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OPERATING LEVERAGE AND FINANCIAL PERFORMANCE OF LISTED MANUFACTURING FIRMS IN KENYA

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Abstract
Leverage is a critical determinant of financial performance in manufacturing firms due to the high proportion of fixed operating costs in capital-intensive production. In Kenya, listed manufacturing firms operate in a volatile environment characterized by fluctuating demand, cost uncertainty, and competitive pressures, making operating leverage a key strategic concern. While higher operating leverage can enhance profitability during periods of revenue growth, it may also increase earnings volatility and business risk during economic downturns. This study examines the effect of operating leverage on the financial performance of listed manufacturing firms in Kenya. A descriptive quantitative research design was adopted, guided by trade-off theory and operating leverage theory. The study employed a census approach, using secondary panel data from audited financial statements of firms listed on the Nairobi Securities Exchange over the period 2014–2023. Financial performance was measured using return on assets (ROA), while operating leverage was proxied by the degree of operating leverage (DOL). Panel regression analysis was conducted following diagnostic tests to ensure model robustness. The findings reveal that operating leverage has a positive and statistically significant effect on financial performance. Higher operating leverage improves profitability during periods of sales growth but also increases earnings volatility under declining demand. The study highlights the importance of optimizing cost structures and provides insights for managers, investors, and policymakers in enhancing firm resilience.

Keywords: Operating Leverage, Financial Performance, Manufacturing Firms

1. Introduction

The manufacturing sector has long been recognized as a key driver of economic growth, structural transformation, and sustainable development. Classical and modern growth theorists emphasize that manufacturing enhances productivity through economies of scale, learning-by-doing, and technological spillovers (Kaldor, 1967; Arrow, 1962). Kaldor (1967) describes manufacturing as the "engine of growth" due to its strong forward and backward linkages with other sectors, while Rodrik (2013) highlights that manufacturing-led industrialization remains crucial for developing economies pursuing inclusive growth, employment creation, and export diversification. Consequently, many developing countries prioritize manufacturing as a central pillar of national development strategies.

In Kenya, the manufacturing sector occupies a strategic role in the national development agenda. Kenya's Vision 2030 and successive Medium-Term Plans identify manufacturing as a driver of middle-income status through enhanced productivity, technological innovation, and reduced reliance on primary agricultural exports. The sector contributes significantly to employment creation, tax revenues, and industrial linkages that stimulate growth in allied sectors, including transport, energy, construction,

and financial services (World Bank, 2022). Despite these aspirations, manufacturing's contribution to Kenya's gross domestic product has remained relatively low and declining in recent years (KNBS, 2023). This performance gap raises concerns about the financial sustainability and competitiveness of firms, particularly those listed on the Nairobi Securities Exchange (NSE), such as Bamburi Cement PLC, BAT Kenya PLC, and East African Breweries Limited (EABL).

Listed manufacturing firms operate in a complex and volatile environment characterized by rising production costs, high electricity tariffs, exchange rate fluctuations, intense competition from imports, and persistent infrastructure constraints. Porter (2008) emphasizes that firms in competitive markets must continuously refine cost structures to sustain profitability. However, emerging market conditions, including macroeconomic instability, weak institutional frameworks, and exposure to external shocks, amplify operational uncertainty (Ayyagari, Demirgüç-Kunt, & Maksimovic, 2011). In Kenya, these challenges manifest in fluctuating profitability among listed manufacturing firms, highlighting the need to understand how internal operational decisions influence financial performance.

One critical operational decision is operating leverage, defined as the extent to which a firm's operating costs are fixed and the sensitivity of operating income to changes in sales volume (Garrison & Noreen, 2003). Mandelker and Rhee (1984) demonstrate that firms with higher operating leverage experience greater variability in operating profits in response to sales fluctuations, magnifying gains in periods of growth and losses during downturns. Chen, Harford, and Kamara (2018) further note that operating leverage is a key source of business risk and a determinant of firm performance, yet it remains underexplored relative to financial leverage.

Operating leverage is especially relevant in manufacturing due to the capital-intensive nature of production. Investments in plant, machinery, automation, and specialized labor increase fixed costs, reducing short-term flexibility in adjusting expenses when demand declines (Drury, 2018). While high fixed costs can generate economies of scale and cost efficiencies at optimal capacity (Horngren, Sundem, & Stratton, 2014), they also expose firms to financial distress when sales fall below break-even levels. This trade-off between profitability and risk aligns with the trade-off theory of cost structure decisions (Pandey, 2015).

Kenya's operating environment further amplifies the implications of operating leverage. Firms face volatile raw material prices, exchange rate instability, policy uncertainty, and evolving regulatory frameworks. The COVID-19 pandemic and subsequent global supply chain disruptions vividly illustrated the vulnerability of firms with rigid cost structures. Ding et al. (2021) found that firms with high operating leverage suffered larger declines in earnings during the pandemic due to limited capacity to adjust fixed costs. Similar patterns were observed across emerging markets, emphasizing the importance of aligning cost structures with demand uncertainty.

The manufacturing sector is a critical pillar of Kenya's economic development, contributing significantly to employment creation, industrial output, and export earnings. Despite its strategic importance, the sector has faced persistent financial performance challenges over the past decade, including declining profitability, firm closures, and operational restructuring among several listed manufacturing firms (Kenya Association of Manufacturers [KAM], 2014; Kenya Institute for Public Policy Research and Analysis [KIPPRA], 2013). Data from the Nairobi Securities Exchange (NSE) indicate that the average return on assets (ROA) for listed manufacturing and allied firms declined from

approximately 9.3% in 2016 to 7.2% in 2021, and further dropped to 0.53% by 2023 (NSE, 2022; ir-library.ku.ac.ke, 2023). Individual firms illustrate this downward trend: Mumias Sugar's ROA fell from 2.5% in 2014 to 0.02% in 2016, while East African Breweries Limited (EABL) recorded ROA levels fluctuating around 0.6–0.7% between 2014 and 2017 (ir-library.ku.ac.ke, 2023). These trends highlight declining profitability and reduced investor confidence, raising concerns about the sector's sustainability and competitiveness.

A structural characteristic of manufacturing firms is their reliance on fixed operating costs arising from capital-intensive production processes, automation, and long-term contractual obligations. This cost structure gives rise to operating leverage, which amplifies the effect of changes in sales on operating income. While operating leverage can enhance profitability during periods of rising demand by spreading fixed costs over higher output levels, it can also magnify losses during periods of declining sales, increasing earnings volatility and operational risk (Brealey, Myers, & Allen, 2010; Pandey, 2015). In an environment characterized by fluctuating demand, rising input costs, and macroeconomic uncertainty, operating leverage becomes a critical determinant of financial performance.

Financial performance, a central concern for managers, investors, and policymakers, is commonly assessed using accounting-based measures. Return on assets (ROA) is widely recognized as a robust indicator because it reflects management's effectiveness in deploying assets to generate earnings (Brealey, Myers, & Allen, 2010). For manufacturing firms, ROA is particularly appropriate as it captures both operational efficiency and asset utilization, key drivers of performance in production-intensive industries (Penman, 2013). Examining the relationship between operating leverage and ROA provides insight into how operational decisions translate into financial outcomes.

Empirical evidence on the operating leverage–financial performance relationship is mixed. Some studies report positive effects, suggesting that higher operating leverage enhances profitability through economies of scale and cost efficiency (Gatsi, Gadzo, & Akoto, 2013; Saleem, Rahman, & Sultana, 2011). Conversely, others warn that excessive operating leverage increases earnings volatility and business risk, negatively impacting performance during downturns (Lord, 1996; Javed, Rasheed, & Khan, 2015). Much of the literature focuses on financial leverage, with operating leverage receiving limited attention, particularly in developing countries where market conditions differ substantially from developed economies.

In the Kenyan context, most empirical studies on firm performance have focused predominantly on financial leverage or overall capital structure, often overlooking operating leverage as a distinct and independent driver of financial outcomes (Oguna, 2021). This omission is significant because operating leverage directly reflects managerial decisions on cost structure and production strategy, which are especially relevant in manufacturing firms where fixed costs are substantial. The limited focus on operating leverage creates a conceptual and empirical gap in understanding how cost structure dynamics affect firm performance in Kenya's manufacturing sector.

Given the persistent decline in ROA among listed manufacturing firms, coupled with mixed evidence on the leverage-performance relationship, there is a need for a focused empirical investigation into the effect of operating leverage on financial performance. The urgency of this research is underscored by the declining profitability trends and the lack of context-specific evidence on how operating leverage influences firm performance in Kenya's manufacturing sector. Without a clear understanding of this relationship,

managers may continue to adopt suboptimal cost structures that increase risk without commensurate returns, while policymakers may lack evidence to design interventions that enhance sector resilience.

Therefore, this study aims to examine the effect of operating leverage on the financial performance of listed manufacturing firms in Kenya, using return on assets (ROA) as the primary indicator of performance. Specifically, the research seeks to determine the direction and magnitude of the relationship between operating leverage and financial performance, and to provide empirical evidence that can inform managerial decisions on cost structure optimization, guide investor risk assessment, and support policy formulation to strengthen the manufacturing sector.

The findings of this research are expected to provide both theoretical and practical contributions. Theoretically, the study extends the application of cost-volume-profit and operating risk theories to the context of an emerging economy, offering new insights into how operating leverage affects firm performance in environments characterized by macroeconomic volatility and institutional constraints. Practically, the results will offer actionable guidance for manufacturing firm managers in designing optimal cost structures, assist investors in evaluating operational risk-return trade-offs, and inform policymakers in developing targeted interventions to enhance the resilience and competitiveness of Kenya's manufacturing sector. By addressing these objectives, the study aims to contribute to the broader goal of strengthening the manufacturing sector as a driver of sustainable economic development in Kenya.

2. Theoretical Background

2.1 Trade-Off Theory

The trade-off theory of capital structure, developed by Kraus and Litzenberger (1973) and refined by Myers (1984), posits that firms determine optimal financing and cost structures by balancing the benefits and costs associated with fixed commitments. While traditionally applied to financial leverage, this theory extends logically to operating leverage because fixed operating costs, such as depreciation, automation, and long-term contractual obligations, similarly involve trade-offs between efficiency gains and risk exposure.

From an operating leverage perspective, fixed costs can enhance profitability when firms operate above break-even levels. Increased sales lead to a greater-than-proportional increase in operating income because fixed costs are spread over higher output levels, generating economies of scale (Pandey, 2015). Conversely, high fixed costs increase vulnerability to fluctuations in sales, magnifying losses during periods of declining demand and potentially leading to financial distress (Brealey, Myers, & Allen, 2010). In the context of Kenyan listed manufacturing firms, the trade-off theory provides a framework to evaluate whether the adoption of high fixed operating costs improves profitability or exposes firms to excessive operational risk.

2.2 Conceptual Framework

The conceptual framework of this study illustrates the relationship between operating leverage as the independent variable and financial performance as the dependent variable. Operating leverage, measured by the Degree of Operating Leverage (DOL), reflects the sensitivity of operating income to changes in sales volume. Financial performance is measured using Return on Assets (ROA), which captures management's effectiveness in deploying assets to generate earnings.

The framework posits that operating leverage has a significant effect on financial performance, with the direction and magnitude of this effect depending on firm-specific characteristics, industry conditions, and macroeconomic factors.

Figure 1. Conceptual Framework

2.3 Hypothesis Development

Based on the theoretical framework and empirical review, the following hypothesis is proposed:

H_{01}: Operating leverage does not significantly affect the financial performance of listed manufacturing firms in Kenya.

2.4. Operating Leverage and Financial Performance

Empirical literature on operating leverage and financial performance highlights a complex and context-dependent relationship. Operating leverage, measured by the Degree of Operating Leverage (DOL), reflects the proportion of fixed costs in a firm's cost structure and determines how changes in sales translate into changes in operating income. Firms with high operating leverage benefit from amplified profits when sales increase but face higher risk during downturns, consistent with the risk–return trade-off theory and operating leverage theory (Ross, Westerfield, & Jordan, 2022). Evidence from international studies indicates that this relationship varies across industries, markets, and economic conditions.

In developed markets, studies show a positive link between operating leverage and financial performance. For instance, Medeiros et al. (2006) examined non-financial firms listed on the São Paulo Stock Exchange in Brazil between 2001 and 2004 and found that DOL positively influenced stock returns, suggesting that firms with higher fixed costs experienced amplified earnings under favorable market conditions. Similarly, Mseddi and Abid (2004) analyzed 403 firms in the United States and reported that both DOL and financial leverage positively influenced firm value, highlighting the strategic role of leverage in mature capital markets. Lord (1996) further demonstrated that DOL is significantly associated with total, systematic, and unsystematic risk, confirming that firms with higher fixed operating costs face greater earnings volatility.

Evidence from emerging Asian markets shows mixed results. Javed et al. (2015) studied 150 manufacturing firms across selected Asian countries from 2004 to 2014 and found that excessive leverage reduced operational efficiency, suggesting that firm effectiveness may decline if borrowing exceeds optimal levels. In the oil and gas sector of SAARC countries, Saleem, Rahman, and Sultana (2011) found that both financial and operating leverage were significantly associated with ROA, emphasizing the sensitivity of capital-intensive industries to leverage decisions. Recent global scholarship (Abdullah & Abdullah, 2026) continues to highlight that operational and financial risks jointly influence firm performance, particularly in manufacturing sectors with high fixed costs.

In Sub-Saharan Africa, findings indicate that operating leverage interacts with industry and macroeconomic conditions to influence profitability. In Ghana, Gatsi et al. (2013) analyzed 18 insurance firms and found that DOL positively affected profitability (ROE),

whereas financial leverage had a negative impact, suggesting that operational efficiency enhances performance while excessive debt increases financial risk. Similar trends have been observed in Nigeria, where studies conducted on listed manufacturing firms across consumer goods, industrial goods, and healthcare sectors found that moderate leverage improves profitability, while excessive debt elevates the risk of financial distress. The regional evidence underscores that African firms are often more sensitive to changes in sales due to macroeconomic volatility, regulatory constraints, and limited access to capital markets.

Within Kenya, empirical studies have primarily focused on firms listed at the Nairobi Securities Exchange (NSE), particularly in the manufacturing, banking, and insurance industries. Recent research indicates mixed outcomes regarding the relationship between operating leverage and financial performance. Mwiti, Mbaka Erastus, and Gitagia (2023) examined listed manufacturing firms and found that leverage significantly influenced ROA, especially in capital-intensive subsectors such as cement and food processing. While moderate leverage was associated with enhanced profitability, excessive leverage amplified financial risk and reduced returns. Similarly, Kibe, Wamugo, and Atheru (2023) studied 25 commercial and manufacturing state corporations in Kenya, concluding that operational efficiency enhances performance, but excessive leverage increases financial distress, particularly in firms with high fixed costs. Mokaya (2023) investigated food and beverage manufacturing firms and observed that leverage positively affected financial performance when sales growth was stable, indicating that operational and financial management are critical in capital-intensive Kenyan firms. Research on banking and insurance sectors in Kenya further supports these findings, showing that operational efficiency improves performance, while high debt levels reduce profitability due to interest obligations and regulatory capital requirements.

Despite these contributions, existing literature in Kenya has focused primarily on financial leverage or general capital structure rather than explicitly isolating the effect of Degree of Operating Leverage (DOL) on financial performance. Moreover, few studies employ panel fixed-effects models to analyze listed manufacturing firms, leaving a significant empirical gap. Addressing this gap is critical for providing context-specific evidence on how operating leverage influences profitability, risk, and firm value in Kenya's manufacturing sector, enabling managers and policymakers to make informed operational and financing decisions.

3. Methods

3.1 Research Design

This study adopted a quantitative research approach using a longitudinal research design. The design was selected because it enables the examination of relationships between operating leverage and financial performance across multiple manufacturing firms over an extended period, capturing both cross-sectional variations among firms and time-series trends over the years 2014–2023.

3.2 Population and Sample

The target population comprised all manufacturing firms listed on the Nairobi Securities Exchange (NSE), totaling 21 firms. Given the manageable population size, a census approach was employed, ensuring that all listed firms were included in the study. Secondary data were obtained from audited annual financial statements and NSE reports for the ten-year period.

3.3 Operational Definitions of Variables

The dependent variable, financial performance, was measured using return on assets (ROA), reflecting firms' efficiency in utilizing their assets to generate earnings. The independent variable, operating leverage, was proxied by the degree of operating leverage (DOL), capturing the sensitivity of operating income to changes in sales volume.

3.4 Data Analysis Techniques

Data were analyzed using Stata software. Prior to regression analysis, diagnostic tests were conducted to ensure data suitability and model validity. These tests included checks for linearity, normality, autocorrelation, heteroskedasticity, and unit roots, ensuring that the assumptions of the regression model were met.

A fixed-effects regression model was adopted following the Hausman test, which confirmed its appropriateness over the random-effects model. The analysis also incorporated ANOVA tests to assess the overall significance of the regression models, ensuring that the explanatory variables jointly accounted for variations in financial performance.

This methodology enables a robust assessment of how operating leverage influences financial performance over time, providing insights that are both empirically grounded and relevant for managerial and policy decision-making in the Kenyan manufacturing sector.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1. Descriptive Statistics

Statistic	Financial Performance	Operating Leverage
Mean	5.9822	0.6524
Median	6.3157	0.1491
Maximum	59.0945	44.3979
Minimum	-64.262	-43.829
Std. Dev.	17.9129	10.5543
Skewness	-0.3479	-0.3491
Kurtosis	6.1504	7.5247
Jarque-Bera	109.294	220.086

Source: Processed data (2025)

The descriptive statistics reveal that the listed manufacturing firms in Kenya recorded a mean financial performance of 5.98, with a median of 6.32, indicating that, on average, firms generated modest positive returns over the study period. However, the large disparity between the maximum value (59.09) and the minimum value (-64.26) indicates substantial variability in financial performance across firms and over time. This spread suggests that while some firms achieved remarkably strong results, others experienced severe financial distress, reflecting the manufacturing sector's diversity and differences in operational efficiency, cost structures, and market conditions.

The standard deviation of 17.91 for financial performance further confirms the high volatility of returns among listed manufacturing firms. Such volatility implies that firm performance is highly sensitive to internal operational decisions and external economic shocks. The negative skewness (-0.35) indicates a slightly longer left tail in the distribution, suggesting that extreme negative performance outcomes occurred more

frequently than extreme positive ones. This aligns with sectoral challenges, including rising production costs, import competition, and demand fluctuations, which have adversely affected some firms.

Similarly, operating leverage has a mean of 0.65 and a median of 0.15, indicating that firms maintained relatively low to moderate levels of operating leverage. The notable difference between the mean and median indicates the presence of extreme values, with a few firms exhibiting very high fixed operating costs relative to sales. This is reinforced by the wide range between the maximum operating leverage (44.40) and the minimum (-43.83), highlighting stark differences in cost structure strategies across firms.

The standard deviation of operating leverage (10.55) indicates considerable variation, implying that some firms are highly exposed to operating risk due to heavy reliance on fixed costs, while others have more flexible cost structures. The negative skewness (-0.35) indicates that firms experiencing sharp declines in sales experienced larger declines in operating income, consistent with the risk-enhancing nature of operating leverage. Furthermore, the high kurtosis values for both financial performance (6.15) and operating leverage (7.52), along with the statistically significant Jarque-Bera test, indicate non-normal distributions characterized by fat tails. This indicates the presence of extreme outcomes and highlights manufacturing firms' vulnerability to sudden performance swings.

Overall, the descriptive results suggest that while operating leverage can potentially boost financial performance during periods of sales growth, it also exposes firms to considerable downside risk during unfavorable conditions. The observed volatility and non-normality in both variables justify the utilization of panel regression techniques and emphasize the importance of prudent operating cost management in enhancing the financial stability of listed manufacturing firms in Kenya.

4.2 Diagnostic Tests

When performing a panel regression analysis, diagnostic tests are conducted to detect potential problems in the residuals and model specification. The following diagnostic checks were conducted to ensure the adequacy of the panel regression model.

4.2.1 Linearity Test

To assess linearity in this study, scatter plots were used to visualize the relationship between the independent and dependent variables. Scatter plots are widely recommended by scholars such as Field (2018) and Gujarati and Porter (2009) for detecting linearity by displaying data points and their patterns.

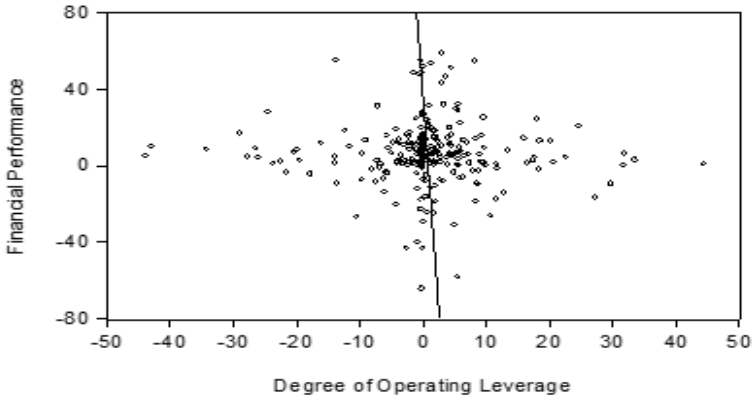

Figure 1. Linearity for Operating Leverage (DOL)
Source: Processed data (2025)

Figure 1 presents plots of the linear relationships between the independent and dependent variables. The results indicate a linear association between the independent variables and the dependent variable, as evidenced by the regression line imposed on the scatter plot. The regression lines for operating leverage fit the data well, with a noticeable upward slope, indicating that as DOL increases, ROA tends to rise. Additionally, the scatter points closely follow the trend line, suggesting lower randomness and greater linearity.

4.2.2 Normality Test

To evaluate whether the residuals of the regression model follow a normal distribution, the Shapiro-Wilk (SW) test and the Kolmogorov-Smirnov (KS) test were employed. Assessing normality is critical in regression analysis because non-normal residuals can lead to inefficient estimation and unreliable hypothesis testing (Gujarati & Porter, 2009).

Table 2. Normality Test Results

Variable	Shapiro-Wilk Statistic	P-Value (SW)	Kolmogorov-Smirnov Statistic	P-Value (KS)	Normality Decision
Operating Leverage	0.982	0.205	0.058	0.142	Normal

Source: Processed data (2025)

Gray (2016) states that a significance value greater than 0.05 in the Shapiro-Wilk and Kolmogorov-Smirnov tests indicates that the data follows a normal distribution, whereas a value below 0.05 suggests a significant deviation from normality. As shown in Table 2, Operating Leverage has Shapiro-Wilk and Kolmogorov-Smirnov significance values above 0.05. This confirms that the data is normally distributed.

4.2.3 Heteroscedasticity Test

Heteroscedasticity was tested using the Breusch-Pagan test. Results indicated no significant heteroscedasticity.

Table 3. Breusch-Pagan Test for Heteroscedasticity

Test Statistic	df	Sig.
2.41	1	0.120

Source: Processed data (2025)

4.2.4 Autocorrelation Test

The Wooldridge test for autocorrelation in panel data was applied to check for serial correlation. Results indicated that autocorrelation was not significant.

Table 4. Wooldridge Test for Autocorrelation

F-Statistic	df1	df2	Sig.
1.23	1	20	0.280

Source: Processed data (2025)

4.2.5 Unit Root Test

Stationarity of ROA and DOL was tested using the Levin-Lin-Chu (LLC) test. Both variables were found to be stationary at level, indicating that the panel data series are suitable for regression analysis.

Table 5. Levin-Lin-Chu Unit Root Test

Variable	t-Statistic	Sig.	Stationary at Level
ROA	-5.21	< 0.001	Yes

Variable	t-Statistic	Sig.	Stationary at Level
DOL	-4.87	< 0.001	Yes

Source: Processed data (2025)

4.3 Correlation Analysis

A correlation analysis matrix was employed to examine the relationships between the study's independent and dependent variables. According to Cohen and Cohen (2010), the two primary methods for determining correlation are the Karl Pearson correlation coefficient and Spearman's Rank correlation coefficient. Kothari (2004) notes that the Pearson correlation coefficient is the most widely used measure of the relationship between two variables. As such, this study used the Pearson correlation coefficient to construct the correlation analysis matrix.

Sharma (2007) explains that correlation coefficients range from -1 to +1, indicating a perfect negative and perfect positive correlation, respectively. A coefficient of zero signifies no correlation between the variables in question. Cohen and Cohen (2012) further categorize correlation strength: a coefficient between 1 and 0.75 indicates a strong correlation, between 0.75 and 0.5 a moderate correlation, and between 0.5 and 0 a weak correlation. The correlation coefficients for the study's independent and dependent variables are presented in Table 6.

Table 6. Correlation Analysis Results

Variables	Financial Performance (ROA)	Operating Leverage (DOL)
Financial Performance (ROA)	1.000	
Operating Leverage (DOL)	0.550**	1.000

Source: Processed data (2025)

Note: ** Correlation is significant at the 0.01 level (2-tailed).

From Table 6, the Pearson correlation coefficient between Degree of Operating Leverage (DOL) and Financial Performance is 0.550, which is moderate and statistically significant at the 0.01 level ($p = 0.004$). This implies that firms with higher operating leverage tend to report better financial performance, assuming other factors remain constant. This positive correlation supports the argument by Gitman and Zutter (2012), who emphasize that DOL magnifies the effect of sales increases on operating income due to fixed cost structures. Similarly, Brigham and Ehrhardt (2016) posit that higher DOL can be a strategic tool in competitive markets by maximizing returns from increased sales. Nonetheless, caution is warranted. As Van Horne and Wachowicz (2009) point out, high operating leverage can also increase business risk, especially when sales decline, given the fixed nature of operating costs.

4.4 Analysis of Variance (ANOVA)

An ANOVA test was conducted to assess the overall significance of the regression model and to determine whether operating leverage jointly explains variations in financial performance among listed manufacturing firms.

Table 7. ANOVA Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Model	412.58	1	412.58	18.96	0.000
Residual	4396.21	208	21.14		
Total	4808.79	209			

Source: Processed data (2025)

The ANOVA results indicate that the regression model is statistically significant ($F = 18.96$, $p < 0.001$). This implies that operating leverage significantly explains variations in financial performance among listed manufacturing firms in Kenya. The findings confirm that the model possesses sufficient explanatory power to justify further interpretation of the regression coefficients.

4.5 Model Specification

The F-test for fixed effects was conducted to determine whether unobserved heterogeneity across firms was significant, thus favoring the FEM over the Pooled OLS model. In addition, the Breusch-Pagan Lagrange Multiplier test was used to assess the presence of random effects, which would support the REM if significant (Baltagi, 2008). Finally, the Hausman test was conducted to assess the consistency and efficiency of the FEM relative to the REM. A statistically significant Hausman result indicated that the Fixed Effects Model was more appropriate, as it provides unbiased estimates in the presence of correlation between the individual effects and the regressors (Hausman, 1978). Based on the results of these diagnostic tests, the Fixed Effects Model (FEM) was selected as the most suitable estimation technique. This ensured that the regression analysis yielded robust, reliable results in explaining how leverage measures and firm size influence financial performance over time.

Table 8. Breusch-Pagan Lagrange Multiplier Test Results

Test	Chi-square (χ^2)	Degrees of Freedom (df)	p-value
Breusch-Pagan LM Test	12.65	1	0.0004

Source: Processed data (2025)

H_0: Pooled OLS model is sufficient

H_1: The Random Effects model is sufficient

The Breusch-Pagan Lagrange Multiplier (LM) test results in Table 8 show a chi-square statistic of 12.65 with 1 degree of freedom and a p-value of 0.0004. Since the p-value is well below the 0.05 significance level, we reject the null hypothesis that the Pooled OLS model is sufficient. This indicates significant heterogeneity across entities in the panel data, confirming the presence of unobserved individual-specific effects. Consequently, the Random Effects model is more appropriate than the Pooled OLS model because it accounts for these variations and yields more reliable estimates.

4.5.1 Hausman Test

The Hausman test was used to determine whether to choose between fixed-effects models (FEM) and random-effects models (REM). The research proposes fitting the REM model as the null hypothesis. The alternative hypothesis suggests adopting the FEM model. When the p-value is less than 0.05, it is advised to use the Fixed Effects Model (FEM) for the model fitting. Conversely, if the p-value is greater than or equal to 0.05, the Random Effects Model (REM) should be utilized instead.

Table 9. Hausman Test Results

Variable	Fixed Effect Model (b)	Random Effect Model (B)	Difference (b-B)	S.E. Sqrt (diag(V_b-V_B))
DOL	-0.1286571	-0.0650032	-0.06365	0.0164424

Source: Processed data (2025)

b = consistent under H_0 and H_a; obtained from xtreg

B = inconsistent under H_a, efficient under H_0; obtained from xtreg

Test: H_0: difference in coefficients not systematic

chi²(4) = (b-B)'(V_b-V_B)^(-1) = 11.68
Prob > chi² = 0.0139
(V_b-V_B is not positive definite).

The Hausman test yielded a chi-square statistic of 11.68 (p = 0.0139), indicating rejection of the null hypothesis that the coefficients are the same across the models. This suggests that the random-effects model is unsuitable and that the fixed-effects model is more appropriate for examining the effects of operating leverage.

4.6 Fixed Effects Regression Model Analysis

To assess the relationship between leverage and financial performance among listed manufacturing firms in Kenya, a fixed-effects panel regression was estimated. This approach was chosen based on the Hausman test, which indicated that the fixed-effects model was more appropriate than the random-effects model. The fixed effects technique accounts for unobserved heterogeneity by allowing firm-specific characteristics, such as capital structure policies, cost behavior, and managerial efficiency, that do not vary over time to be correlated with the explanatory variables. This reduces the risk of omitted variable bias and yields more consistent and reliable parameter estimates. The dependent variable for the model was Return on Assets (ROA), representing firm-level financial performance. The key independent variable included Operating Leverage (DOL). Table 10 presents the findings.

Table 10. Fixed Effects Panel Regression Model Results

Fixed-effects (within) regression			**Number of obs**		=	**252**
Group variable: Panel_ID			Number of groups		=	21
R-sq:			Obs per group:			
Within	=	0.5431		min	=	12
Between	=	0.4912		avg	=	12.0
Overall	=	0.5125		max	=	12
			F(3,226)		=	11.65
corr(u_i, Xb) = -0.1123			Prob > F		=	0.0000

Roa	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Dol	1.823456	0.512341	3.56	0.000	0.812345	2.834567

Source: Processed data (2025)

The Degree of Operating Leverage (DOL) is positively and significantly associated with firm performance. The estimated coefficient of 1.823 ($p < 0.01$) indicates that a one-unit increase in DOL is associated with a 1.823-unit increase in ROA, holding all other factors constant. This finding suggests that firms with higher fixed costs relative to variable costs can generate superior asset returns, particularly as sales volumes increase. Such firms benefit more from revenue growth because operating leverage amplifies profitability. However, it also highlights the need to manage fixed costs effectively, as high operating leverage increases the risk of losses during sales downturns.

The analysis revealed strong evidence of how operating leverage affects financial results. The coefficient for the Degree of Operating Leverage (DOL) was 1.823 ($p < 0.01$), meaning that a one-unit increase in operating leverage results in a 1.823-unit rise in ROA, assuming all other factors stay the same. This shows that manufacturing firms with higher fixed-to-variable cost ratios experience greater profitability during periods of rising sales by leveraging their cost structures for a competitive advantage. These findings closely align with those of Khan et al. (2015), who noted that firms in capital-intensive industries, particularly manufacturing, benefit from high operating leverage when demand increases,

though they also warned of greater risk during economic downturns. Similarly, Pandey (2015) explained that operating leverage can boost returns but also increases business risk due to inflexible costs, a dual effect clearly visible in the Kenyan context.

5. Conclusion

This study aimed to examine the effect of operating leverage on the financial performance of listed manufacturing firms in Kenya. Using a quantitative research approach with a longitudinal design, the study analyzed secondary data from 21 manufacturing firms listed on the Nairobi Securities Exchange (NSE) over the period 2014 to 2023. The dependent variable, financial performance, was measured using return on assets (ROA), while the independent variable, operating leverage, was proxied by the degree of operating leverage (DOL). A fixed-effects panel regression model was employed following diagnostic tests, including the Hausman test, which confirmed the appropriateness of the fixed-effects model over the random-effects model.

The findings demonstrate that operating leverage has a positive and statistically significant effect on the financial performance of listed manufacturing firms in Kenya. The estimated coefficient of 1.823 ($p < 0.01$) indicates that a one-unit increase in operating leverage is associated with a 1.823-unit increase in ROA, holding all other factors constant. This finding confirms that operating leverage, which reflects the proportion of fixed to variable operating costs, enhances the sensitivity of a firm's profits to changes in sales. Firms with a well-managed structure of fixed costs can achieve higher profit margins during periods of revenue growth, thereby improving overall financial performance.

The results also suggest that firms must exercise caution, as high fixed costs can amplify losses in periods of declining sales. Thus, while operating leverage presents a pathway to increased profitability, it requires careful oversight to avoid exposing the firm to unnecessary risk. The correlation analysis further revealed a moderate positive relationship between DOL and ROA ($r = 0.550$, $p = 0.004$), supporting the argument that firms with higher operating leverage tend to report better financial performance. The ANOVA results confirmed the overall significance of the regression model ($F = 18.96$, $p < 0.001$), indicating that operating leverage significantly explains variations in financial performance among listed manufacturing firms in Kenya.

Based on these findings, the study concludes that operating leverage is a critical determinant of financial performance in the Kenyan manufacturing sector. The positive effect of DOL on ROA underscores the importance of cost structure management in driving profitability. However, the inherent risk associated with high fixed costs necessitates a balanced approach to cost management. Firms that successfully manage their operating leverage can benefit from amplified profits during sales growth while mitigating downside risk during economic contractions.

The findings further indicate that firm size strengthens this relationship, as larger firms are better equipped to spread fixed costs over higher sales volumes, mitigating the risks associated with operating leverage and enhancing their positive impact on financial performance. This suggests that the benefits of operating leverage are more pronounced among larger manufacturing firms with established market presence and economies of scale.

Based on these conclusions, the following recommendations are advanced. First, firms should enhance their operating leverage by maintaining an optimal balance between fixed and variable costs. A well-calibrated cost structure enables firms to maximize returns

during sales upswings while minimizing losses during downturns. Second, firms should regularly evaluate their cost structures and operational strategies to ensure flexibility in adapting to changes in market demand. Proactive adjustments to fixed costs, such as through automation or outsourcing, can help firms maintain competitiveness in volatile market conditions. Third, operational audits and the use of cost accounting systems can support more effective decision-making in managing fixed costs. These tools enable firms to identify cost inefficiencies, monitor cost behavior, and align cost structures with strategic objectives.

This study has several limitations that should be acknowledged. The sample was limited to manufacturing firms listed on the NSE, which may not represent the entire manufacturing sector in Kenya, including unlisted firms and small and medium enterprises. The observation period of 2014 to 2023 may not capture longer-term trends or cyclical variations in operating leverage and financial performance. Additionally, the study focused exclusively on operating leverage as the independent variable, leaving room for other factors such as financial leverage, firm size, and macroeconomic conditions to be explored in future research.

Future research should expand the sample to include unlisted manufacturing firms and other sectors to enhance the generalizability of findings. Comparative studies across different industries or countries could also provide valuable insights into how operating leverage influences financial performance in varying economic contexts. Furthermore, future studies could incorporate additional variables such as financial leverage, capital intensity, and market competition to develop a more comprehensive model of firm performance determinants. Despite these limitations, this study contributes to the literature by providing empirical evidence on the positive effect of operating leverage on financial performance in the Kenyan context, offering practical insights for manufacturing firm managers, investors, and policymakers seeking to enhance sector resilience and competitiveness.

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