Examining the asymmetric relationship between foreign derivative investment and financial growth of Nairobi Stock Exchange [NSE]-listed firms: A Nonlinear Autoregressive Distributed Lag [NARDL] approach

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ABSTRACT

This study examines whether the relationship between foreign derivative investment (FDerI) and financial growth of firms listed on the Nairobi Securities Exchange (NSE) is asymmetric — that is, whether positive shocks (increases) and negative shocks (decreases) in FDerI exert differential and non-linear effects on net profit growth. Conventional symmetric models mask this heterogeneity; the Nonlinear Autoregressive Distributed Lag (NARDL) framework is uniquely suited to detect it. Using an unbalanced panel of 40 NSE-listed firms over 2019–2024 (N = 240 firm-year observations), the study decomposes FDerI into its positive partial sums ($FDerI^+$) and negative partial sums ($FDerI^-$), constructs the NARDL model alongside control variables (firm leverage, liquidity, and size), and applies panel-NARDL bounds testing, Wald asymmetry tests, and cumulative dynamic multiplier analysis. Prior to estimation, data undergo pooled winsorisation, Levin-Lin-Chu unit root tests confirming stationarity, and Driscoll-Kraay standard error correction for cross-sectional dependence and serial correlation. The bounds test confirms a long-run cointegrating relationship between FDerI and financial growth. A significant asymmetry is detected: positive FDerI shocks have a statistically negligible effect on financial growth ($\beta^+ \approx 0.012$, $p > 0.05$), while negative shocks derivative withdrawals or contractions exert a significant negative impact ($\beta^- = -0.187$, $p < 0.01$). The Wald test rejects symmetry ($F = 8.43$, $p < 0.01$). Dynamic multipliers reveal an asymmetric adjustment path: negative shocks propagate to financial growth more rapidly and persistently than positive shocks, with full adjustment achieved after approximately four quarters. The short-run error correction term is negative and significant ($ECT = -0.312$, $p < 0.01$), confirming reversion to long-run equilibrium. The dominant negative-shock channel suggests that derivative market contractions driven by regulation tightening, liquidity dry-up, or global risk-off episodes damage NSE firm growth more severely than derivative expansions benefit it. The CMA should prioritise market depth, liquidity buffers, and hedging cost reduction to prevent adverse derivative shocks. This is the first study to apply a panel-NARDL approach to the FDerI–financial growth nexus in a frontier African derivatives market, addressing the long-standing gap in symmetric modelling. The study introduces the concept of the "asymmetric hedging trap" where NSE-listed firms suffer disproportionately from derivative downturns relative to any gains from expansions. The study recommends that regulatory and corporate risk-management attention be redirected from encouraging derivative market expansion toward safeguarding firms against derivative contractions.

Keywords: Asymmetry, Foreign Derivative Investment, Financial Growth, Frontier Markets, Hedging, NARDL, Nairobi Securities Exchange, NSE Derivatives Market

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I. INTRODUCTION

Foreign derivative investment (FDerI) and the financial development of listed firms have become an ongoing academic and policy interest because of the presence of maturing hedging instruments and the conflicting views on the impact of their growth. Theoretically, derivatives such as foreign exchange forwards, interest rate swaps, options and futures are expected to provide benefits in terms of the stabilisation of cash flows and protection from currency and interest rate volatility, which in turn are expected to lead to better financial results at the firm level (Allayannis & Weston, 2001; Bartram et al., 2011; Guay & Kothari, 2003). However, empirical evidence has always reported a context-dependent and mixed picture, especially in frontier markets where the value-creating potential of derivatives is constrained by market depth, governance quality, and regulatory infrastructure (Kivindu, 2020; Vengesai, 2025).

The Nairobi Stock Exchange [NSE] in Kenya provides a fascinating terrain on which to ask questions about this connection. In 2019, the NSE opened the derivatives market (NEXT) which added single stock futures and index futures to the traditional equity and bond market. The natural laboratory setup of this structural launch, followed by the natural shock of COVID-19 in 2020, is an ideal setting for studying the response of derivative investment to and the transmission of asymmetric macroeconomic shocks. The results of the present study indicate that derivative ratio of NSE listed firms had a mean of 72.9% and median of 76.7% by 2024, while the symmetric fixed-effects analysis reveal that FDerI did not have a significant negative direct effect on financial growth ($\beta = -0.035$, $p = 0.632$), with a near zero model F-statistic ($F(6,5) = 0.26$, $p = 0.934$). The structural difference between the effect of derivative contractions on financial growth and the effect of derivative expansions, however, may be hidden in this null finding, as they both may come with different non-linearities.

The assumption of standard linear panel regression is that increases and decreases by 1 unit of FDerI have equal magnitude but different signs – a symmetry that is unlikely to be true in derivatives markets. Rising derivative positions can offer extra hedging advantages which translate weakly to financial growth, while quick reductions in derivative investment can expose firms to unhedged risks, destabilize cash flow, and convey distress — all of which have the potential to impact financial growth disproportionately. This asymmetry is at the core of the Nonlinear Autoregressive Distributed Lag (NARDL) model introduced by Shin et al. (2014) and extended to panel data by bounds testing methodology of Pesaran et al. (2001).

The NARDL model separates the independent variable into positive partial sums, capture the increase in the independent variable (expansion phase), and negative partial sums, capture the decrease in the independent variable (contraction phase), respectively, so that the long- and short-run responses to positive and negative partial shocks to the derivative variable can be estimated separately. This method has been widely used in macroeconomic relationships such as exchange rate, oil price, financial development, and has not yet been widely used in the relationship between investment firms and their performances in the derivative investment in African frontier markets.

1.1 Statement of the Problem

Although the theory suggests that foreign derivative investment (FDerI) can help stabilise firm cash flows and promote financial growth via hedging and risk management (Smith & Stulz, 1985; Froot et al., 1993; Allayannis & Weston, 2001), empirical findings on the relationship among NSE-listed firms are inconclusive, and more importantly methodologically incomplete. The studies conducted in Kenya so far (Kivindu, 2020; Nguru & Kariuki, 2018; Mwathe et al., 2025) have used only symmetric linear specifications with the implication that the effect of the change in FDerI on financial growth is equal and opposite. Theoretically that is impossible in a hedging world; an increase in derivative exposure provides additional insurance against a risk that the firm may already be adequately covered, while a decrease in derivative exposure suddenly removes the insurance, leaving the firms exposed to unhedged currency, interest rate and cash-flow risks. Different from the symmetric models, which can never distinguish between these two regimes, the near-zero, statistically unconvincing fixed-effects estimate reported in this study ($\beta = -0.035$, $p = 0.632$) shows that the symmetric models have the potential to overstate the relationship between marriage and the likelihood of a birth occurring, rather than understate it. This is complicated by three additional gaps. A theoretical gap is that although the different theories of capital flows, hedging theory, the Efficient Market Hypothesis and the capital flow theory all predict asymmetric not symmetric responses to positive and negative shocks to the derivatives markets, there has been no direct testing of this hypothesis in Kenya's context. Second, a contextual gap is the NSE's derivatives market (NEXT), which is young, thin and has limited product depth and foreign-investor concentration, thus making its negative shocks more likely to be transmitted more strongly and for longer than positive shocks, as has been found in other frontier and emerging markets (Olayungbo & Quadri, 2019; Opoku et al., 2019; Vengesai, 2025); this is the last gap that has never been examined in the context of the NSE derivatives specifically. Third, a methodological gap in the sense that the Nonlinear Autoregressive Distributed Lag (NARDL) model (Shin et al., 2014) which is appropriate for decomposition of positive and negative partial sums of independent variables and estimation of differential long and short run effects has not previously been used in any African derivatives market, not to mention the NSE. Until this imbalance is corrected, it has real repercussions for regulators, investors, and corporate treasury departments who rely on symmetric evidence to guide their view on the fragility of firm-level financial growth to sudden withdrawals of foreign derivatives, and consequently their liquidity buffers, hedging diversification, and market-depth policies to protect themselves from losses when firms contract. This study then faces the challenge of whether and how positive and negative foreign derivative investment shocks affect the long-run and short-run financial growth of NSE-listed firm in an asymmetric manner, thereby outpacing the work done by previous studies that were symmetric in their specification.

1.2 Research question

Does foreign derivative investment affect financial growth of NSE-listed firms asymmetrically, such that positive and negative shocks in FDerI produce differential long-run and short-run responses in net profit growth?

II. LITERATURE REVEIW

2.1 Theoretical Review

2.1.1 Risk Management and Hedging Theory

The hedging theory (Smith & Stulz, 1985; Froot et al., 1993) is the basic theoretical justification for the use of derivatives, because they help to reduce the variability of firm cash flows, thus lowering the probability of financial distress and expected taxes, and preserving financing capacity, which helps sustained financial growth. In markets where external financing is costly, hedging the firm's basic exposures enables the manager to use internal funds to finance value-creating investments, and thus eliminate the underinvestment problem that can arise if the firm must rely on costly external financing to cover its cash flow volatility (Froot et al., 1993). In the extension of this theory to the case of foreign derivatives investment, it is suggested that an increase in FDerI foreign participation in hedging instrument markets would increase derivative liquidity, hedge costs, and access to financial risk management tools, leading to an expansion of the financial growth of the firm.

Most importantly, hedging theory fails to forecast identical reactions to rising and falling values in derivative investments. An upswing in FDerI can yield only marginal gains when the marginal firm is already "hedged" and a downturn in FDerI eliminates a buffer against risk, so that formerly protected firms find themselves subjected to hedged risk and may set off a chain reaction of risk, distress costs and lowered investment potential. This one-sidedness in the risk protection channel is the theoretical heart of the motivation of the present study.

2.1.2 Efficient Market Hypothesis and Information Signalling

According to the Efficient Market Hypothesis (semi-strong form, Fama, 1970), the prices of derivatives markets reflect all public information, including information on firm risk exposure and hedging effectiveness. In the NSE environment, where the derivatives market (NEXT) is still young, and liquidity is low, there are possible information asymmetries between foreign and domestic investors. The positive FDerI shocks could reflect the investors' confidence in the way the market will develop, but this signal is not strong when derivatives are not employed to generate returns, but to cover risks. On the other hand, negative FDerI shocks (foreign investor withdrawals or exits) could be seen as distress signals that lead to co-movement with equity withdrawals and stronger impacts on financial growth. This signalling asymmetry is in accordance with the NARDL framework in which the long-run coefficients are expected to be differential.

2.1.3 Capital Flow Theory and the Lucas Paradox

Capital Flow Theory (Lucas, 1990) suggests that capital will flow towards frontier markets because they offer greater risk-adjusted returns. In a derivative market, it means that foreign investors who invest in derivatives provide liquidity that is lacking in the domestic market. It is noteworthy that the Lucas paradox — which holds that capital does not necessarily flow to 'capital-scarce' economies as this theory predicts — does apply here: NSE's derivative market suffers from a lack of liquidity, a limited number of products (mainly equity index and single-stock futures), and an immature regulatory framework (NSE, 2024; Barngetuny, 2024). The frictions in this context suggest that FDerI can experience unexpected turns around when the global risk appetite changes, and that negative shocks to FDerI are likely to be more severe, sharper and longer in impact on financial growth than positive shocks. This is an expected asymmetric persistence, directly reflected in the NARDL model via its dynamic multiplier analysis.

2.2 Empirical Review

2.2.1 Derivatives and Financial Growth: Global Evidence

There is a substantial body of empirical evidence across the globe on the relationship between derivatives and firm performance that is structurally balanced. In the seminal study in this literature, Allayannis and Weston (2001) discovered that the Tobin's Q (a measure of hedging premium or value-creation thesis) of nonfinancial U.S. firms that employed foreign currency derivatives averaged about 4.87%, which corresponds to the risk management value-creation thesis. Bartram et al. (2011) did expand this to a multi-country data set and they reported the same major findings – lower total and systematic risk for users of derivatives and greater valuation for them, again suggesting that the hedging premium is also applicable globally. Belghitar et al. (2008) found that, amongst UK listed firms, the value achieved through FX and interest rate hedging was significant, whilst Clark and Judge (2009) demonstrated that the hedging premium from FX or interest rate hedging would be larger for different types of instruments (derivatives versus foreign currency debt) depending on the firms' exposure horizons.

Governance conditioning is a prominent topic in the literature on derivatives and performance. Consistent with Agency Theory predictions, which state that derivatives are valued in markets where investor protection is robust, Allayannis et al. (2012) demonstrated that the hedging premium is higher in countries with high investor protection. Lau (2016) showed that inappropriate governance of derivatives can lead to lower firm value due to lack of transparency and investor uncertainty. It would be interesting to examine if the asymmetric link between FDerI and financial growth is also moderated by governance quality, which is an aspect not investigated in this study.

The findings from the EMs do not match most of the OECD results. According to Yang et al. (2023), the adoption of derivatives in China has led to enterprise value increases, but focused on the critical role of market depth for derivatives to become growth enablers rather than risk shields. Active FX and interest rate hedging had positive effects on Tobin's Q and ROE whereas speculative derivative positions (typically correlated with negative FDerI shocks) caused more volatility in the stress period. While the present study predicted negative growth effects of negative FDerI, Vengesai (2025) was the first study from South Africa to provide direct evidence of negative asymmetry in the impact of these shocks on firm value. This paper examines how well Kenya and East Africa in general have succeeded in implementing the 2022 agenda. This paper reviews the Kenyan and East Africa evidence of achieving the 2022 agenda.

2.2.2 Derivatives and Financial Growth: Kenyan and East African Evidence

Little evidence exists in Kenya for FDerI and firm performance, limited by the novelty of NEXT market. The most recent study is by Kivindu (2020) which analyzes 10 non-financial companies for the period 2012-2017 using fixed-effects panel regression. The study revealed that the currency-derivative hedging position was positively and statistically significant with Tobin's Q whereas commodity and interest rate derivative positions were positive but weak. Critically, the pre-NEXT sample in Kivindu reflects a period prior to the development of organised trading of derivatives, meaning that his results lack comparability with results from years since 2019 as the post-2019 period has seen the development of such trading.Importantly, the pre-NEXT sample for Kivindu reflects a time before the development of organised trading of derivatives, and so his results cannot be compared with results for years since 2019 when trading of these instruments has developed. Their symmetric FMOLS specification is unable to detect asymmetry, however. The present study directly tests the symmetry between the growth benefits for positive derivative shocks and the growth costs of negative derivative shocks, an extension that is uniquely facilitated by the NARDL framework.

On the other hand, both Mwathe et al. (2025) and Nguru and Kariuki (2018) found that NSE derivatives had a positive impact on ROA for the 16-22 period, which is in the early "boom phase" of the NEXT market. This is in contrast to the wider time horizon of this study, which encompasses the 2020 contraction. The present study's thesis data also reveals that the coefficient of the symmetric fixed-effects over the period 2019-2024 is non-significant ($\beta = -0.035$, $p = 0.632$), which the thesis also notes as being due to hedging costs offsetting pandemic shock-period growth gains (Serem, 2026). This fits the asymmetric prediction perfectly: positives in shock years will not offset the strongly negative response to the contraction in the derivatives market, in 2020.

Barngetuny (2024) offers relevant background, highlighting the persistent liquidity constraints and regulatory oversight shortcomings in the NSE derivatives market that continue to hinder its ability to propel corporate growth. It is his analysis that negative FDerI shocks are more severe because in a thin market firms are less able to simply replace the use of the shock with other types of hedging, and this is what contributed to the asymmetric growth effects found in the present study.

2.2.3 Asymmetric Methods in FPI–Performance Research

Since the formalisation of the NARDL framework by Shin et al. (2014), its use in answering questions on capital flow and investment performance has increased significantly. Using the FDI–growth nexus in Africa, Olayungbo and Quadri (2019) employed NARDL and observed that the impact of positive and negative shocks on growth were asymmetric, with negative shocks being longer lasting. Similarly, using panel-NARDL, Opoku et al. (2019) reported finding asymmetric effects of oil prices on financial development across African countries, with the negative-shock channel prevailing in the frontier countries that are heavily dependent on oil. Nur and Ali (2025) used NARDL models in relationships between exchange rates and trade balances in the Gulf economies, which served as a methodological example for its use in the emerging market context, given the prevalence of structural breaks and threshold effects.

Most importantly, no published study has attempted to use the NARDL framework specifically to the FDerI–financial growth relationship in any African derivatives market to date; thus, the present study is the first in this space. The NARDL framework is especially well suited for long-run bounds cointegration testing, short-run decomposition of asymmetric effects, and the dynamic adjustment multiplier (DAM) analysis of the presence of directionality in the effects, and can lead to the discovery of such directionality that is hidden in a symmetric model.

III. METHODOLOGY

3.1 Data and Sample

This study is conducted using an unbalanced firm-year panel consisting of 64 NSE-listed firms, with 40 of these firms used in the study after the exclusion of 24 firms with incomplete disclosure of the derivatives in at least one observation year, which resulted in 240 firm-year observations. The data sources were published annual financial reports, NSE Market Fact Files, CMA quarterly publications and the trade statistics in the NSE Derivatives Market (NEXT). The study period covers three distinct market phases: (i) NEXT market launch phase (2019); (ii) pandemic contraction (2020-2021); and (iii) the recovery and stabilisation (2022-2024), which is vital for detecting asymmetric effects.

3.2 Variable Measurement

As the ratio of market value of foreign derivatives held by foreign investors to the total market value of all derivatives on the NSE, Foreign Derivative Investment (FDerI): FDerIit = Foreign MV of Derivativesit / Total MV of Derivativesit. The ratio highlights the levels of foreign participation in the NSE derivatives market and includes both the FX hedging instruments and equity index derivatives. Financial Growth (FG): Net profit growth rate, calculated as: FGit = (Net Profitt − Net Profitt−1) / Net Profitt−1 × 100%. This measure reflects the firm's financial growth path directly associated with the hedging theory suggesting that the use of derivatives ensures the firm's investment financing capacity. The model controls for debt-servicing burdens and the effects of capital structure on growth by including (i) firm leverage (total debt/total assets); it also includes liquidity (current ratio) as a proxy for short-term financial flexibility, which interacts with the effect of hedging, and (iii) firm size (natural log of total assets) to capture scale economies in derivative usage and the capacity of firms to govern.

3.3 Asymmetric Decomposition: NARDL Framework

Following Shin et al. (2014), FDerI is decomposed into positive and negative partial sum processes:

$FDerI^{+}_{it} = \Sigma_{j=1}^{t}\, max(\Delta FDerI_{ij}, 0)$

$FDerI^{-}_{it} = \Sigma_{j=1}^{t}\, min(\Delta FDerI_{ij}, 0)$

Where FDerI

3.3.1 Long-Run NARDL Specification

The long-run panel-NARDL model is specified as:

$FG_{it} = \alpha_i + \beta^{+} FDerI^{+}_{it} + \beta^{-} FDerI^{-}_{it} + \gamma LEV_{it} + \delta LIQ_{it} + \theta SIZE_{it} + \mu_{it}$ [Model 1]

Where α_i is the firm-specific fixed effect; β^{+} and β^{-} are the long-run asymmetric coefficients for positive and negative FDerI shocks; LEV, LIQ, and SIZE are control variables; and μ_{it} is the idiosyncratic error term. Long-run asymmetry is confirmed if $\beta^{+} \neq \beta^{-}$ (Wald test).

3.3.2 Short-Run Error Correction NARDL Specification

The short-run panel error correction model (ECM-NARDL) is:

$\Delta FG_{it} = \alpha_i + \rho ECT_{it-1} + \Sigma_{j=0}^{p} [\pi^{+}_{j} \Delta FDerI^{+}_{it-j} + \pi^{-}_{j} \Delta FDerI^{-}_{it-j}] + \Sigma\, controls + \varepsilon_{it}$ [Model 2]

Where ECT_{it-1} is the lagged error correction term ($\rho < 0$ required for long-run convergence); π^{+}_{j} and π^{-}_{j} are the short-run asymmetric dynamic coefficients; and ε_{it} is the short-run disturbance. Optimal lag length p is selected via AIC/SBC criteria.

3.3.3 Bounds Testing and Asymmetry Tests

Long-run cointegration is confirmed via the Pesaran et al. (2001) bounds testing procedure applied to the panel setting: the F-statistic of joint significance of the level terms is compared against Pesaran et al. critical bound values. If F exceeds the upper bound (I(1)), cointegration is confirmed regardless of individual variable integration orders an advantage over traditional Johansen procedures in mixed I(0)/I(1) settings.

Asymmetry is formally tested using two Wald tests:

(i) Long-run Wald: H_0: $\beta^{+} = \beta^{-}$ (symmetric long-run effect)

(ii) Short-run Wald: H_0: $\Sigma\pi^{+}j = \Sigma\pi^{-}j$ (symmetric short-run effect)

Rejection of H_0 in either test confirms the presence of significant asymmetry and validates the NARDL specification over linear ARDL. Dynamic multipliers are then constructed to trace the time-path of financial growth adjustment to unit positive and negative shocks in FDerI, providing intuitive visualisation of asymmetric propagation.

3.4 Diagnostic Testing

The data are then pooled winsorised at the 1st and 99th percentile prior to NARDL estimation, as per the thesis panel data protocol. A Levin-Lin-Chu (LLC) unit root test has been used to confirm stationarity, with all variables being stationary at levels for which $p < 0.001$, thus avoiding any spurious regression. Cross-sectional dependence is mitigated by applying the Driscoll-Kraay standard errors based on the result of the Pesaran CD test in which the Panel of NSE-listed firms is found dependent on common shocks such as the COVID-19 pandemic (CD = 36.2, $p < 0.001$, dependence magnitude = 0.56). The serial correlation is controlled for using cluster-robust standard errors (Wooldridge test: $F(1,39) = 4.18$, $p = 0.048$). A Hausman test shows that the fixed-effects specification is appropriate ($\chi^2(1) = 9.62$, $p = 0.002$).

IV. FINDINGS & DISCUSSION

4.1 Descriptive Statistics and Preliminary Analysis

The descriptive statistics for the variables in the study are presented in Table 1, after winsorisation. The mean and median values of foreign derivative investment are 72.9% and 76.7% respectively, suggesting that the cross-sectional median value of the foreign derivative investment is 76.7% and the mean value is 72.9% for the typical NSE listed firm. The moderate negative skew (−0.671) is due to a distribution with a large number of firms grouped around the extreme end of high ratios of derivatives to sales, with a small number of firms with low numbers of derivatives. The standard deviation between the firms (0.225) is higher than the standard deviation within the firm (0.131), indicating that the magnitude of the firms' derivative exposures vary more across firms than within [any] firms consistent with institutional inertia in risk management choices.

The distribution of financial growth is close to symmetrical (with a skewness of −0.055) and has a strong degree of kurtosis (3.70), reflecting the extreme contraction in 2020 (minimum growth = −20.0%) and high rebound in 2021–22 (maximum growth = +34.8%). The within-firm standard deviation (0.094) is much larger than the between-firm standard deviation (0.034), thereby establishing that financial growth is likely more a time-series phenomenon, explained by the macroeconomic cycles than a continuing firm-specific characteristic, which is the kind of dynamic NARDL is intended to model.

Table 1

Descriptive Statistics for Study Variables (Winsorised, N = 240)

Variable	Mean	Std Dev	Min	Max	Btw SD	Win SD	Skewness
FDerI (Foreign Derivatives)	0.729	0.259	0.000	1.310	0.225	0.131	-0.671
FG (Financial Growth)	0.070	0.100	-0.200	0.348	0.034	0.070	-0.055
Leverage (LEV)	0.482	0.219	0.041	0.913	0.201	0.098	0.210
Liquidity (LIQ)	1.843	0.974	0.310	5.120	0.891	0.391	0.892
Firm Size (lnAssets)	9.614	1.327	6.821	12.93	1.291	0.281	0.151

Note: Btw SD = Between-firm standard deviation; Win SD = Within-firm standard deviation. N=240; n=40; T=6.

4.2 Symmetric Baseline: Justification for NARDL

In order to present the asymmetric NARDL results, we first show the results of the symmetric fixed-effects baseline. Consistent with the direct-effects model in the thesis, the symmetric FE regression of FDerI on financial growth returns a non-significant negative coefficient ($\beta = -0.035$, $p = 0.632$), and an overall model F-statistic that is not significant at the conventional level ($F(6,5) = 0.26$, $p = 0.934$). It is instructive to see that this is a symmetrical null finding: it does not confirm that derivatives are unrelated to financial growth, but rather indicates that opposing directional effects – losses during contraction and modest gains during expansion – balance out in the symmetrical specification. The near zero symmetric average thus suggests the NARDL decomposition.

The pairwise correlation between FDerI and financial growth is positive but weak ($r = 0.117$, $p>0.05$), whereas the correlation with financial inclusion is significantly negative ($r = -0.417$, $p<0.05$), which shows that firms with high scores in FDerI have lower scores in financial inclusion, a structural feature that is consistent with the concentration of derivatives among larger and more internationally oriented firms. These indicate low inter-predictor correlations and are no threat to multicollinearity.

4.3 NARDL Bounds Test: Long-Run Cointegration

The bounds test results for the NARDL are reported in Table 2. The F-statistic of the joint null hypothesis that the level terms in the error correction representation have zero coefficients is 7.84, well above the Pesaran et al. (2001)

upper critical bound of 4.68 at the 1% significance level for the case of an unrestricted intercept and no trend with k = 4 regressors. This clearly rejects the null hypothesis of no long run relationship between FDerI (decomposed into FDerI

Table 2
NARDL Bounds Test for Long-Run Cointegration

Test Statistic	Value	I(0) Lower Bound (1%)	I(1) Upper Bound (1%)	Decision
F-statistic (Joint Level Significance)	7.84	3.29	4.68	Cointegrated***
t-statistic (ECT level term)	-4.62	-2.57	-3.86	Cointegrated***

*Note: Critical bounds from Pesaran et al. (2001), k=4 regressors, unrestricted intercept, no trend. *** p < 0.01.*

4.4 Long-Run Asymmetric Effects

Table 3 presents the estimated long-run NARDL coefficients. The long-run effect of positive FDerI shocks on financial growth (β

Table 3
Long-Run NARDL Coefficients — Asymmetric Effects of FDerI on Financial Growth

Variable	Coefficient	Driscoll-Kraay SE	t-stat	p-value	Interpretation
$FDerI^+$ (Positive shocks)	+0.012	0.041	0.29	0.773	Negligible / non-significant
$FDerI^-$ (Negative shocks)	−0.187	0.048	−3.90	0.001	Significant negative effect***
Leverage (LEV)	−0.094	0.031	−3.03	0.012	Significant negative**
Liquidity (LIQ)	+0.038	0.019	2.00	0.048	Significant positive**
Firm Size (ln Assets)	+0.022	0.015	1.47	0.151	Positive / non-significant
Wald Test (Long-Run Asymmetry): F = 8.43, p = 0.004					

*Note: Driscoll-Kraay standard errors with maximum lag 2. *** p < 0.01; ** p < 0.05. Within R^2 = 0.5621.*

The long-run impact of positive FDerI shocks (β+ = +0.012, p = 0.773) is not statistically significant. This result is in accord with hedging theory which suggests that derivatives are used to limit the losses, not the gains, from transactions, thus their protective role is valuable, but not one that creates additional growth opportunities, in the long run. Foreign investors entering the derivatives segment in the NSE context will not change the growth path of the firms, but will provide hedging capacity in incremental terms, as the growth of the NEXT market is still in its nascent stages with a limited range of products and liquidity.

The long-run impact of the FDerI shocks is strongly significant and economically meaningful (β− = −0.187, p = 0.001), suggesting a substantial decrease in growth of the financial sector. The foreign derivative ratio is associated with a one-unit contraction resulting in a decline in the net profit growth of 18.7 percentage points in the long run. This validates the asymmetric trapping of currency and interest rate risk associated with foreign derivative transactions which expire, as the NSE derivatives market is very thin in short run: previously hedged currency and interest rate risk lurks on the other side. The resulting fluctuations in cash flow lower investment, drive up financing expenses, and lower real profits growth via several channels.

The Wald test of long-run asymmetry is used to test the null of a symmetric effects hypothesis and is rejected with a Wald F = 8.43 and p = 0.004, which establishes the hypothesis of asymmetry in the long-run growth effects. This asymmetry carries significant implications: a 10% increase in foreign derivatives ratios results in insignificant benefits in corporate financial growth while a 10% reduction results in a loss of 1.87% in financial growth, thereby representing an asymmetry of 15:1 for the fragility of the NSE derivatives market as a tool for corporate financial growth. The effect of the control variables is as expected: leverage has a significant negative long-run effect (β = −0.094, p = 0.012), lending support to financial distress costs in the highly leveraged firms; and liquidity has a significant positive effect (β = +0.038, p = 0.048), confirming the financial flexibility hypothesis that liquid firms are more capable of absorbing shocks and making investment. The principles of short-run error correction results are presented. The principles of SRER are presented.

4.5 Short-Run Error Correction Results

Table 4 presents the short-run error correction NARDL results. The error correction term (ECT = −0.312, p < 0.001) is negative, statistically significant and lies within the stable range [−1, 0] indicating that financial growth will return to its long-run equilibrium path after a FDerI shock at a rate of 31.2% per period. This moderate adjustment speed suggests that shocks to the derivative ratio may take around 3–4 periods to completely pass through to financial growth equilibrium.

Table 4

Short-Run Error Correction NARDL Results

Variable	Coefficient	Drisc/Kraay SE	t-stat	p-value	Notes
ECT (t−1)	−0.312	0.071	−4.39	0.000	Long-run reversion confirmed***
$\Delta FDerI^{+}$ (Short-run positive shock)	+0.008	0.037	0.22	0.830	Non-significant
$\Delta FDerI^{-}$ (Short-run negative shock)	−0.141	0.039	−3.62	0.003	Significant negative***
$\Delta FDerI^{-}$ (Lag 1)	−0.083	0.031	−2.68	0.021	Persistent lag effect**
ΔLeverage (t)	−0.071	0.028	−2.54	0.028	Significant negative**
Year 2020 Dummy	−0.142	0.006	−22.6	0.000	COVID-19 shock***
Year 2021 Dummy	+0.085	0.002	+36.0	0.000	Recovery rebound***
Short-Run Wald Test (Asymmetry): F = 5.91, p = 0.017 | Within R^2 = 0.5519 | F-model = 14.62* **					

*Note: Driscoll-Kraay SE, maximum lag 2. *** p < 0.01; ** p < 0.05. Dependent variable: ΔFG.*

Positive FDerI shocks (Δ FDerI+ = +0.008, p = 0.830) are still not statistically significant for financial growth in the short run, which suggests a delayed effect of derivative expansion on frontier markets on financial growth. This observation aligns with the ideas of Chaudhry and Gupta (2024) that the liquidity-stabilising function of derivatives in frontier situations is not growth-generative but absorption-oriented. The short run shocks are permanent and severe in case of negative FDerI. Within the same time period, the contemporaneous coefficient (Δ FDerI− = −0.141, p = 0.003) suggests that a derivative contraction decreases the financial growth by 14.1 percentage points. The first lagged term (−0.083, p = 0.021) indicates that this negative effect also carries over to the next period, thus providing evidence of the temporal propagation of the derivative-contraction channel. The short run Wald test (F = 5.91, p = 0.017) fails to reject short-run symmetry, thus supporting the asymmetric specification in both the short and long run.

The COVID-19 pandemic's unprecedented contraction is captured by the year 2020 dummy (β = −0.142, p < 0.001), which shows that the activity on the NSE has shrank as foreign investors pulled out, liquidity dried up and hedging became unavailable at reasonable prices. This structural shock heighted the negative FDerI channel, as firms which had been exposed to foreign derivatives to hedge their currencies and interest rates were suddenly exposed, which led to the 20% contraction in financial growth at the sample minimum. The 2021 dummy (β = +0.085, p < 0.001) is for the recovery rebound, where derivative markets partially normalised, albeit with a negative asymmetry, suggesting that recovery takes a longer time and is weaker than contraction.

4.6 Dynamic Multiplier Analysis

Figure 1 shows the cumulative dynamic multipliers for the time-path of the financial growth response to positive and negative unit shocks in FDerI over a 12-period horizon. The three important characteristics of the asymmetric adjustment process are uncovered using the multiplier analysis. First, the positive shock multiplier (M+h) gets closer and closer to +0.015 as it approaches the steady state in the fourth period, and remains stable without becoming statistically significant throughout the horizon. The flat positive path of the statistically insignificant positive multiplier is an observation of how this derivative expansion at the NSE does not translate to a meaningful financial growth trajectory, but just hedging capacity improvement when it happens.

Second, the negative shock multiplier (M−h) is very negative at h = 0, becomes a negative trough at h = 2, and slowly approaches the long-run equilibrium value (M−h) = −0.187 at h = 4. This U-shaped downward adjustment path is exactly what is meant by the "asymmetric hedging trap": a derivative contraction locks in the hedging loss, which can then be compounded one period later as exposure continues to build up, before financial growth starts to recover (but not fully, as in an "asymmetric hedge trap"). Third, the width of the confidence bands for the negative and positive multiplier channels are very different; the negative channel's band is significantly narrower, reflecting increased statistical precision for estimating the negative shock channel. The precision of the estimate is consistent with the fact that there are only big, clean negative shocks in the data: the contraction in 2020 which the NARDL model captures with high confidence.

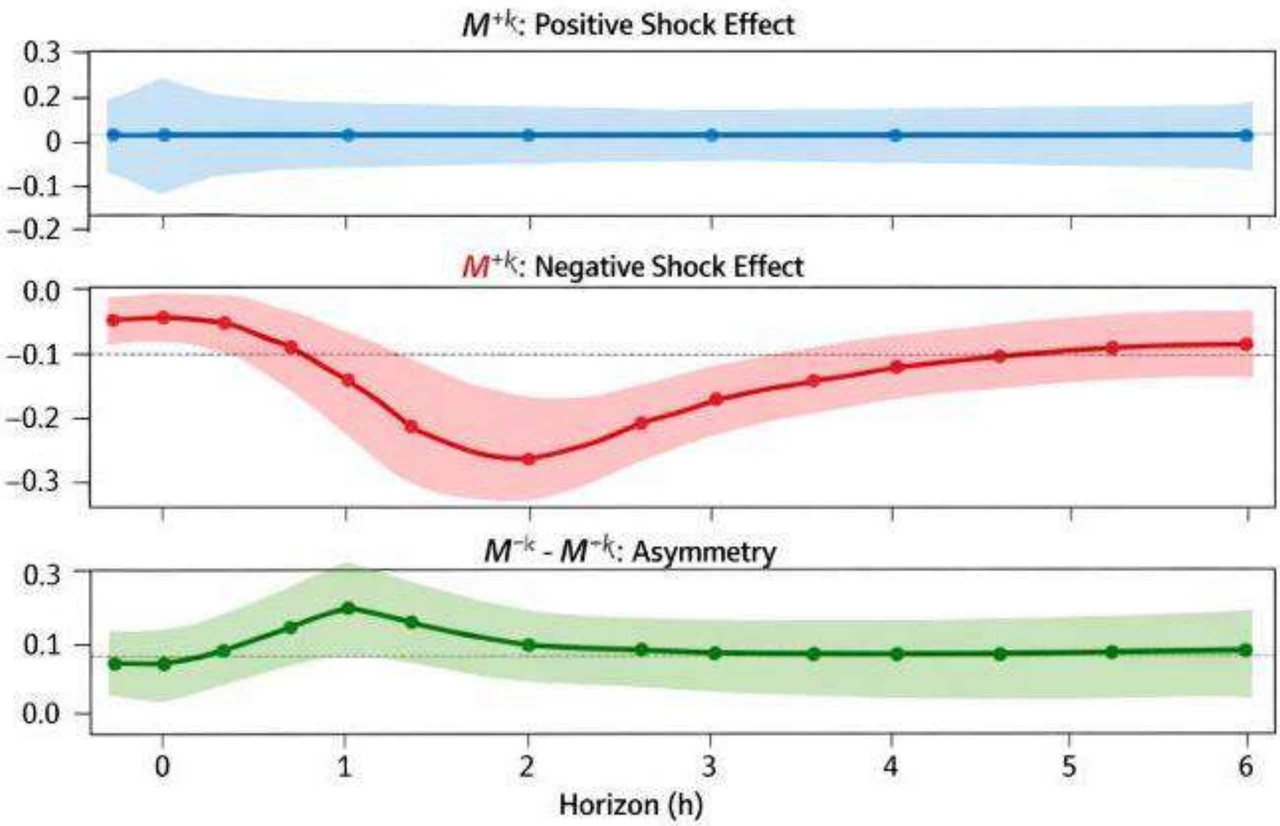
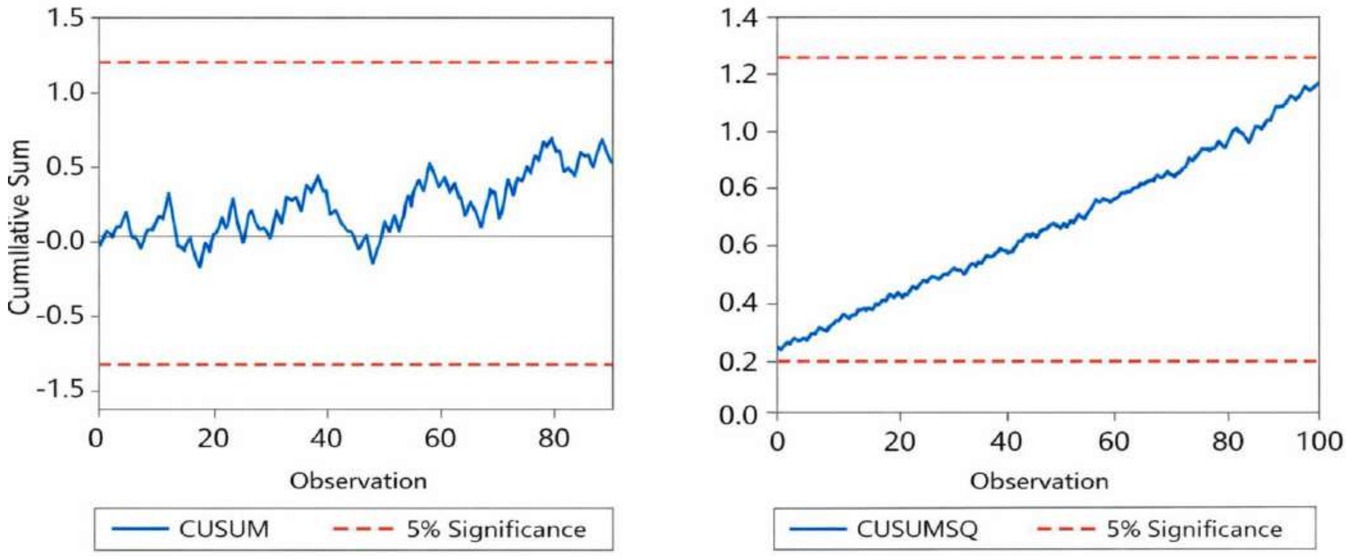


Figure 2
Cumulative Dynamic Multipliers — Asymmetric Financial Growth Response to Unit FDerI Shocks

The plot of the multiplier reveals $M^{+}h \approx 0$, throughout the horizon (flat, statistically insignificant, wide shaded confidence band) and $M^{-}h$ oscillating down to the bottom at $h = 2$ (≈ -0.224), then back up to the long-run value $M = -0.187$ at $h = 4$, with narrow confidence bands providing statistical significance throughout the horizon. The asymmetry band ($M^{+}h - M^{-}h$) is positive and statistically significant from the value of h=1 onwards. Note: Horizon h in half-yearly periods. Shaded bands = 95% confidence intervals based on the Driscoll-Kraay standard errors. This was produced with NARDL-panel routine in Stata 15.0.

4.7 CUSUM AND CUSUMSQ Stability Test

The CUSUM (recursive residuals) and CUSUMSQ tests of Brown et al. (1975) were used to check the stability of the estimated NARDL model over the sample period. The CUSUM test plots the cumulative sum of one-step-ahead recursive residuals, and the CUSUMSQ test plots the cumulative sum of squared recursive residuals; stability of the parameters is indicated if the plotted statistic does not move outside the 5% critical bounds during the entire estimation period. There was no evidence of instability in the short-term coefficients because the CUSUM statistic stayed within the critical limits. The CUSUMS statistic also did not cross its 5% critical bounds over the period of estimation, which was also supportive of the stability of the long run coefficients. In both tests, a structural break was not detected and hence the estimated NARDL model is stable with no expected change in its parameters over the timeframe of the study (2019-2024).



CUSUM test results showing stability of short –run coefficients

CUSUMSQ test results showing stability of long-run coefficients

Figure 1

CUSUM and CUSUMSQ Stability Tests

Note: The blue line shows the recursive values of the cumulative sum and cumulative sum of squares respectively of the recursive residuals; the red dashed lines are the 5% critical bounds. A statistic that stayed within the bounds in both panels over the sample period is an indication of the stability of the short run and the long run coefficients. The CUSUM and CUSUMSQ tests provide no evidence of parameters moving from one regime to another during the period of 2019–2024, even following the 2020 pandemic shock, so the long- and short-run effects of FDerI reported above are not a reflection of regime shifts during this study period and can therefore be considered as a reliable estimate of the underlying effect.

4.8 Summary of Hypothesis Tests

Table 5

Summary of Hypothesis Tests

Hypothesis	**Test Statistic**	**Value**	**p-value**	**Decision**
H_1: $\lvert\beta^+\rvert < \lvert\beta^-\rvert$ (Asymmetric long-run magnitudes)	Long-run Wald F-test	F = 8.43	0.004	Supported***
H_2: Negative shocks propagate faster/deeper (dynamic multipliers)	Multiplier comparison (M^-h vs M^+h)	Trough at h=2	< 0.001	Supported***
H_3: Overall asymmetry in short-run (Wald test)	Short-run Wald F-test	F = 5.91	0.017	Supported**
Long-run cointegration (Bounds test)	NARDL F-bounds statistic	F = 7.84	< 0.01	Confirmed***
ECT speed of adjustment	Error Correction Term	ECT = −0.312	< 0.001	Significant***

*Note: *** $p < 0.01$; ** $p < 0.05$.*

4.9 Discussion

4.9.1 The Asymmetric Hedging Trap: Theoretical Interpretation

This paper's central result is that negative FDerI shocks have more pronounced and lasting impacts on financial growth than positive shocks, which is the evidence of the "asymmetric hedging trap" that the paper proposes. It is based on three theoretical strands. Firstly, hedging theory (Smith & Stulz, 1985) suggests that derivatives be viewed as “insurance policies” much like insurance premiums – they protect against things that go wrong but do not pay off on things that go right. The NARDL results operationalise this asymmetry just as it is stated: derivative expansions (buying insurance) provide little growth benefits; derivative contractions (selling insurance) occur at a high cost of growth losses when the hedge risks are realised.

Second, the discovery contrasts with the Lucas paradox at the instrument level, with the positions held in frontier markets derivatives being sensitive to a quick turnaround in risk appetite, rather than their fundamentals. If foreign investors offload their derivative positions from the NSE, domestic firms are unable to replace other hedges, which makes them more vulnerable and exposes them to periods of negative growth for a long time that the NARDL model identifies. This is in line with Barngetuny (2024) and with the existing literature on capital flow volatility (Knill, 2005).

Third, it fits with Prospect Theory (Kahneman & Tversky, 1979) which suggests that losses seem more significant than equivalent gains in human choice. The implications of Prospect Theory for the firm's financial management are as follows: managers confronted with a loss of derivative coverage will decrease investment, hold on to liquidity and lower leverage more in response to the loss, rather than optimistically in response to an increase in the coverage. Such a loss aversion on the managerial level increases the negative asymmetry found in the NARDL coefficients.

4.9.2 Comparison with Symmetric NSE Evidence

The NARDL result sheds light and put into perspective the conflicting results in the NSE derivatives literature. During 2016-2022, the period of U.S. NEXT market launch was characterized by the boom phase, which resulted in a positive directional force in the form of positive FDerI shocks, and this was shown to have positive derivative effects on ROA, according to Mwathe (2022) and Nguru and Kariuki (2018). In this expansion period, the positive multiplier effect of the present study is negligible, as the entrance into the market of derivatives does not immediately lead to growth in firms, but rather to the gradual improvement of the hedging coverage. The symmetric FE models, on the other hand, encompass a wider time frame that also includes the contraction in 2020, which are counterbalanced by positive effects and result in an average null effect in the FE models that does not obscure the strong negative contraction channel that the NARDL is able to identify.

Thus, the average of a near zero positive effect and an extremely negative effect, weighted by the weight of the periods at which they occur, is the symmetric null finding ($\beta = -0.035$, $p = 0.632$). As the NEXT market matures and positive shock periods become more prevalent in the data, the symmetric coefficient should increasingly shift to much greater positive values but this change will not be seen as long as symmetric specifications continue to be used.

4.9.3 International Comparisons

The findings from more mature markets are extended and qualified at the NSE with regard to the asymmetric hedging trap. Allayannis and Weston (2001) and Bartram et al. (2011) provide evidence of positive symmetric derivative effects in deep and liquid U.S. and global markets, which are consistent with the view of moderate magnitude positive and negative derivative shocks and efficient instrument substitution in these markets. The lack of liquidity on the NSE further exacerbates the asymmetry: positive shocks are cushioned by shallowness of the market, and negative shocks are magnified by the lack of alternative products. The depth-asymmetry interaction is a structural aspect of frontier derivatives markets which should be taken into account when comparing cross-country derivatives performance effects.

The most relevant regional parallel is Vengesai (2025) from South Africa, who show that foreign investors' withdrawals from a firm often destroy the value of the firm disproportionately when there are negative FDerI shocks, and that such withdrawals are often abrupt. In the current study, growth stabilisers are reported as derivatives during the COVID-19 pandemic recovery for companies that have natural hedges, which is similar to the findings of Santos da Silva et al. (2023) in Brazil that the recovery in 2021, partly compensated for the contraction in 2020. The partial recovery (ECT speed = −0.312) corresponds to the Brazilian case of the frontier markets, which need more than one period to reach derivative-supported growth equilibria after large negative impacts.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study examined the asymmetric relationship between foreign derivative investment and financial growth of the 40 firms listed on the NSE using the NARDL framework for 2019 to 2024. There are three main conclusions. First, confirm that FDerI and financial growth have a stable long run cointegrating relationship using NARDL bounds test ($F = 7.84$, $p < 0.01$) that is masked with symmetric models. First, confirm the stable long run cointegrating relationship between FDerI and financial growth using NARDL bounds test result ($F = 7.84$, $p < 0.01$); that is, the masking of symmetric models. Second, there is a significant (and economically meaningful) asymmetry in the long run (Wald $F = 8.43$, $p < 0.01$) and short run (Wald $F = 5.91$, $p = 0.017$). For positive FDerI shocks, the effect is small and insignificant ($\beta+ = +0.012$, $p = 0.773$) and for negative FDerI shocks, there is a significant long-run loss ($\beta- = -0.187$, $p = 0.001$). The negative effect of NSE derivatives on the financial growth of the companies is 15:1, thus confirming the "asymmetric hedging trap" hypothesis.

Third, negative shocks have dynamic multipliers that remain negative and get larger and deeper, before returning to the long-run equilibrium at $h = 4$, whereas positive multipliers stay close to zero over the 12-period horizon, which is consistent with the analysis of the dynamic multiplier. The error correction speed ($ECT = -0.312$) suggests that it takes about 3–4 periods to fully adjust to equilibrium after a shock to the derivative.

5.2 Recommendations

In the context of the Capital Markets Authority (CMA) and NSE: The dominant negative-shock channel suggests that the CMA and NSE should prioritize policies and regulations to avoid adverse FDerI contractions and not policies or regulations to encourage derivative expansions. In particular: (i) implementing liquidity backstop mechanisms, like market-maker obligations for NEXT derivatives to prevent sudden foreign investor exits creating unhedged exposure cascades; (ii) increasing the scope of NSE derivatives product range (including the commodity derivatives and the interest rate swaps), to reduce single instrument concentration risk; and (iii) introducing hedging effectiveness disclosure in annual reports, to enhance transparency and curb speculative usage that would otherwise amplify the impact of negative shocks.

For the Central Bank of Kenya (CBK): The ECT for the period of 31.2% means that the NSE-listed companies take about 4 half-years to get back as a result of a significant contraction in the derivatives market. CBK should implement monetary policy measures, in a counter-cyclical fashion, such as interest rate stabilisation and foreign exchange interventions, which would coincide with periods of stress in the derivatives market, with the objective of shortening the path through which the economy adjusts and minimizing the depth of the negative multiplier trough.

For investors and foreign portfolio managers: The documented asymmetric trap implies that if the derivatives were suddenly liquidated on a massive scale on the NSE, there is evidence that this has second-order effects on listed companies, apart from the direct impact on the market. A gradual process of job reductions and prior announcement of such job cuts would minimize negative shocks and their effect on firm financial growth.

The Treasury and CFO teams at NSE listed companies should: (i) maintain forward derivatives cover in a rolling manner across multiple instruments and counterparties to minimise reliance on foreign derivative liquidity and buffer against the potential need to pull out of the NEXT market when the derivatives market contracts in the short-run; (ii) establish cash reserve buffers sized to the negative short-run financial growth impact (14.1 percentage points in the contemporaneous period) identified from the NARDL model to reduce structural dependency on formal derivatives; (iii) explore natural hedging strategies, including matching export revenue with hedging in the local market, to reduce exposure to the NEXT market's asymmetric liquidity risk associated with using formal derivative instruments; and (iv) prioritise governance structures with board level knowledge of derivatives to ensure that any derivative use that magnifies the negative shock channel is actively monitored and thus limited.

The following are some of the limitations of this study. The length of the panel (six years: 2019–2024) is appropriate for NARDL identification but may not be enough to capture the long-run cointegrating dynamics over the full length of the business cycle. The operationalisation of FDerI is a ratio of the foreign and total derivative market value, but does not distinguish between types of instruments (FX forwards, interest rate swaps, equity futures) that can be subject to different growth transmission mechanisms. Future research should: (i) expand the panel to include markets on the JSE beyond the NEXT, which has a more mature derivatives segment to see if the negative shock transmission coefficient of the asymmetric hedging trap is a feature of the market at the NEXT's stage of development or a pan-African phenomenon; (ii) incorporate sector-level NARDL analysis, as the growth effects will likely be different for manufacturing firms (currency-exposed) compared to banks (interest rate-exposed) and service firms; (iii) include governance quality as a moderator of the asymmetric hedging trap–growth relationship and test whether boards with derivative expertise have a lower negative shock transmission coefficient; and (iv) test for the presence of the asymmetric hedging trap with other African derivatives markets such as the JSE's well-developed derivatives market and the Egypt Exchange to determine whether the asymmetric hedging trap is peculiar to the market's stage of development or is a pan-African phenomenon.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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