risk capital) induce investors to demand a higher return on their capital, increasing the company's cost of capital? Is the Impact of derivatives usage the same across different financing sources? This study investigates these issues for Johannesburg Stock Exchange (JSE)-listed non-financial firms.

3. Empirical Approach

3.1 Data, sampling and variables

To ascertain the impact of derivatives usage on firm financing policy, the study considered all JSE-listed firms for the post-apartheid and pre-COVID-19 periods (2000 to 2019). Listed firms were specifically selected due to the availability of reliable financial data. Secondary data used for this study is available in the public domain and obtained from Bloomberg's online database. Financial firms were excluded from the sample due to their complex financial structures heavily influenced by prudential regulations. In addition, financial firms actively use derivatives for profit-seeking rather than purely risk management. The study employed unbalanced panel data; excluding financial firms, 176 firms were left for estimation after screening and checking for missing variables and coding errors. Panel data has the ability to reduce co-linearity and allows observation of multiple phenomena over many periods, hence improving the efficiency of the econometric estimates (Akhtar & Oliver, 2009).

The primary dependent variable is the cost of capital. A company's total capital is made up of owners' capital (Equity) and Debt Finance. As such, the study used the three different component costs: cost of equity (required return for equity holders), cost of debt (required return of lenders) and the Weighted Average Cost of Capital (WACC) – The WACC captures the total cost on total firm assets, reflecting equity and debt financing. To calculate the cost of equity capital, the study employed the widely used Capital Asset Pricing Model (CAPM) (Fama & French, 1992). The CAPM provides a straightforward and relatively simple framework for estimating a company's equity capital cost, grounded in the fundamental principle of the risk-return trade-off as it calculates the required return based on the asset's systematic risk, which Investors are typically compensated for, in addition, the CAPM serves as a benchmark for evaluating investment decisions. The model is specified as follows:

$$k_e = r_f + \beta(R_m - r_f) \quad (1)$$

where k_e Is the cost of equity; β captures the sensitivity of the firm returns to market returns; $(R_m - r_f)$ is equity market risk premium measured as the difference between the return on the market and the risk-free rate. The study, following previous studies, used the return on the Johannesburg Stock Exchange (JSE) all-share index as the market proxy as it reflects the return of all publicly traded securities and the return on government bonds as a measure of the risk-free rate (r_f).

Following Moore (2016), the beta (β) in equation 1 is obtained by regressing the returns of the firm (calculated as daily changes in stock prices $(return = (\frac{P_t}{P_{t-1}}) - 1)$) against the returns of the market. $R_e = \alpha + (R_m - rf)$.

The weighted average cost of firm financing (WACC) was determined as follows:

$$WACC = \sum W_i * r_i \quad (2)$$

where r_i captures financing source i (debt or equity) cost; W_i Is the proportion of financing source i in the firm's capital structure measured in market values. The cost of debt was calculated as the weighted

average current yield to maturity on all outstanding debt (weighted on debt shares in total debt) after tax.

The study aims to evaluate the Impact of derivatives use on a firm's cost of capital. Derivatives usage is the primary independent variable. Two different measures of financial derivatives use were employed. Firstly, a dummy variable equal to 1 for firms that use financial derivatives and 0 otherwise. This allows differentiation of whether firms that use derivatives have a lower cost of capital. Secondly, a ratio of the total notional value of derivatives instruments (as reported in the firm's financial statements) used by a firm to the book value of assets. The second measure (notional value to assets ratio) captures the extent of hedging and its Impact on capital cost. The following standard control variables used in the empirical literature were added as other explanatory variables. Following Yuan & Motohashi (2014), the leverage ratio was measured as the ratio of long-term debt to total assets. Firms that use more debt have higher leverage ratios. Liquidity was calculated as a ratio of cash and cash equivalents to current liabilities) - firms with high liquidity can raise finances at a lower cost. Asset tangibility- firms with more tangible assets (which can be used as collateral) can raise finances at a lower cost. Firm size was measured as a natural logarithm of total assets (Ayturk et al., 2016) - larger firms are expected to enjoy a lower cost of borrowing. Cash flow to control for internal funds availability was calculated as a ratio of operating cash flows to total assets.

3.2. Model specification

The study employed a dynamic panel model to examine the impact of derivatives usage on the firm's cost of capital. A dynamic model captures previous financing costs effects (Yuan & Motohashi, 2014) and help to reduce autocorrelation that may arise from any model misspecification (Manuel Arellano and Stephen Bond, 1991).

A general panel model is specified as follows:

$$Y_{i,t} = \beta_0 + \beta_1 x_{i,t} + \sum_i^j Z_{it} \beta + \varepsilon_{i,t} \quad (3)$$

where $Y_{i,t}$ is the dependent variable, $x_{i,t}$ the main explanatory variable and Z_{it} A vector of independent variables. it represents firm i in time period t. $\varepsilon_{i,t} \sim N(0, \sigma^2_\varepsilon)$ random disturbance and assuming $\sigma^2_\varepsilon > 0, \varepsilon(\varepsilon_{i,t}, \varepsilon_{j,s}) = 0$

Extending Equation 3 to a dynamic panel model:

$$y_{i,t} = \gamma y_{i,t-1} + \sum_i^j x_{it} \beta + \varepsilon_{i,t}; |\gamma| < 1 \quad (4)$$

where $y_{i,t-1}$ is the lagged dependent variable.

3.2.1. Derivatives use and cost of capital

First, the study analysed the impact of derivatives usage on the three components' capital costs (WACC, Cost of equity and cost of debt). Therefore three dependent variables were used for the three different specific models. The models take the following form:

Model 1: Derivatives use Impact on WACC

$$WACC_{i,t} = \gamma WACC_{i,t-1} + \beta D_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (5)$$

Model 2: Derivatives use Impact on Cost of Equity

$$Ke_{i,t} = \gamma Ke_{i,t-1} + \beta D_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (6)$$

Model 3: Derivatives use Impact on cost of debt.

$$Kd_{i,t} = \gamma Kd_{i,t-1} + \beta D_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (7)$$

where: as outlined above, $Kd_{i,t}$ is the cost of debt, $Ke_{i,t}$ is the cost of equity; $WACC_{i,t}$ is the weighted average cost of capital. $L_{i,t}$ is leverage (ratio of debt to assets). $S_{i,t}$; $AT_{i,t}$; $LQ_{i,t}$; and $CF_{i,t}$ Respectively are firm size, asset tangibility, liquidity, and cash flows γ ; β ; ϑ ; λ ; π ; ξ ; ϕ are parameters to be estimated.

3.2.3. Extent of Hedging and Cost of Capital.

Second, the study examined the extent of hedging (HE) impact on the three components' capital costs (WACC, Cost of equity and cost of debt). The derivatives use dummy variable does not measure the exact extent of hedging (Ayturk et al.'s (2016). The study thus employed a continuous variable that measures hedging extent to distinguish the cost effect of hedging.

The models take the following form:

Model 4: HE Impact on WACC

$$WACC_{i,t} = \gamma WACC_{i,t-1} + \beta HE_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (8)$$

Model 5: HE Impact on Cost of Equity

$$Ke_{i,t} = \gamma Ke_{i,t-1} + \beta HE_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (9)$$

Model 6: HE Impact on cost of debt.

$$Kd_{i,t} = \gamma Kd_{i,t-1} + \beta HE_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (10)$$

where: $HE_{i,t}$ Is the extent of hedging measured as a ratio of a firm's total notional value of derivatives instruments to the book value of assets.

Third, the study examined the Impact of derivatives use on financial stability. Borrowing from bank stability literature, the study adopted a Z-Score as a measure of firm stability calculated as a ratio of return on assets (ROA) plus equity to total assets to the standard deviation of ROA (Pham et al. 2021; López-Penabad et al.2021; Danisman & Tarazi, 2020) Firm stability = $\frac{ROA+E/TA}{\sigma_{ROA}}$. Return on assets was measured as a ratio of earnings to total assets. The estimated models take the following form:

Model 7: Derivatives use (Dummy) Impact on stability

$$Stability_{i,t} = \gamma WACC_{i,t-1} + \beta D_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (11)$$

Model 8: HE Impact on Firm Stability.

$$Stability_{i,t} = \gamma Ke_{i,t-1} + \beta HE_{i,t} + \vartheta L_{i,t} + \lambda S_{i,t} + \pi AT_{i,t} + \xi LQ_{i,t} + \phi CF_{i,t} + \varepsilon \quad (12)$$

$S_{i,t}$ is firm i's stability for period t, all other variables are as defined before.

3.3. Estimation technique

Previous studies, including Coutinho et al. (2012), assumed non-unobservable individual effects and used a pooling regression. $\varepsilon_{i,t}$ is not directly observable and does correlate with other control variables hence pooling variables is inefficient (Antoniou et al., 2008). The Ordinary Least Squares (OLS) will still be an inefficient estimator even after taking the first differences of the variables to eradicate the time-invariant fixed effects because of the correlation of $K_{i,t}$ ($K_{i,t} - K_{i,t-1}$) and $\Delta \varepsilon_{i,t}$ ($e_{i,t} - e_{i,t-1}$). Anderson & Hsiao (1982) Instrumental variables(IV) technique can address the endogeneity problem; however, it might not be efficient because it does not use all the available moment conditions. The endogeneity problem, which may result in the explanatory variables being correlated with the error term, arises from measurement errors and potential bi-directional causation omitted variables (Muñoz, 2013).

The lagged dependent variable ($K_{i,t-1}$) introduces dynamic bias and autocorrelation with the error term that cannot be controlled by the IV and traditional techniques used in previous studies. Roodman (2009) argues that the Generalised Methods of Moments (GMM) is a suitable technique under such conditions. The models were estimated using the GMM system developed by Blundell & Bond (1998). The system GMM technique is robust in dealing with endogenous variables, heteroscedasticity and serial correlation. The technique increases efficiencies by creating a system of equations through differenced instruments, instrumenting levels equations and levels instruments differenced equations (Blundell & Bond, 1998). The lagged and levels of endogenous instruments make the endogenous variables predetermined and eliminate correlation with the error term (Blundell and Bond, 1998).

Through the first difference, the models one to six (equations 5 -12) are transformed to:

$$\Delta K_{it} = \beta_0 \Delta K_{it-1} + \beta * \Delta Dev/HE_{it} + \beta_2 \Delta X_{it} + \Delta \varepsilon_{it} \quad (13)$$

$$\text{where } \varepsilon_{i,t} = v_i + e_{i,t} \quad (14)$$

First differencing removes the firm-fixed effect (v_i) that do not vary over time. Thus equation 14 becomes:

$$\Delta \varepsilon_{i,t} = \Delta v_i + \Delta e_{i,t} \quad (15)$$

Taking the first differences it follows:

$$\varepsilon_{i,t} - \varepsilon_{i,t-1} = (v_i - v_i) + (e_{i,t} - e_{i,t-1}) = e_{i,t} - e_{i,t-1} \quad (16)$$

Autocorrelation emanates from the presence of the lagged dependent variable ($K_{i,t-1}$), The system GMM controls for autocorrelation by instrumentation with past levels and differenced instruments. Blundell and Bond (1998) establish that the technique is handy in controlling endogeneity, correlation of errors over time and heteroscedasticity.

3.4. Model specification tests

It is crucial to test instruments legitimacy in dynamic panel analysis. The study used Arellano and Bond AR(2) test to test for autocorrelation and the Hansen/Sargan test for instruments overidentification. The GMM estimation is consistent in the absence of second-order serial correlation. The Pesaran (2004) CD test was used to test for cross-sectional dependence among the panels.

4. Empirical Results

4.1. Descriptive statistics

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std.		
			Dev.	Min	Max
WACC	2,047	9.58	2.23	4.76	16.85
K_E	2,047	10.07	2.29	5.47	16.89
K_D	1,857	7.25	2.35	2.00	12.66
PANEL 1 B			Hedgers vs Non-hedgers		
WACC Users	888	10.38	1.77	6.53	16.85
WACC NonUsers	1,147	8.95	2.34	4.76	15.09
K_E Users	888	10.88	1.89	7.29	16.89
K_E Non-users	1,159	9.45	2.39	5.47	15.50

K_D Users	816	7.87	1.79	3.01	12.66
K_D Non-users	1,041	6.76	2.60	2.00	12.66

Source: Author compilation from raw data.

Table 1 depicts the descriptive statistics of the cost of capital for firms that use and do not use derivatives. The statistics show an average WACC of 9.56 with a maximum of 16.85, a cost of equity of 10.07 with a maximum of 16.89 and a cost of debt of 7.25 with a maximum of 12.55 over the sample period. The cost of equity and WACC values are slightly lower than the average BRICS countries (12.07; 10.29, respectively), and the cost of debt is higher than the BRICS average (4.59), as reported by Evdokimova & Kuzubov (2021). The WACC values are higher than US firms, with an average of 8% (Moore, 2016). The statistics suggest that South Africa has a higher borrowing cost and a lower equity financing cost than other BRICS countries over the sample period. Panel B shows the means of costs of capital for hedgers and non-hedgers. Firms that use derivatives have a higher mean cost of capital, as demonstrated by higher values of WACC, K_E and K_D than non-derivative-users.

4.2. Correlation analysis

Table 2 shows the correlation analysis of the variables employed. The correlations between explanatory variables are very low, all less than 0.3 suggesting that multicollinearity is not a problem for this analysis. The correlations show a statistically positive relationship between derivatives hedging (Notional) and KD, suggesting that firms that use more derivatives face a higher cost of borrowing. However, correlation does not imply causation.

Table 2. Correlation Analysis.

	WACC	K_E	K_D	Notional	Leverage	Tangibility	size	CF
WACC	1.000							
K_E	0.9409*	1.000						
K_D	0.6475*	0.5335*	1.000					
Notional	0.009	-0.002	0.1370*	1.000				
Leverage	-0.0933*	0.016	0.1316*	0.084	1.000			
Tangibility	-0.1116*	-0.1195*	-0.0905*	0.014	-0.025	1.000		
size	0.1982*	0.1924*	0.0835*	0.2694*	0.0723*	0.0653*	1.000	
CF	0.0537*	0.009	0.001	-0.042	-0.1636*	0.010	0.033	1.000

4.3. Cross-sectional dependence test

The study employed the Pesaran (2004) cross-sectional dependence (CD) test for cross-sectional dependence. The choice of the Pesaran CD test was motivated by its suitability for panels characterized by a larger number of cross-sectional units (N) relative to the number of time periods (T), which aligns precisely with the data structure employed in this study (De Hoyos & Sarafidis, 2006). The results of the CD test did not provide sufficient evidence to reject the null hypothesis of no cross-sectional dependence, indicating no evidence of cross-sectional dependence in the data set. These results imply that the array of cross-sectional units does not exhibit significant interdependence or mutual influence over time. Consequently, the study concludes that there is no substantial indication of cross-sectional dependence in the dataset, indicating that the individual units can be considered relatively autonomous, not contingent upon or influenced by the actions or characteristics of other units, and operate independently throughout the observed period (De Hoyos & Sarafidis, 2006).

Cross Sectional dependence test

Pesaran test of cross-sectional independence	0.987	Pr.	0.324
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4.4. Financing premium: Univariate analysis

Table 3 presents the mean differences between hedgers (derivatives users) and non-hedgers for the different cost of capital measures. Derivatives users have an average WACC of 10.38 compared to 8.95 for non-hedgers yielding a statistically significant financing premium of 1.43 in favour of non-hedgers. Hedgers have an average K_E of 10.88 versus 9.45 for non-hedgers deriving a statistically significant financing premium of 1.42 for non-hedgers. There is a significant mean difference on K_D in favour of non-hedgers. The significantly higher means for hedgers than non-hedgers indicate that firms that use derivatives to hedge risk face a higher cost of capital and are associated with higher riskiness. The results highlight the significance of prudent risk management in transactions involving derivatives and understanding the potential consequences on the firm's overall risk profile. Firms using derivatives should design and execute risk management strategies to mitigate the increased riskiness associated with derivatives usage. The results imply that even though derivatives can be used to minimise risk, they are risk instruments that increase the firm's riskiness and cause funders to demand a higher rate of return for providing financing for such firms. Firms should carefully consider the potential Impact of derivatives on their cost of capital and evaluate whether the benefits of risk reduction outweigh the higher financing costs.

However, regarding the financial stability of firms, the results show no statistically significant difference between derivative users and non-users, as shown by an insignificant mean difference. This indicates the presence of financial instability for both hedgers and non-hedgers. Thus, derivatives may not provide a significant impact on the stability of a firm. Firms should explore other strategies to stabilize their earnings and not solely rely on derivatives as a sole earnings stabilizer. Overall, from a risk-return trade-off perspective, the findings indicate that derivatives can be used as risk management instruments; they introduce additional risks and increase financing costs, thus the need to evaluate the trade-off between the increase in financing costs and risk reduction through derivatives. In optimising the firms overall financial performance and sustainability, it is essential to strike a balance between managing risk and cost of capital.

Table 3. Mean differences.

		Hedgers	Non-Hedgers	Difference	t-statistics
WACC	Mean	10.38	8.95	1.43	15.680
	Std. dev	1.77	2.34		
K_E	Mean	10.88	9.45	1.42	15.059
	Std. dev	1.89	2.39		
K_D	Mean	7.87	6.76	1.11	10.834
	Std. dev	1.79	2.60		
Stability	Mean	0.29	0.25	0.07	-0.484
	Std. dev	0.56	2.12		

4.5. Regression results

Table 4. Dynamic panel data estimation: Derivatives and Cost of Capital [Models 1-3].

VARIABLES	Definition	Model 1	Model 2	Model 3
		WACC	K_E	K_D
γ	Lagged dependent	0.952*** (0.0087)	0.740*** (0.0055)	0.921*** (0.0113)
β	Derivatives use	-0.611*** (0.0357)	-0.599*** (0.0456)	-0.221*** (0.0769)
ϑ	Leverage	-0.00697*** (0.0014)	0.0423*** (0.0024)	0.000611 (0.0034)
ϕ	Cash flows	-1.309** (0.0764)	-0.179** (0.0822)	-0.832*** (0.0605)
π	Asset Tangibility	-6.061*** (0.4130)	-3.943*** (0.1190)	-6.599*** (0.5940)
λ	Size log(TA)	-0.222*** (0.0460)	-3.57E-05 (0.0325)	-0.222*** (0.0697)
ξ	Liquidity	-0.0423 (0.0585)	0.239** (0.0390)	-0.0562 (0.1310)
Observations		1,045	1,045	1,029
Number of ID		139	139	136
AR(2)	Autocorrelation test	0.48	0.51	0.08
Hansen test	Test of overid	0.34	0.39	0.14

Corrected standard errors in parentheses, The AR (2) tests for autocorrelation and the Hansen test tests for over-identification of instruments. *** p<0.01 significant at 1% level, ** p<0.05 significant at 5% level, * p<0.1 significant at 10% level.

Table 4 depicts the dynamic panel regression model results on derivatives use and cost of capital. The Impact of derivatives use was estimated on three different capital costs (WACC, K_E and K_D) for South African-listed non-financial firms. First, derivatives use was captured as a dummy variable equal to 1 for users of derivatives and 0 for non-users. The dummy variable for derivatives use in Table 4 is negative and statistically significant for all three capital costs across all three capital costs. The results suggest that firms that use derivatives experience a lower average cost of financing, consistent with the hypothesis that derivatives can be practical tools in hedging risk and reducing the required rate of return demanded by lenders and investors. Such low financing costs can enhance derivative users' competitiveness and financial performance. The negative relationship between the cost of capital and derivative use indicates that firms effectively use derivatives as risk management instruments. The reduction in risks can enhance the firm's stability and creditworthiness among lenders and investors. The findings imply that investors view firms using derivatives more favourably due to risk reduction associated with such strategies. The positive perception can increase investor confidence and attract more investment, positively impacting growth. The results suggest that derivatives can be effectively used to manage financial risks and reduce financing costs; thus, firms should incorporate derivatives strategically in their risk management approaches. It is vital for firms to understand their unique risks and identify appropriate derivative instruments to implement sound

risk management policies to manage such risks. In addition, monitoring and assessment of risks regularly can help evaluate derivatives hedging effectiveness and ensure alignment with the firm's objectives and risk appetite.

The negative relationship between the dummy variable for derivatives use and the cost of capital is consistent with Coutinho et al. (2012), who found a negative relationship between derivatives usage dummy and the cost of capital for Brazilian firms post the financial crisis. The results are also consistent with Nguyen et al. (2018) and Kim et al. (2017), who document that derivatives reduce costs and risks brought about by market imperfections. Froot et al. (1993) risk management theory asserts that active and efficient risk management practices create value for firms. From the risk management perspective, hedging reduces costs and adds value to the firm. Lessard & Lightstone (1990) and Shapiro & Titman (1986) proclaim that firms that are active in risk management benefit from a reduction in the volatility of cash flows; thus, firms experiencing high volatility in cash flows will experience higher financing costs.

Table 5. Dynamic Panel GMM model hedging extent and cost of capital [Models 4-6].

VARIABLES	Definition	Model 4 WACC	Model 5 K_E	Model 6 K_D
γ	Lagged dependent	0.264*** (0.0140)	0.0441** (0.0218)	0.966*** (0.0267)
β	Hedging extent	21.39*** (0.1300)	15.36*** (0.9610)	15.24*** (0.3940)
ϑ	Leverage	-0.0294*** (0.0055)	0.0102 (0.0063)	0.0746*** (0.0052)
ϕ	Cashflows	-0.237*** (0.0676)	-0.586** (0.1220)	-0.0921 (0.0562)
π	Tangibility	-16.65*** (0.4390)	-2.641*** (0.8970)	1.556*** (0.3010)
λ	Size	-1.315*** (0.0353)	-1.796*** (0.1760)	-0.961* (0.0366)
ξ	Liquidity	1.197 (0.1270)	0.998*** (0.1660)	-0.531** (0.2240)
AR(2)	Autocorrelation test	0.96	0.40	0.09
Hansen test	Test of overid	0.50	0.75	0.37

Corrected standard errors in parentheses, The AR (2) tests for autocorrelation and the Hansen test tests for over identification of instruments. *** p<0.01 significant at 1% level, ** p<0.05 significant at 5% level, * p<0.1 significant at 10% level.

The results show a negative relationship between WACC and firm leverage, implying that the increase in debt results in lower financing costs. According to the trade-off theory, an increase in leverage is associated with using cheap debt, which will result in an initial decline in WACC. Hence the negative relationship between WACC and leverage (Myers & Majluf, 1984). The negative relationship suggests that South African non-financial firms are still operating below the optimal debt level, as shown by a decrease in WACC following an increase in debt financing as per the trade-off theory; hence these firms have an edge to exploit the tax shield. The finding is consistent with Vengesai & Muzindutsi (2020).

The cost of equity was found to correlate positively with leverage, implying that as firms increase debt, shareholders will demand a higher return to compensate for increased financial risk. Debt financing creates agency costs; investors value highly levered firms less (Jensen & Meckling, 1976). The findings are consistent with Thien & Hung (2023), who found a positive relationship between the cost of equity finance and firm leverage, concluding that firms with high leverage are viewed as risky than firms with more equity capital. Modigliani & Miller's (1958) irrelevance proposition asserts that as firms use cheap debt, the cost of equity will increase linearly to offset any benefit drawn from the lower cost of debt. The tables show a negative relationship between asset tangibility and cost of capital. Firms with more tangible assets which can be used as collateral in borrowing can enjoy a low cost of capital. This finding is consistent with Thien & Hung (2023), who document that intangible investments raise the cost of finance since such investments are less liquid, risky and have higher levels of information asymmetry. Firm size was found to be negatively associated with the cost of capital. Large firms enjoy a lower financing cost because of their negotiation power in the financial markets and economies of scale.

4.5.1. Hedging Extent and Cost of Capital

Ayturk et al. (2016) argue that using a dummy variable does not capture the extent of hedging. To capture the hedging extent, the study conducted a further detailed examination and employed a continuous variable measured as a ratio of derivatives notional value to total firm assets. The dynamic panel GMM regression results depicted in Table 5 shows a positive and statistically significant relationship between hedging extent and the three different cost of capital (WACC, KE and KD). When the extent of hedging was employed, the results indicate that firms that use derivatives extensively experience a higher cost of capital. The increase in the cost of capital can be attributed to the risky nature of derivatives. While derivatives can be effective in managing risks, they also introduce different risks to the firm, causing investors to demand a higher return to account for the additional risk associated with firms that engage in risky derivatives transactions. These findings are consistent with Coutinho et al. (2012), who found a positive relationship between foreign currency (FX) derivatives and the cost of capital for Brazilian listed firms. The results imply a trade-off between risk and return. Investors consider the risk management advantage to be offset by the additional risk introduced by these instruments, demanding higher compensation in the form of higher returns on their capital investments. The findings show how investors are cautious about the extent of derivatives firms use. Extensive use of derivatives may be perceived as riskier investments. Firms should tailor their derivatives usage to align with their risk management exposures within their risk management needs. Adopting optimal hedging strategies may be useful in balancing risk reduction while minimizing the cost of capital potential increase. Diversifying risk management approaches to achieve a comprehensive risk management framework can help minimise the Impact of an additional set of risks introduced by derivatives instruments. In addition, firms need to note that the cost of capital short-term fluctuations can occur due to market conditions, hence the need to adopt a long-term perspective in derivatives strategies. Focusing on long-term risk management may increase the financial resilience of the firm.

4.5.2. Derivatives hedging and financial Stability

The study further analysed the Impact of derivatives usage on the firm's stability. The results are presented in Table 6. The derivatives use dummy (model 8) is positive and statistically significant, implying that the use of derivatives in general results in financial stability. However, the dummy variable does not capture the degree of using derivatives. The hedging extent variable (model 7), which measures the degree of hedging, shows that firms that use derivatives extensively are more

financially unstable, as shown by a negative relationship between stability and hedging extent variables. This finding is explained by the fact that derivatives are high-leverage instruments; leverage magnifies profits and losses hence high firm variability. The findings have significant implications for corporate decision-making and financial markets. The result shows the significance of rigorous risk management and understanding the true impact of derivatives usage on the firm's risk profile. Derivatives instruments intensify firms' leverage and increase the variability of earnings, which may, in turn, influence capital structure decisions. Hence the need to assess the firm's financing strategies to ensure the ability to manage potential earnings fluctuations and maintain financial stability. The increase in financial instability due to widespread derivatives use might have broader implications for the overall stability of financial markets, contributing to market volatility and systematic risk, most likely during market shocks. Policymakers, therefore, need to consider such implications and implement appropriate measures, such as placing limits on trading and using such instruments to effectively manage systematic risks.

The study found a negative relationship between leverage and financial stability. Firms with high debt levels are more volatile; leverage amplifies returns and losses. The study established a positive association between cashflows and firms' stability. Firms with high cash flows are associated with more stability. In addition, the results show that firms with more tangible assets are more stable. Inconsistent with expectations, the results show that big firms have less stable earnings, as shown by the negative relationship between size and stability.

Table 6. Dynamic panel data estimation hedging and return stability [Models 7 & 8].

VARIABLES	Description	Model 7 Stability	Model 8 Stability
γ	Lagged dependent	0.925*** (0.0150)	0.412*** (0.0071)
β	Derivatives use Dummy		0.0143** (0.0066)
β	Hedging extent	-5.718*** (0.7020)	
ϑ	Leverage	-0.00155*** (0.0005)	-0.00258*** (0.0003)
ϕ	Cashflows	0.0960*** (0.0070)	0.0732*** (0.0104)
π	Tangibility	0.658*** (0.0221)	0.0574 (0.0436)
λ	Size	-0.00445 (0.0096)	-0.00615* (0.0031)
ϑ	Liquidity	-0.0859*** (0.0140)	-0.0411*** (0.0038)
AR(2)	Autocorrelation test	0.81	0.82
Hansen test	Test of overid	0.42	0.46

Corrected standard errors in parentheses, The AR (2) tests for autocorrelation and the Hansen test tests for over-identification of instruments. *** p<0.01 significant at 1% level, ** p<0.05 significant at 5% level, * p<0.1 significant at 10% level.

4.6. Model specification tests

The GMM estimators are consistent if the residuals in the differenced equations exhibit no second-order serial correlation. The Arellano-Bond AR (2) test was used to examine serial correlation. In all eight models estimated, the AR (2) is more than 5 per cent, indicating the absence of serial correlation. The study employed the Hansen test to inspect the over-identification of moment conditions. In all eight models, the Hansen test probability is more than 5 per cent, evidencing correct instrument identification and model specification. In all models, the number of instruments was less than the number of groups and consistent with dynamic stability; the coefficients of the lagged dependent variables are statistically less than one, attesting to correct GMM and dynamic model specification.

5. Conclusion

The study employed a dynamic panel model estimated with the system GMM to examine the Impact of derivatives usage and hedging extend on firms' cost of capital. The study found that the use of derivatives for hedging generally reduces the cost of capital. However, the relationship changes when a more informative derivatives hedging measure that captures the extent of hedging is used. Firms that use derivatives extensively experience a higher cost of capital. This is explained by the risky nature and double role served by derivatives. Derivatives' role is two-edged – risk management and speculation – risk management should result in a low cost of capital, and the speculation function should result in a high cost of capital. The results imply that the risk management function is outweighed by the risk induced by speculation; hence investors will demand a higher return on their invested capital. Therefore, firms should exercise caution in using derivatives instruments to manage risk to ensure stability and sustained growth over the long run.

The findings emphasize the need for a prudent and comprehensive approach to derivatives usage. While derivatives can be used effectively for specific risk management, they also induce financing costs and riskiness implications. The benefits (risk management) and drawbacks (potential Impact on the cost of capital) of derivatives usage should be carefully weighed to optimize financial performance and mitigate potential risks. The results suggest that investors are cautious about firms' extensive use of derivatives, which may be perceived as risky. The study recommends diversification of risk management approaches to help reduce the Impact of risks introduced by derivatives. To increase financial resilience, firms should take a long-term perspective in their derivatives strategies. The study established that extensive derivatives use increases leverage and firm instability, influencing capital structure decisions. High financial instability might have broader implications for the overall financial markets' stability. This may result in an increase in market volatility and systematic risk, most likely during market shocks. To manage systematic risks effectively, policymakers, therefore, should take into account these implications and implement appropriate measures, such as limiting the extent of the use of derivatives for speculation and risk management purposes. The study's weakness is that it assumed that all derivatives are the same and used for the same purpose and used the aggregate values of derivatives. Future studies can look at disaggregating derivatives use and analyse the Impact of different derivatives types on firm financing.

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