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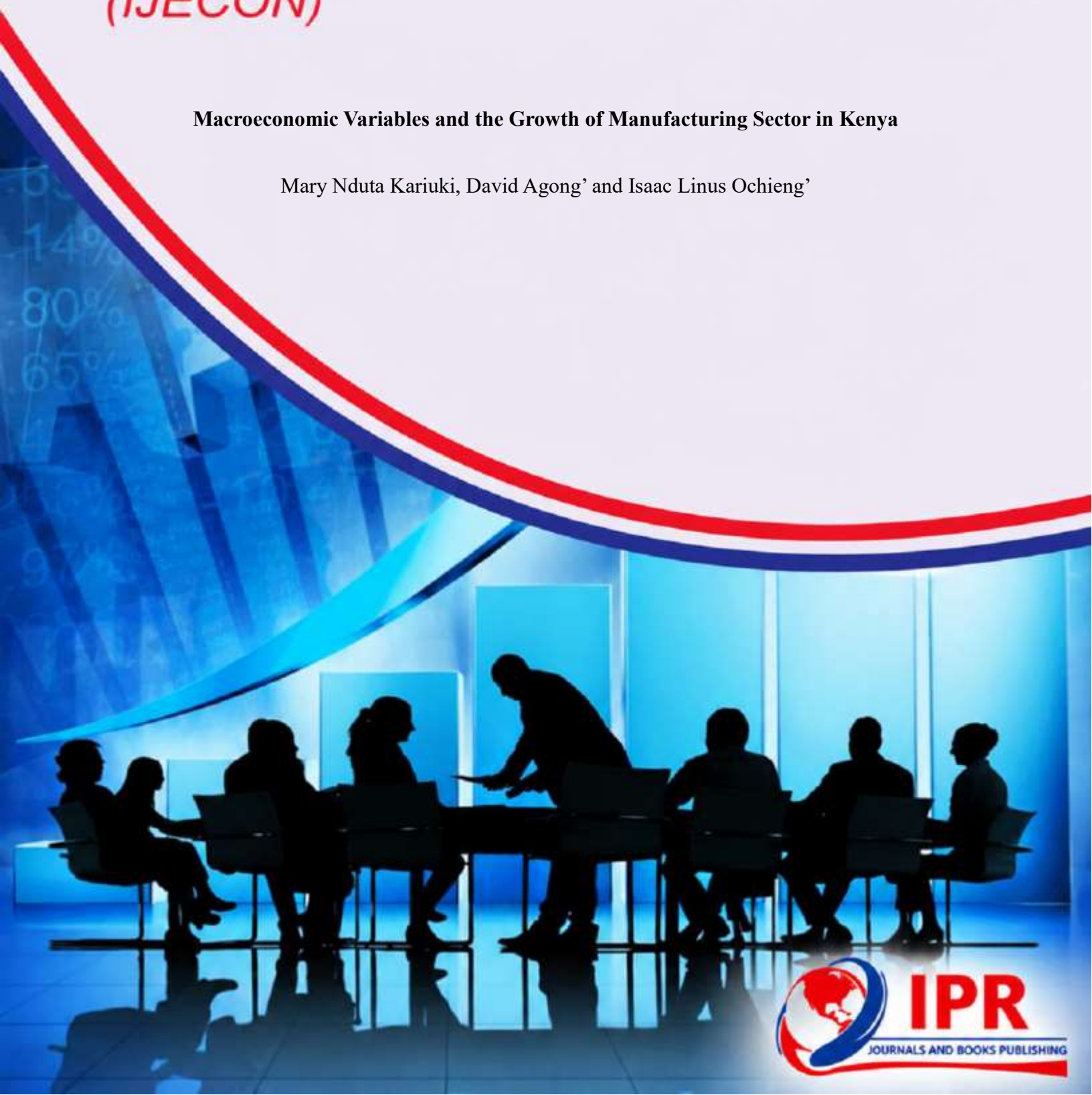
Mary Nduta Kariuki, David Agong' and Isaac Linus Ochieng'



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Abstract

Purpose: The manufacturing sector is crucial to the realization of the Kenya Vision 2030. The sustained growth of the sector is critical to providing a sustainable income to Kenya's rapidly growing population, increasing the level of exports, and stimulating the growth of other sectors. However, the sector's growth rate has been reducing significantly over the years, risking jobs for the rapidly growing population and the transformation to a high-capital economy. This paper examines the impact of inflation rate on the growth of manufacturing sector in Kenya.

Methodology: This research determined the relationship between selected macroeconomic variable and the growth of manufacturing sector in Kenya using ARDL model which captures both short term and long-term relationships. The research employed the use of qauntitave research design and census approach using secondary quarterly data from 2013 Q1 to 2024 Q4 collected from KNBS and CBK reports. The collected data was analyzed using STATA 19 Software.

Findings: The findings of this study indicate that the relationship between inflation rate and manufacturing-sector output differs between the short run and the long run. In the short run, a one-unit increase in inflation rate was associated with a 0.3487 unit increase in manufacturing sector growth, and the effect was statistically significant at the 5 percent level ($\beta = 0.3487$, $p = 0.00$). This positive short-run relationship may suggest that manufacturers respond to increases in producer prices by adjusting output and prices, particularly where higher producer prices reflect stronger demand conditions or increased economic activity. However, the long-run coefficient was statistically insignificant

Unique Contribution to Theory Practice and Policy: The study emphasizes on the importance of differentiating inflation short- term and long-term impacts and recommends policymakers to implement measures aimed at creating a stable and supportive macroeconomic environment to enhance the growth of manufacturing sector in Kenya and achieve the 20by30 vision. The Central Bank of Kenya and Monetary Policy Committee should maintain inflation within a stable and manageable range that supports production incentives without creating excessive cost pressures. Inflation should also be closely monitored to prevent high and volatile price increases, which can erode purchasing power, increase production costs, create economic uncertainty, and ultimately hinder sustainable manufacturing sector growth

Keywords: *Inflation Rate, Manufacturing Sector*

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INTRODUCTION

The manufacturing sector plays a significant role in the economic development of developing countries. Internationally, almost all countries have achieved a sustainable high standard of living with the contribution of the sector, except for a few oil countries (Haraguchi, Cheng, & Smeets, 2017). It helps to ensure that labour resources are transferred from low-productive sectors or "disguised employment" in the rural and informal sectors to more productive economic segments of the industrial sector due to its substantial need for intensive labour resources (Rioba, 2015). Growth and development are greatly aided by the manufacturing sector, which accounts for 16% and 14% of the world's GDP and employment, respectively (Oduor, Ngala, Ruto, & Abdillahi, 2021). The second-largest contribution to Malaysia's GDP is the manufacturing sector (Husaini & Hooi, 2015). Similarly, China's ability to double its GDP per capita was greatly aided by its rise to prominence as a manufacturing powerhouse (Eloot, Alan, & Martin, 2013).

In Kenya, ensuring continuous growth of the sector is paramount to providing a sustainable income to Kenya's expeditiously growing population, increasing the level of exports, and stimulating the growth of other sectors. The sector covers a wide range of various industries including and not limited to textiles, apparel, food and beverages, chemicals, cement, and paper. The growth of the manufacturing sector since independence has been notable; it has employed over 66,000 people in 2022 from 46,248 in 2018 (KNBS, Manufacturing Sector Review, 2023). Mburu (2017) stipulates that the value of the manufacturing sector is derived from its fostering creativity and innovation, research and development activities and eventually increasing the productivity of other sectors. Kenya's strategic location as a regional trade and transport hub, along with its membership in East African Community and the African Continental Free Trade Area provides significant advantage for the manufacturing sector to expand internationally.

The Kenya Vision 2030 stipulates that the manufacturing sector will be a key driver to economic growth and development; encouraging more industrial activities to create jobs, increase GDP and contribute to wealth accumulation. In alignment to the Kenya Vision 2030, the aim of the Kenyan government is to ensure structures and incentives are put in place to ensure manufacturing sector attains 15 percent of the GDP by 2030 (Shah, 2019). To that end, the Bottom-Up Economic Transformation Agenda is operationalised in the fourth Medim-Term Plan (MTP IV 2023-2027), which emphasises value chain development, supports micro, small, and medium-sized businesses, and increases the manufacturing sector's GDP contribution to 15% (Ministry of Investment, Trade, and Industry). A growing emphasis has been placed on industrialisation through digital transformation and support for small and medium-sized businesses in the manufacturing sector. The government has implemented policies such as tax incentives, the creation of special economic zones, and enhancements to the ease of doing business (Shah, 2019). The theme for the 2024 manufacturing priority agenda is 'steering economic growth through economic sector for common good' (Kenya Association of Manufacturers, 2024). However, the percentage share of manufacturing sector to GDP in 2022 was 7.8 percent (KNBS, Economic Survey 2023, 2023).

The manufacturing sector continues to grow worldwide with the Manufacturing Value Added (MVA) having increased by 3.8 percent in 2018; developed countries recorded a 2.3 percent increase in MVA in 2018 compared to 2017 (Oduor et. Al, 2021). African nations however continue to struggle to match with the growth rate of the global manufacturing sector growth rate. The

average manufacturing output to GDP in African countries has dropped to 8.3 percent compared to 19.6 percent of emerging industrial economies (Oduor et. Al, 2021). This indicates a challenge to achieving the sustainable development goal of doubling MVA share in GDP by 2030. In Kenya, the manufacturing sector recorded a drop from 4.5 percent to 3.2 percent and a GDP contraction from 10.7 to 7.5 percent between 2010 and 2019 (Oduor, et. Al, 2021). Further, the manufacturing sector's contribution to GDP has decreased from 9.3 percent in 2016 to 7.2 percent in 2021 (KNBS, Economic Survey 2022, 2022).

Among the most critical influencers of the growth of manufacturing sector in Kenya is macroeconomic variables, like inflation rate, interest rate, exchange rate and unemployment. Mugure (2021) explains macroeconomic variables as indicators of the current economic trends. When an economy is performing well, there is a general expectation from the investors and shareholders that companies would perform well and increase the sector's overall growth; hence necessitating such macroeconomic indicators to remain favourable (Osoro & Ogeto, 2014).

Inflation is one overarching concern that may affect the growth of manufacturing sector. Mugure (2021) explains inflation as a key macroeconomic indicator that reflects the rate at which the prices of goods and services increase in a given economy for a period of time. Nyakiamo (2015) explains that inflation may be because of increased government expenditure which results increased money supply without necessarily increasing output level. According to Amisi (2021), from November 2016 to June 2017, Kenya experienced unprecedented rise in inflation rate to a high of 11.7 percent. The increased rate of inflation may affect the manufacturing sector with an increased cost of production resulting from cost push production. This impacts the cost of production through areas such as cost of raw materials and wages. Mugure (2021) states that inflation affects the aggregate demand, level of investment as investors loose confidence in the domestic currency and the cost of production. Inflation affects the Producer Price Index (PPI), which are prices that producers receive at all stages of production proces, including raw materials, intermediate materials to finished products. According to Umaru & Zubairu (2012) , neo-keynesian attributes inflation to diminishing returns of prodction resulting from increased velocity of money and excessive consumption incomparison to investment.

Problem Statement

The manufacturing industry is a major contributor to Kenya's economic growth, according to an East Africa Community report on the country's manufacturing sector profile. The industry helps the country thrive by generating jobs, boosting exports due to higher productivity, and encouraging the expansion of other industries. The Kenya vision 2030 stipulates that the manufacturing sector will be a key driver to economic growth and development, thus aiming at attaining and sustaining an annual growth rate of the sector of 15 percent to GDP (Kenya Vision 2030). According to KIPPRA attaining manufaturing sector growth is critical in generating jobs for the rapidly growing labour force and ensuring a high-capital economy transformation (Wambugu, 2013). According to Oduor, Ngala, Ruto, & Abdillahi (2021), growth and development are greatly aided by the manufacturing sector, which accounts for 16% and 14% of the world's GDP and employment, respectively. The 20by30 initiative seeks to maximmize opportunities available to spur local industry's growth and increase job opportunities from 352,000 to 1,000,000 which will increase total tax contribution from 360 billion to 1 trillion Ksh. The manufacturing sector's share of GDP

decreased proportionately from 9.3% in 2016 to 8.4% and 7.6% in 2018 and 2020, respectively, according to the Kenya Association of Manufacturers (2022). Between 2010 and 2019, the manufacturing sector saw a decline from 4.5 percent to 3.2 percent, while the GDP shrank from 10.7 to 7.5 percent (Macharia, Gathiaka, & Ngui, 2022). The sector's GDP contribution fell to 7.2% in 2021 (KAM, 2024). The country's GDP and employment levels may be impacted by the contraction of the manufacturing sector growth rate brought on by macroeconomic variable swings brought on by shifts in the rates of inflation. Inflation has been shown to have a favorable impact on the manufacturing sector's performance according to Kayala's (2022) study findings. The study by Mugure (2021) provides that the rate of inflation has a negative impact on the manufacturing sector as it influences the purchasing power of money that in turn influences the level of sales. Additionally, Omondi (2020) mentions that 15,000 individuals were left jobless in the manufacturing industry in Kenya in 2018 due to deindustrialization. This is projected to carry on with a higher inflation rate of 7.3 percent that has an impact on the cost of production (Trading Economics, 2023). Haraguchi et al. (2017) note that developing nations have gone through deindustrialization in the past 25 years. The manufacturing sector in Kenya has been shrinking continuously, this would diminish the export level, shrink GDP and leave thousands of people without a job. The author of the studies included Osoro and Ogeto (2014) and Mugure(2021), who examined the connection between the selected macroeconomic variables and the financial performance of Kenya manufacturing sector. However, these research studies population has focused on the listed manufacturing sectors in the NSE. According to Nairobi Securities Exchange (n.d) there are 9 manufacturing firms listed under NSE. The manufacturing sensus of 2009 reports a total of 2,097 firms located and distrubuted across 47 counties and performing various types of manufacturing activities (Wambugu, 2013). This creates the issue of generalization and analysis of data that is not represenative. Therefore, establishing the relationship between macroeconomic variable and the growth of the manufacturing sector using the sector output to GDP will impact both the job market in Kenya, by creating jobs and enhancing job retention in the manufacturing sector and the economy growth through suggesting policies that will enhance the growth of the manufacturing sector, increasing productivity, export level and GDP growth.

General Objective

To evaluate the effect of macroeconomic variable on the growth of manufacturing sector in Kenya

Research Hypotheses

To evaluate the impact of macroeconomic variables on the growth of manufacturing sector the following research hypotheses is specified.

Ho_1 : Inflation rate does not impact the growth of manufacturing sector in Kenya

Literature Review

The section presents theoretical review, empirical review, and conceptual framework.

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Theoretical Review

Structural Theory of Inflation

Structural theory of inflation is primarily associated with the Latin American structuralist school as it was originally developed by economists in Economic Commission for Latin American and Caribbean. Specifically, the main founders of the theory include Raul Prebish who stipulated that inflation in developing countries originates from structural rigidities and not excess demand. Celso Furtad, expounded on the structural inflation rate causes such as the income inequality, sectoral bottlenecks, and imbalanced production structures. Proponent Osvaldo Sunkel contributed to the understanding of structural inflation resulting from external dependency, import constraints and institutional rigidities.

The structural theory of inflation was further discovered from the writings of Myrdal and Streeten published in the year 1968 and 1972 respectively (Oduor, Ngala, Ruto, & Abdillahi, 2021). The economists strengthened and expanded the structural theory of inflation from the development economic perspective. Myrdal and Streeten base the theory argument that in developing countries, inflation cannot be explained by the forces of aggregate demand and supply but deeply originates from structural rigidities within the economy. The economists stipulate that these structural rigidities include supply bottlenecks, low productivity in main economic sectors, foreign exchange constraints, institutional imperfections and unequal income distribution. The structural theory of inflation thus view inflation rate as a result of an economy's inability to respond flexibly to increases in demand or changes in international economic conditions, resulting in persistent price increases. According to the theory, there is lack of balanced integrated structure in developing countries; creating a scenario where the flow of resources between economic sectors is not smooth and fast. The economists' arguments in support of the theory question why aggregate output does not increase relative to the increase in demand created by money supply and investment expenditure. This is based on the model assumption of inelastic supply. According to the theory supply of goods cannot quickly adjust to increases in demand, causing persistent prices. The economists further argue that even in cases where demand is not excessive to cause persistent prices, inflation persists due to structural features which continuously push the prices upward. The other concern in support of the structural theory of inflation is the failure of voluntary savings to fully fund investment expenditures, resulting in excessive finance deficit. Thus, this theory states that changes in the money supply and relative prices have an impact on inflation in emerging nations like Kenya. The model also implies that there is sectoral imbalance which suggests a mismatch between the growth of different industries.

The manufacturing sector is subject to inflation due to changes in these relative prices. According to Oduor, Ngala, Ruto, & Abdillahi (2021) an increase in inflation leads to increased cost of production arising from high input cost, electricity and fuel cost, and wage costs. This is due to cost constraints resulting from supply-side challenges like limited access to capital and wage-price spiral. Oduor, Ngala, Ruto, & Abdillahi (2021) further stipulates that structural inflation affect the level of manufacturing investments due to uncertainities arising from persistent inflation. In cases of persistent inflation, the CBK try to contain it through high interest rates, this discourage investors and impact industrial expansions.

The structural theory of inflation is however applicable only in developing countries only due their governments having significant public expenditure, contributing to the issue of inflation that limit the growth and development of manufacturing sector compared to developed countries. The theory further holds that structural rigidities are the primary cause of inflation rate. This may not be that cases in economic situations where demand-pull or cost-push forces dominate.

The structural inflation theory is relevant to this study as it provides a framework for understanding the persistence of inflation rate despite the conventional monetary and fiscal interventions. it explains how developing countries, such as Kenya experience supply bottlenecks and cost of production constraints in the manufacturing sector. Kenya's inflation is largely caused by supply-side rather than excess demand. These structural issues increase production costs, impair competitiveness, and influence manufacturing growth. The structural theory of inflation helps explain the patterns of inflation rate that will be seen throughout the study and emphasizes the necessity of structural transformation to attain sustainable price stability by connecting inflation with institutional and economic issues

Conceptual Framework

The below diagram shows the study framework of macroeconomic variables and the manufacturing sector. It conceptualizes the dependent variable the manufacturing sector growth rate which will be measured using the sector output percentage to GDP and the independent variable inflation rate.

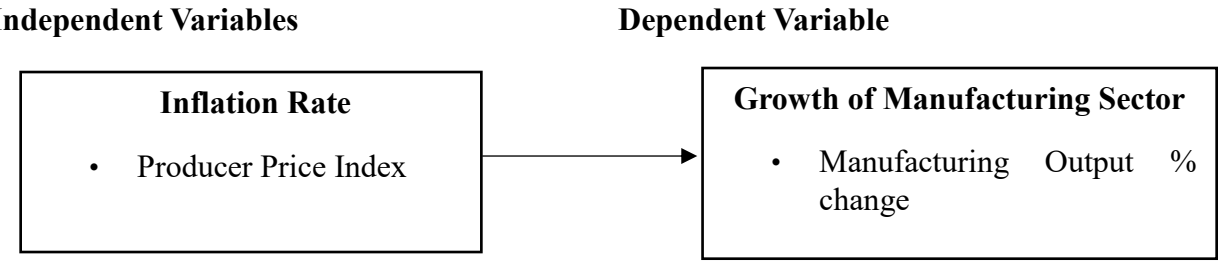

Figure 1: Conceptual Framework

Empirical Review

A cross-sectional study of Malaysian companies' performance and inflation was carried out by Maimunah & Ibrahim (2018). The study employed the use of cluster random sampling, investigating fifty enterprises selected depending on the population. The research findings reveal a beneficial association between inflation and manufacturing companies' success. Maimunah & Ibrahim (2018) state that inflation rate increases manufacturing companies' profits. The study recommends formulating policies to control inflation rate fluctuations as the sector contributes significantly to Malaysia's export.

Brans-Akutey, Yaw Deh, and Mohammed (2016) examined how inflation affected Ghana's manufacturing sector's productivity between 1968 and 2013. The Johansen Test, the Vector Error Correlation Model, and the Ordinary Least Square regression test were used in the study's empirical verification. The results of the study show a steady and long-term correlation between

inflation and Ghana's manufacturing sector productivity. Brans-Akutey, Yaw Deh, and Mohammed (2016) claim that the sector's productivity has declined as a result of inflation. It suggests that in order to increase the productivity of the manufacturing sector, policymakers should control inflation.

Abere & Abu (2023) examined the impact of inflation and Value Added Tax (VAT) on the productivity of the manufacturing sector in ECOWAS nations. The National Bureau of Statistics and the World Bank provided secondary data for the study between 2000 and 2022. The findings show a negative correlation between the rate of inflation and the productivity of the manufacturing sector. According to Abere & Abu (2023), poor financial performance affects a firm's investment and, consequently, value addition. The report suggests that governments in ECOWAS should give regulatory bodies more leeway.

Judith & Ezeaku (2016) studied the dynamics of inflation and manufacturing sector performance in Nigeria. The research methodology employed the use of timeseries data from 1982 to 2014. The study findings show that inflation has a negative effect on the growth of manufacturing sector. Judith & Ezeaku (2016) recommends that monetary bodies and government should encourage the manufacturing sector productivity by making credit available at a competitive price and stimulating domestic production to increase domestic and international demand of local goods. According to the researchers, in the long run this has the potential to lower inflation rate.

Oduor, Ngala, Ruto, & Abdillahi (2021) researched on the effects of inflation on the growth of manufacturing sector in Kenya from 2008 to 2017. The reserachers used time series secondary data from World Bank, United Nations Conference on Trade and Development (UNCTAD), International Monetary Fund (IMF), Central Bank of Kenya (CBK), and Kenya National Bureau of Statistics (KNBS). According to the research findings, inflation affects the growth of manufacturing sector by reducing the manufacturing value-added. Oduor, Ngala, Ruto, & Abdillahi (2021) recommended the use of inflationary targets by CBK and addopt monetary policies to monitor fluctuations in inflation rates.

Kayala (2022) study evalauated the impact of macroeconomic variables on the financial performance of listed manufacturing companies Kenya. The researchers employed the use of panel secondary data from 2015 to 2020 with a target of 8 listed manufacturing companies on the NSE. The research results indicate that inflation affects the growth of manufacturing sector positively. Kayala (2022)recommended formulation of prudent macroeconomic policies during pandemics to enhance the performance of manufacturing sector.

Mugambi & Murunga (2019) study on creating a favourable macroeconomic environment for manufacturing industry in Kenya analyses the impact of infaltion as one of the macroeconomic variables on the performance of manufacturing sector in Kenya. The authors use the ARDL bond testing approach to examine the relationship between manufacturing output and inflation; using time series data from 1980 to 2017. According th the study unit root tests results the study variables integrated mixed orders justifying the use of ARDL. The reserachers findings indicate that in Kenya, inflation negatively affect manufacturing output. The study further interprates the results using solow growth model and endogenous growth theory emphasizing on the role of capital

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formation, technological progress, and infaltion stability on the productivity of manufacturing sector in kenya.

METHODOLOGY

The research adopted qauntitative research design. Fischer, Boone, & Neumann (2023) explains quanitative research design as a research method used in various discplines including social sciences and economcs whose aim is to collect and anylse numerical data to respond to the research questions and test the research hypotheses. The reserch design was selected as the study will collect and analyse numerical data on inflation rate and the growth rate of manufacturing sector. This will involve using explanatory research design to evaluate the relationship between the dependent and independent variables using secondary data. Thus, stipulating the cause-and-effect relationship while controlling other variables through standardization. The population covers the entire set of units in which the study data is obtained consisting of the manufacturing sector in Kenya. The sector represents the most relevant population for examining the relationship between inflation rate and the growth of manufacturing sector in Kenya. The sector was selected due to the continued slow growth rate and reduced contribution to GDP. Therefore, the research adopt a census approach and collect secondary data from 2013 Q1 to 2024 Q3 on inflation rate and the growth rate of manufacturing sector in Kenya. The study period will ensure capturing the recent macroeconomic fluctuations that impact the performance of the manufacturing sector in Kenya. This period covers significant macroeconomic and policy developments, including the implementation of Kenya's vision 2030 medium-term plans, changes in the global economic environment from economic disruptions caused by Covid-19 pandemic and the subsequent recovery efforts policies. Collected data was anlyzed using STATA 19 software.

The study employed the Autoregressive Distributed Lag (ARDL) in the form below

$$\text{OutputtoGDP} = \alpha_0 + \sum_{i=1}^{3} \alpha_i \, \text{OutputtoGDP}_{t-i} + \sum_{i=0}^{1} \beta_i \, INF_{t-i} + \varepsilon_t$$

Where:

OutputtoGDP = Manufacturing output

INF= Inflation rate

α_0 = Constant/intercept

α_i, β_i, = Estimated coefficients

t = Current quarter

t-i= Lagged quarterly observations

ε_t = Error term

FINDINGS AND DISCUSSIONS

This chapter outlines the research data analysis that will be used in drawing research conclusions and recommendations.

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Descriptive Statistics

Table 1: Central Tendency Measures

Statistic	Mean	Median	Mode	95% CI Lower	95% CI Upper	Observations
Inflation Rate (%)	117.45	115.82	119.03	113.87	121.03	47
GDP Growth (%)	-1.18	-0.68	4.09	-2.71	0.35	47

Inflation rate which the study measures using PPI had a mean of 117.45 indicating that producer prices increased over the years and reflecting cumulative inflation. The study observed increased PPI from 107.42 in 2013 to 144.7 in 2024. According to Jerry, Kennedy, & Mugambi (2024), inflation rate Kenya inflation rate for the period 2005 to 2023 implies high fluctuations in domestic prices in Kenya. PPI median of 115.82 and mode of 119.03 implies that PPI is relatively normally distributed due to the closeness to the mean. The 95% confidence interval 113.87 to 121.03 shows that the true average PPI is likely to fall within this range. This means that managing the inflation rate to a monetary policy target rate of 5% continues to be a challenge (Jerry, Kennedy, & Mugambi, 2024).

Manufacturing sector output to GDP growth rate had a mean of -1.18%, median of -0.68%, and a mode of 4.09%. The negative mean and a median indicate that, on average, growth was negative during the study period, although the positive mode suggests that there were periods of strong growth. The wide confidence interval -2.71% to 0.35% highlights significant variability and uncertainty in growth performance.

Table 2: Dispersion Measures

Statistic	Std Deviation	Variance	Minimum	Maximum	Range	IQR	CV (%)
Inflation Rate	12.34	152.28	101.07	145.92	44.85	13.89	10.51
GDP Growth (%)	4.82	23.23	-10.2	7.84	18.04	6.94	-408.47*

Inflation rate measured as PPI had a minimum of 101.07 and maximum of 145.92 with a range of 44.85. This reflects changes in producer prices due to economic shocks. However, the interquartile range of 13.89 indicates that the middle 50% of the observations were fairly spread out reflecting consistency in variability. The standard deviation of 12.34 and variance of 152.28 suggest that the PPI variation was around the mean.

The Manufacturing sector growth rate measured using output to GDP percentage exhibits substantial dispersion, reflecting pronounced fluctuations over the study period. The standard deviation of 4.82 and variance of 23.23 indicate considerable deviations from the mean, pointing to instability in the sector's performance. The wide range of 18.04, spanning from negative growth of -10.20% to positive growth of 7.84%, highlights the presence of both contraction and expansion phases. The interquartile range of 6.94 shows that even the central portion of the data is fairly spread out, indicating consistent variability. The coefficient of variation -408.47% is negative due to the mean being close to or below zero.

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Table 3: Distribution Shape

Variable	Skewness	Kurtosis	Distribution Type	Tail Thickness
PPI	0.847	1.234	Moderately Skewed (Right)	Heavy-tailed
GDP Growth	-0.234	0.156	Symmetrical	Normal

According to the study analysis, inflation rate (PPI) has a moderate positive skewness of 0.847 and is heavy tailed with a kurtosis of 1.234. This indicates that throughout the study period extremely high values occur more frequently than low values, suggesting periods of sharp increases in producer prices. Such behavior may reflect inflationary shocks or cost-push pressures in the manufacturing sector. Manufacturing growth rate exhibits near symmetry of -0.234 skewness and kurtosis of 0.156. This suggests that growth rates are relatively stable and evenly distributed, with fewer extreme deviations compared to other variables.

Correlation Analysis

Table 4: Pearson Correlation Analysis

```
pwcorr PPI OutputtoGDP, sig obs

             |      PPI  Output~P
-------------+------------------
         PPI |   1.0000
             |
             |       47
             |
OutputtoGDP  |   0.0369   1.0000
             |   0.8055
             |       47        47
```

The findings indicate that the growth of the manufacturing sector has a weak positive correlation with inflation rate ($r = 0.0369$, $p = 0.8055$). However, the relationship is statistically insignificant ($p > 0.05$), suggesting that inflation does not exhibit a meaningful linear association with manufacturing output during the study period. This finding contrasts with the structural theory of inflation, which argues that persistent inflation increases production costs through higher input prices, thereby reducing manufacturing growth. Nevertheless, the insignificant inflationary effect on manufacturing may indicate demand-pull dynamics where aggregate demand outpaces the immediate production capacity, prompting the manufacturing sector to scale up production. According to Maimunah & Ibrahim (2018) inflation rate positively impacts the performance of manufacturing sector due to the sector's ability to adapt to changes in production cost

Regression Analysis

The study adopted Autoregressive Distributed Lag (ARDL) to analyze the relationship between inflation rate and the growth of manufacturing sector.

Table 5: Model Summary

```
Number of obs =     44
R-squared     = 0.8008
Adj R-squared = 0.7746
Root MSE      = 2.9966
```

The selected ARDL (3,1) model was estimated using 44 quarterly observations. Although the dataset initially contained 47 quarterly observations covering the period from 2013Q1 to 2024Q3, the estimated model utilized 44 observations. The reduction in the effective sample size is attributable to the inclusion of lagged variables in the ARDL specification. The selected model includes a maximum lag length of three quarters; the first three observations cannot be used in the estimation because the required lagged values are unavailable. Consequently, the estimation begins in 2013Q4, resulting in an effective sample of 44 observations. This reduction is a standard feature of dynamic time-series models and does not imply that observations were arbitrarily removed from the data set.

The model yielded an R-squared of 0.8008, indicating that approximately 80.01% of the variation in manufacturing-sector output-to-GDP is explained by the current and the lagged values of inflation rate together with the lagged values of the growth of the manufacturing sector in Kenya. The adjusted R-squared was 0.7746, implying that after accounting for the number of explanatory parameters in the model, approximately 77.46% of the variation in manufacturing-sector output-to-GDP is explained by the model. The relatively small difference between the R-squared and adjusted R-squared suggests that the selected ARDL specification provides a reasonably good fit to the data without excessive loss of explanatory power after adjusting for model complexity. The Root Mean Square Error (RMSE) was 2.9966, indicating the magnitude of the model's typical prediction error in the units of the dependent variable. Overall, these results suggest that the selected ARDL model provides a satisfactory fit for examining the relationship between inflation rate and the growth of Kenya's manufacturing sector.

Table 6: Regression Coefficients

D. OutputtoGDP	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
ADJ OutputtoGDP L1.	-2.440361	.2988943	-8.16	0.000	-3.045441	-1.835281
LR PPI	.0099882	.0164972	0.61	0.548	-.0234087	.0433851
SR OutputtoGDP LD.	1.115862	.1871818	5.96	0.000	.7369324	1.494792
L2D.	.4210898	.1428704	2.95	0.005	.1318639	.7103158
PPI D1.	.3487591	.1188533	2.93	0.006	.1081532	.589365
_cons	-5.647449	4.899472	-1.15	0.256	-15.56591	4.271014

Discussion

The results indicate that the first lag of manufacturing sector growth has a positive coefficient of 1.115862 and a p value of 0.000. This suggests that the manufacturing sector's growth in the immediately preceding period has a significant influence on current growth. The second lag of manufacturing sector growth has a positive value of 0.4210890 and p value of 0.005. Specifically, a one-unit increase in the previous quarter's change in manufacturing-sector output was associated with approximately a 1.1159-unit increase in the current change in manufacturing sector output, while a one-unit increase in the change two quarters earlier was associated with approximately a 0.421-unit increase in the current change, ceteris paribus. These results suggest that manufacturing-sector performance exhibits dynamic persistence, whereby changes in output are carried forward into subsequent quarters. The declining magnitude from the first to the second lag may also indicate that the influence of previous output changes weakens as the time interval increases.

The findings of this study indicate that the relationship between inflation rate and manufacturing-sector output differs between the short run and the long run. In the short run, a one-unit increase in inflation rate was associated with a 0.3487 unit increase in manufacturing sector growth, and the effect was statistically significant at the 5 percent level ($\beta = 0.3487$, $p = 0.00$). This positive short-run relationship may suggest that manufacturers respond to increases in producer prices by adjusting output and prices, particularly where higher producer prices reflect stronger demand conditions or increased economic activity. However, the long-run coefficient was statistically insignificant. The insignificant coefficient indicates that the study does not provide sufficient

statistical evidence of a long-run effect of inflation rate on manufacturing-sector output. The findings therefore provide the importance of distinguishing between short-run and long-run inflationary effects.

The adjustment coefficient (ADJ) is negative and statistically significant (−2.4404, p = 0.000), indicating the presence of an adjustment mechanism towards the long-run equilibrium following short-run deviations. Its magnitude suggests a rapid adjustment process, with approximately 244.04% of the previous quarter's disequilibrium corrected within one quarter. Since the coefficient is greater than one in absolute value, the adjustment process may involve overshooting rather than gradual convergence**.**

$OutputtoGDPt = 0.0099882PPI_t + \varepsilon t$

Bounds Test

```
Pesaran, Shin, and Smith (2001) bounds test

H0: no level relationship                                   F =    33.904
Case 3                                                      t =    -8.165

Finite sample (1 variables, 44 observations, 3 short-run coefficients)

Kripfganz and Schneider (2020) critical values and approximate p-values
```

	10%		5%		1%		p-value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F	4.129	4.959	5.135	6.073	7.505	8.663	0.000	0.000
t	-2.567	-2.930	-2.898	-3.278	-3.562	-3.968	0.000	0.000

```
do not reject H0 if
    either F or t are closer to zero than critical values for I(0) variables
      (if either p-value  > desired level for I(0) variables)
reject H0 if
    both F and t are more extreme than critical values for I(1) variables
      (if both   p-values < desired level for I(1) variables)

decision: no rejection (.a), inconclusive (.), or rejection (.r) at levels:
```

	10%	5%	1%
decision	.r	.r	.r

The existence of a long-run relationship between inflation rate and manufacturing sector output growth was examined using the Pesaran, Shin and Smith (2001) ARDL bounds testing approach. F-statistic of 33.904 and a t-statistic of -8.165, based on 44 observations. The calculated F-statistic exceeds the upper-bound critical value of 8.663 at the 1% significance level, while the calculated

t-statistic is more negative than the corresponding upper-bound critical value of -3.968. Additionally, both approximate p-values are 0.000. The null hypothesis of no level relationship is rejected at the 1% significance level. This provides evidence of a long-run relationship between inflation rate and manufacturing sector growth in Kenya. The findings therefore establish that inflation rate and manufacturing sector growth move together in the long run, supporting the application of the ARDL framework to examine both short-run and long-run dynamics.

Model Stability

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. estat sbcusum

Cumulative sum test for parameter stability

Sample: 2013q1 thru 2024q2                      Number of obs = 46
H0: No structural break
```

	Test	Critical value		
Type	statistic	1%	5%	10%
Recursive	**0.7210**	**1.1430**	**0.9479**	**0.8499**

The results indicate a CUSUM test statistic of 0.7210, which is below the critical values of 1.1430, 0.9479 and 0.8499 at the 1%, 5% and 10% significance levels, respectively. Consequently, the null hypothesis of no structural break cannot be rejected at all conventional significance levels. This suggests that the estimated ARDL model is structurally stable over the period

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study investigated the macroeconomic variable and the growth of manufacturing sector in Kenya using the ARDL model. The findings established that inflation rate has a positive and statistically significant effect on the growth of manufacturing sector in Kenya but only in the short run. The study concludes that maintaining a stable macroeconomic environment is essential for promoting sustainable growth of the manufacturing sector in Kenya. Policies aimed at supporting productive industrial activities are critical for improving manufacturing growth rate. The study therefore emphasizes the importance of coordinated macroeconomic and industrial policies in strengthening the manufacturing sector and fostering long-term economic development.

Recommendations

The study recommends policymakers to implement measures aimed at creating a stable and supportive macroeconomic environment to enhance the growth of manufacturing sector in Kenya and achieve the 20by30 vision. The Central Bank of Kenya and Monetary Policy Committee should maintain inflation within a stable and manageable range that supports production incentives without creating excessive cost pressures. Inflation should also be closely monitored to prevent high and volatile price increases, which can erode purchasing power, increase production costs, create economic uncertainty, and ultimately hinder sustainable manufacturing sector growth.

Suggested Areas for Further Studies

The study population focused on the manufacturing sector as the unit of analysis and collected data at national level. The tartget population was led by an assumption that all of the manufacturing sector subsectors are subject to the same influences. The study therefore recommends that future research should focus on stractural changes on specific manufacturing sub sector and specific county in Kenya.

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