Impact of Manufacturing Sector on Economic Growth in East Africa: Evidence from World Bank National Accounts Data

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Abstract

This paper analyses the impact of the manufacturing sector on economic growth in Kenya, Tanzania, Ethiopia and Uganda using World Bank national accounts panel data for the period 2000−21. During the two decades, the share of the sector's growth to gross domestic growth remained low. Agriculture and service sector accounted for the greatest share in the growth of the economies being studied. The study uses fixed effects regression for analysis. Results show that manufacturing sector promotes economic growth in line with Kaldor's first law. The findings suggest the need to support and strengthen infrastructure and working environment for manufacturing firms, as well as woo more firms especially in areas of comparative advantage.

Keywords: Manufacturing Sector, Economic Growth and Fixed Effects, Kaldor

Introduction

The manufacturing sector could be a key element in fostering economic growth in East Africa through creation of capital and consumer goods. Capital goods increase efficiency in production even in other sectors thereby raising returns to scale. Felipe (2018) opines that manufacturing is the single most important sector that led East Asia's growth success. It is not sufficiently established as to whether manufacturing sector in East Africa has been a dynamic driver of economic growth considering the sector's growth performance.

The manufacturing infrastructure in East Africa stands under developed compared to the importance of the sector to the economy. The operating environment has not been conducive enough to the struggling firms forcing them to either close or relocate. In addition, the environment has been unable to offer enough incentives that can attract manufacturing firms in areas where the region has comparative advantage. The region's manufacturing growth potential remains unused up.

This study is therefore of vital importance to policy makers in the field of manufacturing and economic development. It being an empirical study, it provides insights on how manufacturing impacts economic growth in East Africa and whether the impact is in line with economic theory. Through its findings and recommendation, it shall promote economic growth by addressing the challenges that limit growth of the manufacturing sector.

In the period 2001-10, manufacturing sector played a crucial role in economic transformation in East Africa. However, though the sector serves both local and external markets, its role in driving economic growth has been declining in the region. The sector is also dominated by minimally processed resources and resource-based manufactures (AfDB, 2015, 2018). Figure1.1shows that on average manufacturing grew steadily in the period 2001-2005, but in the period2006-09 the sector declined. Though the sector experienced rising growth in the period 2010-2011, there was a sharp decline in 2010. The sector's growth recovered in 2011-2013 but started falling to an all-time low in 2020.
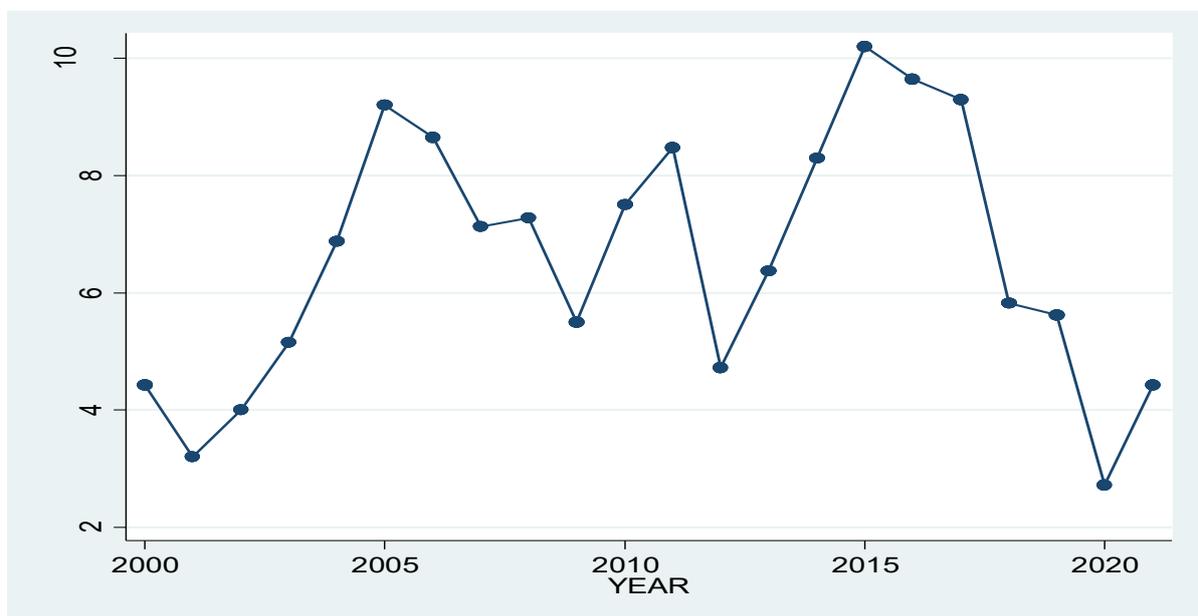

Figure 1.1: Manufacturing Growth in East Africa, 2000-2020(% of GDP)
Source: World Bank national accounts data.

Figure 1.2 presents manufacturing sector growth from 2000 to 2021 for Kenya, Tanzania, Ethiopia and Uganda. The countries have been selected on the basis of data availability. Kenya's manufacturing sector grew by less than 5 percent in the period. Uganda and Tanzania' sectors grew by 10% in three instances while Ethiopia experienced a double-digit growth in the sector in almost all the years. Ethiopia experienced the highest growth while Kenya experienced the least growth in the sector.
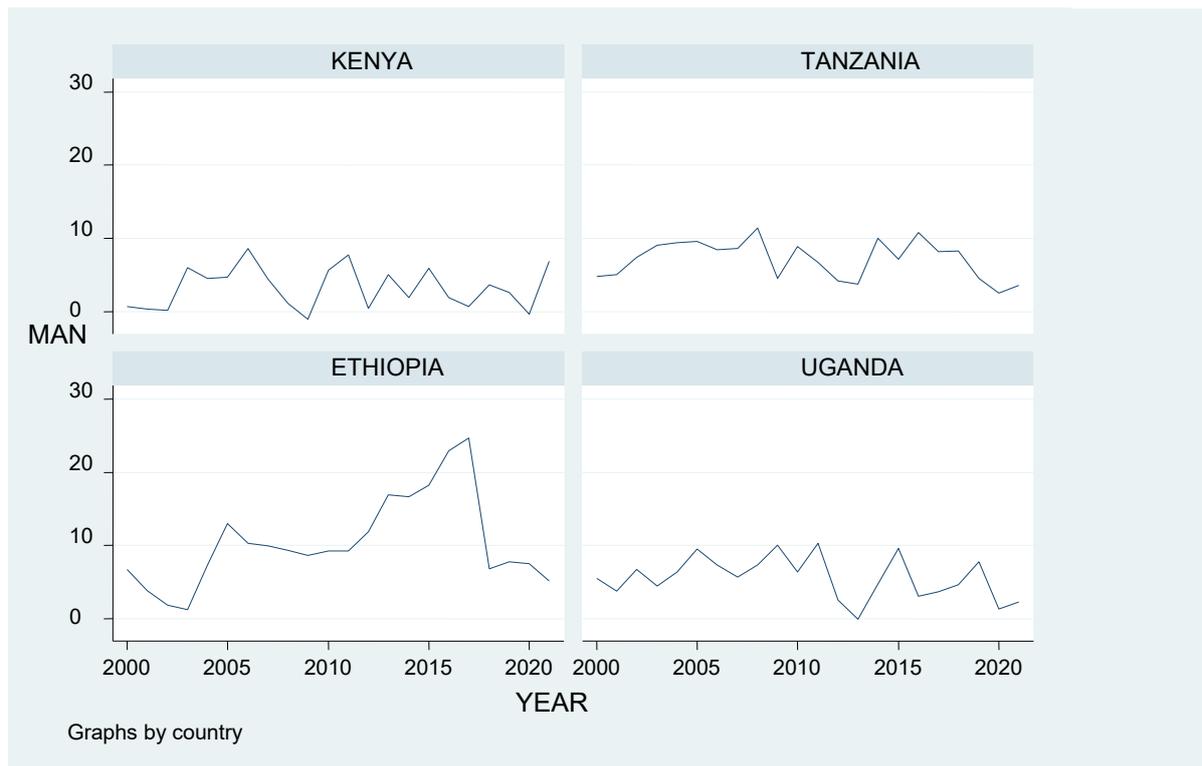
Figure 1.2 Manufacturing output in Kenya, Tanzania, Ethiopia and Uganda, 2000-2021
Source: World Bank national accounts data

Comparing manufacturing growth stability, Ethiopia, Tanzania and Uganda were more stable in the period 2000–10 compared to the period 2011— 21 as shown in Figure 3.
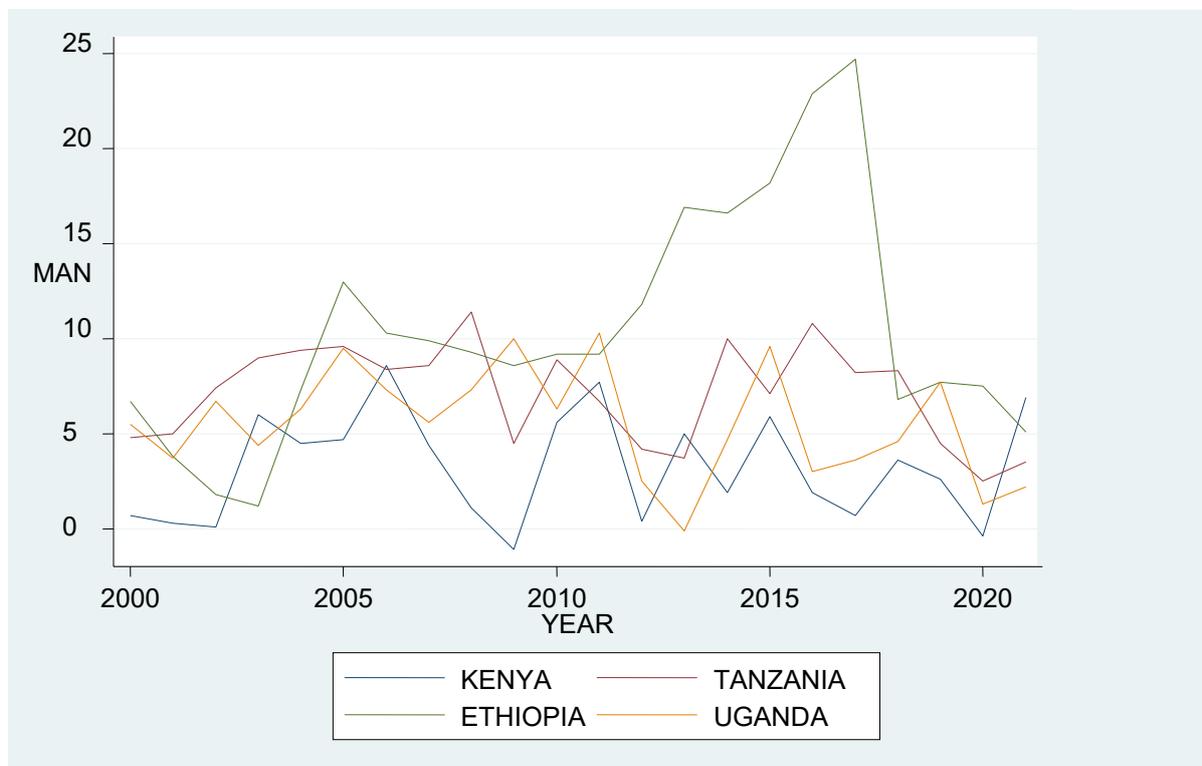

Figure 1.3: Comparison of manufacturing output stability in East Africa between 2000 – 2010, and 2011 – 2020 (annual growth %).

Source: World Bank national accounts data file

The average annual growth rates in these countries could be compared to the growth in manufacturing output. It was very erratic and declining over the period, just as in the case of manufacturing GDP. It was highest in the period 2004-07 after which it plummeted in 2008-2009. In 2010-11, it went up again before falling sharply in 2013. During 2013-19, the mean growth rate was above 5 percent except in 2017 when it fell below 5 percent. In 2020, the growth was lowest ever and this could be attributed to the impact of Covid-19 pandemic.
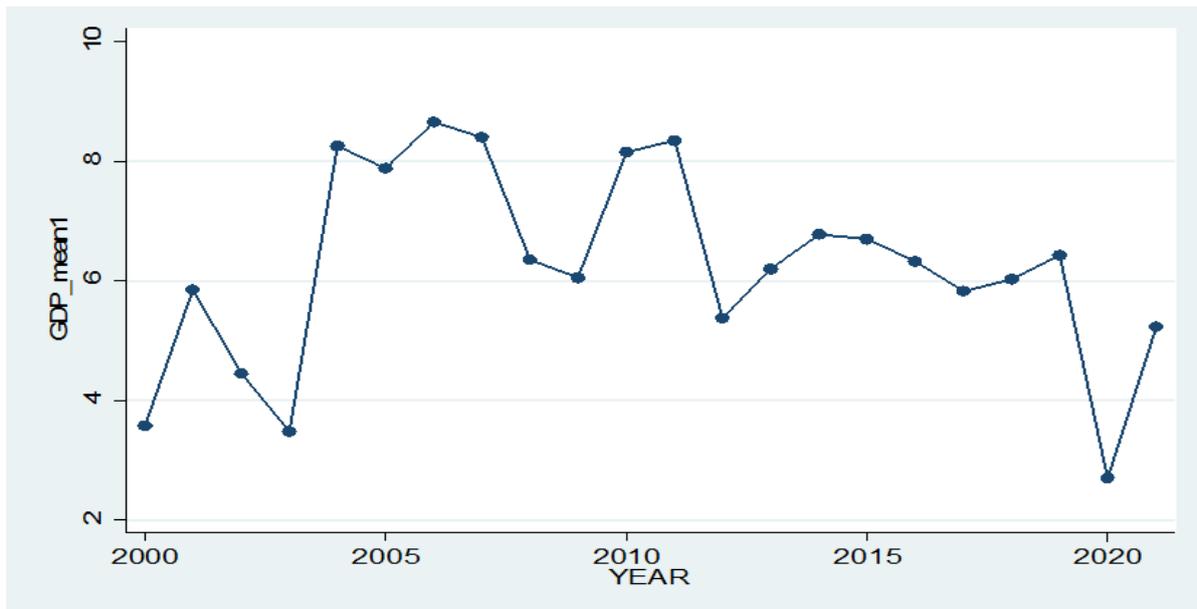
Figure 1.4: Average Economic Growth in East Africa, 2000-2020 (%)
Source: World Bank national accounts data file

The growth rate in individual countries is shown in Figure 1.5. Kenya's GDP growth was very erratic and averaged below 5% in most of the years, while Tanzania's was fairly stable and averaged above 5% in most of the years. Ethiopia posted the highest rise in growth of over 10% though also erratic and falling with time. Uganda experienced growth of above 5% in most of the years but also erratic.
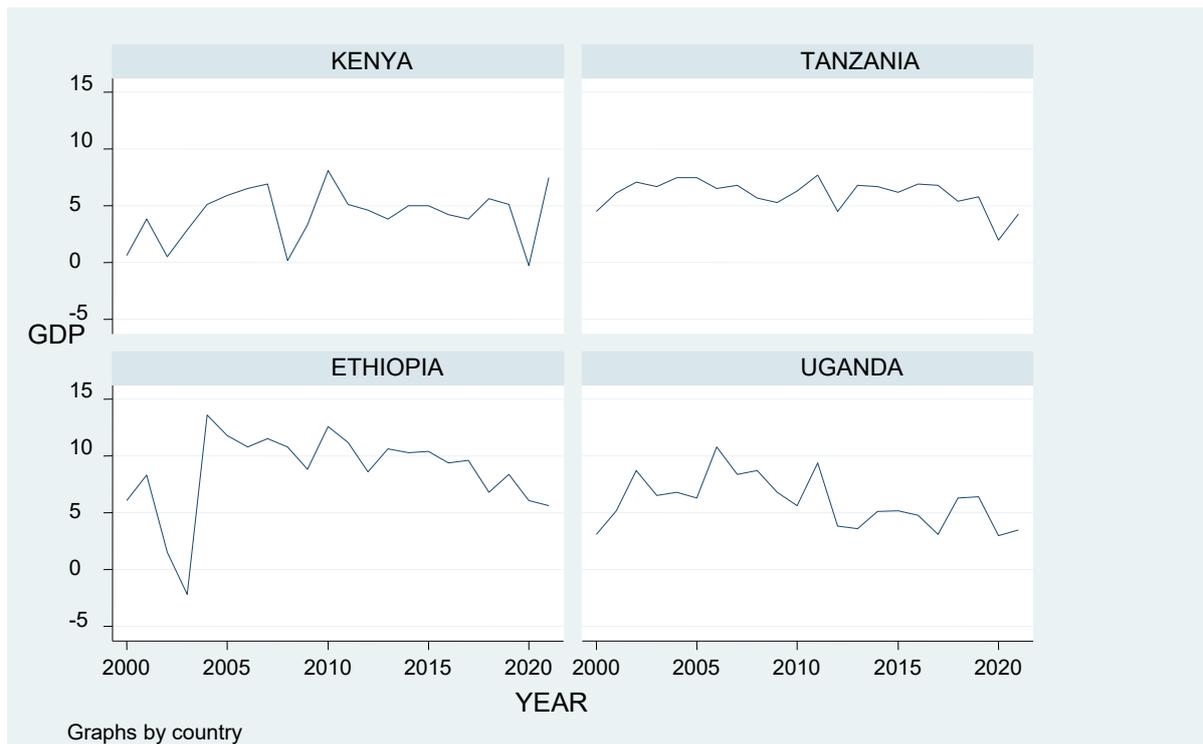
Figure1. 5: GDP growth rate in individual east African countries, 2000-2020 (%)
Source: World Bank national accounts data

Figure 1.6 is comparative analysis of GDP growth. The graph demonstrates that between 2000 and 2010, economic growth was highest in Ethiopia, followed by Uganda, Tanzania then Kenya. Between 2011 and 2021, Ethiopia's growth again took the lead followed by Tanzania, Uganda with Kenya trailing behind. Tanzania experienced a relatively steady economic growth. The growth rate in all the economies seemed to decline gradually towards the end of the second period.
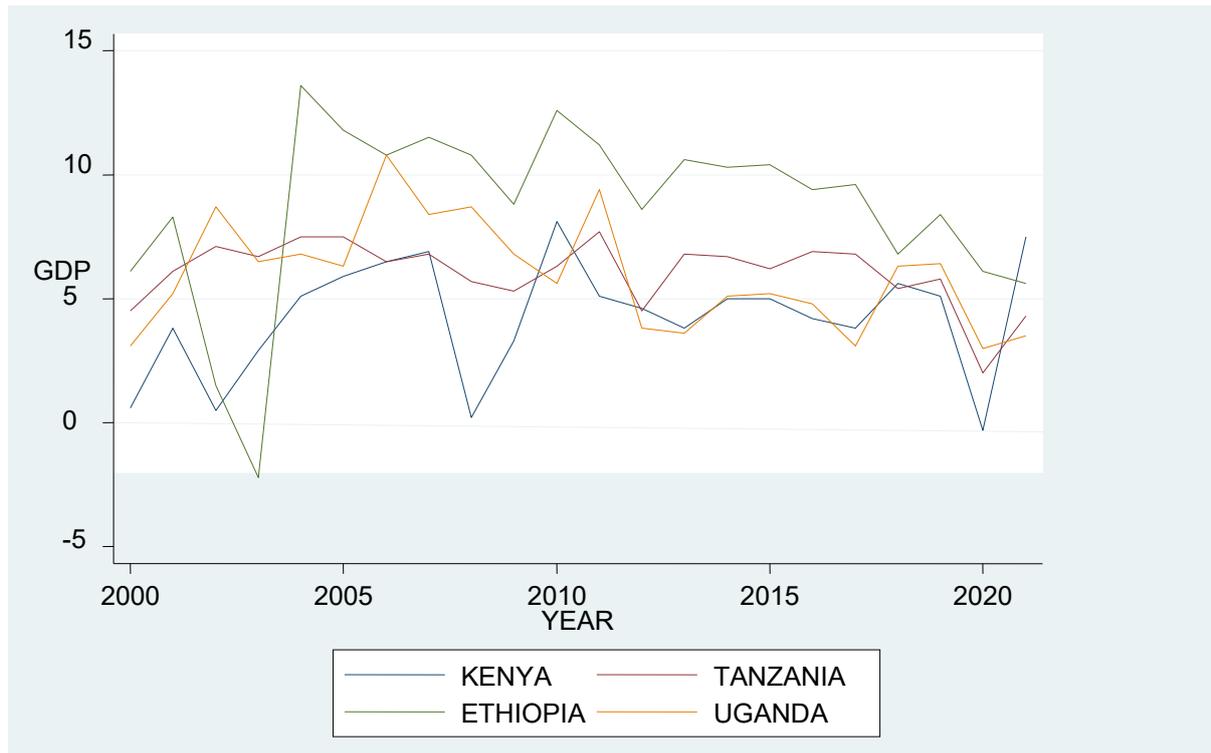
Figure 1.7: Comparative analysis of GDP growth among East African countries (%)
Source: World Bank national accounts data

GDP and manufacturing output grew at a varying rate. The manufacturing output grew gradually in all the four countries but at a rate below 10 percent in most of the years save for Ethiopia where it grew to over 20 percent towards the end of the period. The GDP growth exceeded manufacturing growth with a dismal margin in all the economies. At some point, manufacturing growth was higher than the GDP growth with Ethiopia experiencing the greatest growth difference.

Figure 1.8: GDP growth versus manufacturing output (2000-2021, %)

Source: World Bank national accounts data

Thus far, the question to ask is whether Kaldor's hypothesis regarding the role of manufacturing in economic growth holds in East Africa. According to Kaldor, manufacturing is the main engine for a long-term economic growth.

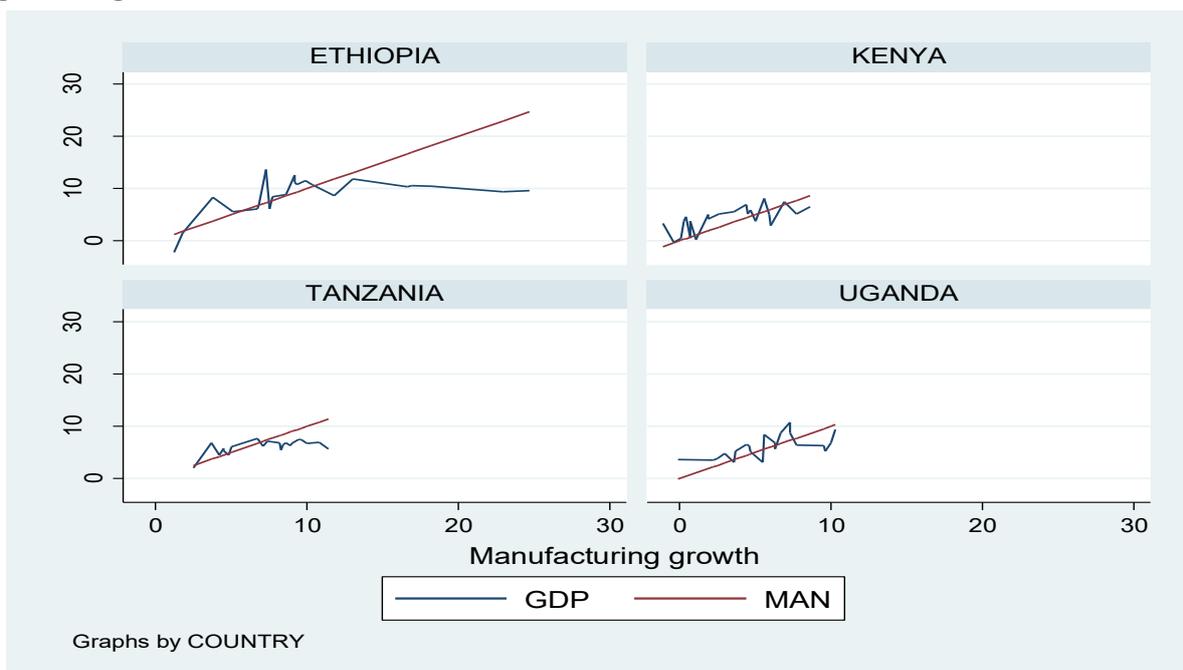The rest of the paper is structured as follows: section 2 explores literature review, section 3 explains the methodology while section 4 presents descriptive statistics and analysis. Section 5 and 6 demonstrates diagnostic test and estimation results respectively. Lastly, section 7 captures discussion and conclusion.

Literature Review

Nicholas Kaldor (1966) laid down the laws of economic growth in the article 'Causes of the Slow Rate of Economic Growth in the United Kingdom,' (https://g.co/kgs/vS1GFG).Kaldor considers manufacturing as the only engine for a long-term economic growth. This law is dubbed 'growth hypothesis'. On his second law which he called 'Verdoorn's law' Kaldor states that the productivity of the manufacturing sector and the growth of the sector are directly proportional. In this law, Kaldor implies increasing returns to scale in manufacturing. His third law also allude a positive relationship between productivity in the non-manufacturing sector and growth of the manufacturing sector. Kaldor premised this law on the argument that associated non-industrial sector have diminishing returns to scale. Validation of these laws has become a focus of attention by many researchers including Su, and Yao (2016) who tested Kaldor's hypothesis by studying manufacturing sector's contribution to growth in middle income economies. Effiong and Udofia (2022) studied the applicability of the laws in Nigerian economy, and Keho, Y. (2018) examined the applicability of the laws to the Economic Community of West Africa (ECOWAS). Attiah(2019) tested the hypothesis that manufacturing is the engine of economic growth by examining the role of manufacturing and service sectors in developing countries during the period 1950-2015.

Olumuyiwa and Oluwasola (2016) studied the growth of manufacturing output and economic output in 28 African countries for the period 1981-2015 to test Kaldor's first law. This panel data was analyzed using fixed effects, pooled Ordinary Least squares and Systems Generalised Methods of Moments methods. The results upheld Kaldor's growth hypothesis that manufacturing is the long-term engine of GDP growth. One of the policy implications from the study is that protracted contraction in the manufacturing sector can lead to economic slowdown in developing economies.

Fayeq (2023) analyzed the impact of manufacturing sector on the real gross domestic product and labor productivity in Jordan using Autoregressive Distributed lag (ARDL) model and time series of 1990-2019. The analysis indicated that growth of manufacturing sector had a positive and long-term effect on the growth of output and labor productivity.

Loria et, al (2019) in a bid to understand what explained slow economic growth in Mexico studied the impact of manufacturing on economic growth. Using data for the period 1980-2017and Ordinary Least Squares (OLS) method, the study examined how Kaldor's hypothesis has evolved over time. The results show that the hypothesis weakens with trade liberalization. The results also reveal a weaker relationship between manufacturing and economic growth and they attribute this to premature education of industrial activity that had caused increased

tertiarization. They conclude that slow economic growth could be caused by slow growth of the manufacturing sector.

Szirmai& Adam, (2012) analyses theoretical and empirical evidence of industrialization being the driving force of economic growth in both advanced and developing economies in the period 1950-2005. The empirics show that manufacturing has been instrumental in growth of developing economies. The analysis further shows that, manufacturing had more impact in the period 1950-1973 in developing economies than in advanced economies. The challenge with this study is that it under represents Sub-Saharan Africa due to lack of long-run time series data. The study cast doubts on the validity of Kaldor's growth hypothesis in view of increased contribution of service sector to GDP at a time of declining share of manufacturing GDP.

Most of the studies on manufacturing and economic growth focus on impact analysis. It can be noted that deindustrialization limits the impact of manufacturing on growth process (Szirmai& Adam, 2012). The validity of Kador's growth law depends on the stage of development of a country, and the sector driving growth most. Loria et, al (2019) suggest that Kaldor's hypothesis diminish with trade liberalisation. These studies cause scepticism on the effectiveness of manufacturing in promoting growth. However, there is no sufficient empirical evidence on the relationship between manufacturing and economic growth in East Africa.

Literature review shows that, in an attempt to test Kaldor's growth hypothesis, most studies have used multivariate models. Manufacturing output has been used with other variables as regressors. Olumuyiwa,Oluwasola (2016) regression model uses both manufacturing growth and non-manufacturing sector as the independent variables. The non-manufacturing sector consisted of agriculture and service sector.

Eman and Attiah (2019) empirical study used manufacturing and service sector as explanatory variables to establish their impact on economic development. Although services accelerate economic growth, this is not like the manufacturing. In case of poor countries, the share of service sector has no effect on economic development.

This study uses a bivariate model since the main focus is to establish the influence of manufacturing output on economic growth over time. It uses a sample of 4 economies in East Africa which have been chosen on the basis of availability of continuous data. Manufacturing output is represented by annual growth of value added in manufacturing while economic growth is represented by annual growth of GDP.

East Africa economies are largely driven by agriculture and service sectors. The share of manufacturing in GDP growth is relatively dismal. Evidence shows that the impact of manufacturing growth depends on the stage of development of a country. This study will enhance empirical evidence on the role of manufacturing on economic growth in a region where agriculture and service industry account for the largest share in gross domestic product.

Methodology
Theoretical Framework
The analysis in this study is packaged using Kaldor's insights on economic growth. The aim is to establish how the East Africa manufacturing sector has influenced economic growth between $2000 - 2021$. The two-decade period is based on data availability.

Upon studying cross-sectional data from developed countries between 1952-54 and 1963-64, Kaldor observed a strong link between growth in manufacturing and overall economic growth. He then formulated the law that manufacturing is the engine of economic growth. This law is referred to as Kaldor's first law. Increasing share of manufacturing GDP is associated with high overall growth rate. The law could be expressed mathematically in linear form as:

$$^g{}_{GDP} = a_1 + b_1{}^g{}_m \dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where: $^g{}_m$ is manufacturing output, and $^g{}_{GDP}$ is the growth of total output. The regression coefficient b_1 should be positive and less than a unity since overall growth of the economy is not limited to manufacturing growth alone.

Empirical studies have established that ordinary least squares (OLS) estimation is not suitable in solving this equation since the variables under consideration are highly correlated. There is also the possibility of reverse causality and country heterogeneity is likely to be a problem as is common with empirical growth regression models. In the event that the regressors are related with the error term, there may be endogeneity bias. These obstacles render OLS a biased estimator.

To circumvent these problems, this paper employs the fixed effects model. The strength of fixed effects model is in its ability to control for all variables that are constant over time and that vary over cross-sectional units. This helps to solve the problem of spurious regression.

Analytical Method
The analysis uses panel data from the World Bank national account. The economies in East Africa that are studied include; Kenya, Tanzania, Ethiopia and Uganda. The selection of these economies is based on the data available. The analysis uses static panel which entails random and fixed effects regression.
The generalized model for this panel data analysis is formulated as:
$$Y_{it} = a_i + \delta X_{it} + u_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$
Where; a_i (i=1....4) is an unknown intercept for each entity/country, Y_{it} is GDP of entity i in time t, X_{it} is a vector of independent variables, u_{it} is the error term, δ is a vector of coefficients to be estimated, while i,t represent entity and time, respectively.

Random Effects Model
Random effects model assumes that the influence of the explanatory variable(s) on the dependent variable varies across entities. The entity's error term is assumed not to be correlated with the independent variables in the model. The general form of the random effects model is
$$Y_{it} = \delta X_{it} + \gamma + u_{it} + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where, Y_{it} is the dependent variable,X_{it}, is a vector of independent variables,u_{it} is between-entity error term, while ε_{it} is within-entity error term. i is for entity while t stands for time.$\delta$is a vector of coefficients to be estimated.

Fixed Effects Model
The fixed effects model assumes a common influence of the explanatory variable(s) on the dependent variable. It controls for factors within an entity that may impact the outcome variable. The model helps in obtaining the net effect of the explanatory variable on dependent variable.
The general form of the fixed effects model is
$$Y_{it} = \rho_1 X_{it} + \gamma_i + u_{it} \quad \text{... (4)}$$
Y_{it} is the outcome variable, X_{it} is a vector of explanatory variables, and ρ_i is a vector of coefficients to be estimated.$\gamma_i(i = 1 \dots . n)$ is an unknown intercept for each entity, and u_{it} is the error term. When time effects are added, the equation of the model can be specified as follows
$$Y_{it} = \alpha_0 + \alpha_1 X_{it} + \delta_i T_2 + \cdots \dots . + \delta_T T_t + u_{it} \quad \text{............................... (5)}$$
$\delta_i$are coefficients of time dummies. δ_1 is omitted because the model includes an intercept. There are $(T-1)$ dummies included.

Hausman Test
This test determines the model most appropriate for estimation between fixed effects and random effects. The test statistic has an asymptotic Chi-square distribution. Before this test is applied, both fixed and random effects models are estimated. The estimated coefficients are then compared using the test. The null hypothesis implies that both models are consistent but it is only the coefficients of the random effects model that are efficient.The estimates are consistent if with increase in sample size, they tend to get closer to their true parameters and their variance is minimal when compared to the coefficients from other estimators. This means the errors are minimal. Failure to reject the null hypothesis shows that the random effects model is more suitable. Rejecting the null hypothesis implies that we accept the alternate hypothesis.

Descriptive Statistics and Analysis
The study uses panel data that relates to annual growth rate of economic growth (GDP) and manufacturing (MAN) for four entities, Kenya, Tanzania, Ethiopia and Uganda. The outcome variable is economic growth.

Table 4.1
Descriptive Statistics of variables used in estimation.

VARIABLE	OBS	MEAN	STD.DEV	MIN	MAX	VARIANCE	SKEWNESS	KURTOSIS
GDP	88	6.227273	2.942347	-2.2	13.6	8.657409	0.8256	0.3183
MAN	88	6.569318	4.654188	-1.1	24.7	21.66146	0.0000	0.0007

From Table 4.1, the mean of GDP is 6.22 while that of manufacturing is 6.57. The standard deviation for GDP is 2.94 and that of manufacturing is 4.65. The range of manufacturing is

higher than that of GDP growth. Therefore, manufacturing growth was more varied than the GDP growth within the study period.

Skewness of the manufacturing data is zero thus the data has approximate symmetry. On the other hand, the data for GDP growth exhibit slightly positively skewed distribution as the value falls between 0.5 and 1.

The kurtosis value of the GDP is 0.3 while that of manufacturing is zero. The peak and tail shape of the data is similar to that of normal distribution.

Diagnostic Test Results

Unit Root Test

The data was first tested for stationarity using Fisher-type unit root test that is based on augmented Dickey- Fuller tests. The null hypothesis suggest that all panels contain unit roots while the alternative suggest that at least one panel is stationary.

Table 5:1

Unit root test results of stationarity of data

2001- 2010	Ln GDP		LnMAN	
	Statistic	p-value	Statistic	p-value
Inverse chi-squared(8) P	41.0921	0.0000	31.7645	0.0001
Inverse normal Z	-5.0135	0.0000	-4.1187	0.0000
Inverse logit t(24) L*	-5.7818	0.0000	-4.4476	0.0001
Modified inv. chi-squared Pm	8.2730	0.0000	5.9411	0.0000

In tables 5.1, the P-values are less than 0.05 in all cases and the null hypothesis is for this reason rejected. The variables are stationary at level.

Wu-Hausman Test

Table 5.2 presents the Hausman test results. The p-value is 0.0181which is less than 0.05. The null hypothesis is therefore, rejected. The analysis should therefore be approached using fixed effects method.

Table 5.2

Hausman test

Independent variable	Coefficient of fixed effects model	Coefficient of random effects model	H- statistic	Critical Chi-square value
lnMAN	.3639126	.4371945	5.59	0.0181

Also, in the table H= 5.59> 0.0181. Since the H-statistic is greater than the reported critical chi-square value. This implies that null hypothesis ought to be rejected. Therefore, fixed effects model is consistent unlike the random effects.

Heteroscedasticity Test

It is assumed that the variance of the error term is constant otherwise the standard errors will be biased thus affecting inference. To ascertain constant variance, we used the Modified

Wald test for group-wise heteroscedasticity. The null hypothesis for test suggests homoscedasticity.

Cross-Sectional Dependence
The aim of this test is to check whether the residuals are correlated across entities as this can cause the test results to be biased. We used the Breuch-Pagan/LM test method. The null hypothesis for the test indicates that the residuals across entities are not correlated.
The test results for both heteroscedasticity and cross-sectional dependence are summarized in Table 5.3.

Table 5.3
Modified Wald test and Breuch-Pagan/LM test results

Diagnostic Test	Fixed Effects Model	
	Statistic	P-value
Heteroscedasticity	chi2 (4) = 92.26	Prob>chi2 = 0.0000
Cross-sectional dependence	chi2(6) = 6.440	Pr = 0.3758

In table 5.3, the p-value for heteroscedasticity is greater than 0.05.The null hypothesis is rejected. The variance of the error term is not constant. This is solved by use of robust standard errors. Thep-value for cross-sectional dependence is greater than 0.05. The null hypothesis is not rejected indicative of no cross-sectional dependence.

Time Fixed Effects
Fixed effects model is important in eliminating bias that may arise from omitting unobserved variables that are the same across entities but change over time. The effects can be controlled by including time fixed or entity effects. Both entity and time fixed effects can also be combined.
According to the joint F-test, Prob > F =   0.0307 is less than 0.05. Time fixed effects should therefore be added.

Estimation Results
Fixed Effects Model Estimation Results
The estimation results are summarized in tables 6.1 and 6.2. In this application, fixed effects are controlled by including time fixed effects. Since the time under consideration is 22 years, we include 21 dummy variables.

Table 6.1
Fixed effects estimation results of impact of manufacturing on economic growth in East Africa

Fixed-effects (within) regression	Number of obs = 88	
Group variable: c_id	Number of groups = 4	
R-sq: within = 0.3203 between = 0.9605 overall = 0.4782	Obs per group: min = 22 avg = 22.0 max = 22	
	F(1,3) = 44.37	
corr(u_i, Xb) = 0.4985	Prob > F = 0.0069	
rho |.12384164 (fraction of variance due to u_i)		

From the estimation results in table 6.1, we note that 12.38% of the variance in outcome is due to differences across entities. Corr (u_i, Xb) = 0.4782 implies that the errors ui are correlated with the regressors in the fixed effects model. It is therefore appropriate to control for fixed effects. Since P≤ 0.05 we conclude that the model is appropriate. Consider table 6.2 for the parameter estimates.

Table 6.2
Fixed effects parameter estimates of impact of manufacturing on economic growth in East Africa

lnGDP	Coef.	Std. Err.(Robust)	T	P>|t|
lnMAN	.3639126	.0546319	6.66	0.007
_cons	3.836615	.3588942	10.69	0.002

Table 6.1 demonstrates that the estimated coefficient of manufacturing is 0.3639126 is statistically significant. The t-value is 6.66 which is higher than 1.96 (for a 95% confidence). Thus, manufacturing growth has a significant influence on economic growth. The estimated regression equation is as indicated below;

$$\widehat{g_{GDP}}$$
$$= 3.837 + 0.3639 g_{MAN} + \ldots + \delta_{2001} T_{2001} + \cdots \ldots + \delta_{2021} T_{2021} + u_{it}$$
$$(0.359)\ (0.0546)$$

Where; g_{GDP} is growth in GDP,
growth in manufacturing g_{MAN}
and time dummy variables (time fixed effects dummies) are; $\delta_{2001} T_{2001} + \cdots \ldots + \delta_{2021} T_{2021}$

There are 21 dummy variables. δ_{2000} is omitted since the model has an intercept. The regression coefficient is positive and less than unit. Thus, for a given country, as manufacturing growth varies across time by a unit, economic growth increases by approximately 0.3639 units.

Time Fixed Effects
The coefficients for year dummies that are statistically significant are summarized in table 6.3. The level of significance is also indicated.

Table 6:3
Coefficients of year dummies.

Time	2001	2004	2005	2006	2007	2009	2010	2011	2013	2014	2015	2019
Coeff (gdp)	2.635	3.955	2.896	3.833	4.031	2.159	3.671	3.584	2.052	2.061	1.427	2.497
Std error	0.461	1.394	0.782	1.369	1.075	0.549	1.565	0.642	0.275	0.824	0.603	0.622
Sig.level.	5%	5%	10%	5%	10%	5%	5%	10%	1%	1%	10%	10%

The impact of manufacturing on economic growth was relatively stronger within the first decade as compared to the second. The impact was highest in 2007.

Discussion and Conclusions

According to the empirical analysis, growth in manufacturing sector in East Africa has a significant impact on economic growth. On average, 1 percent growth in manufacturing is associated with nearly 0.4 percent economic growth in each country over time. The regression coefficient is positive and less than a unit thus conforming to Kaldor's growth hypothesis. Accordingly, even though agriculture is the backbone of these economies, manufacturing provides significant impetus to economic growth.

From 2015 onwards, both manufacturing and economic average growth rates for East Africa region trended downwards as visualized in figures 1.1 and 1.4. Precisely, when manufacturing was on a decline, economic growth also declined especially towards the end of the period considered.

The major policy implication from this study is to revamp the manufacturing sector. The trend where manufacturing firms close shop in their numbers every year should worry policy makers. Governments should provide better infrastructural and operational environment to manufacturing firm, and also support struggling firms to stem their closure even where structural adjustment programs dictate otherwise. Without such support, it is empirically evident that economic growth in East Africa will falter. The region should also aim to attract more manufacturing firms particularly in areas where the region has a comparative advantage. Manufacturing in software, electronic components and semi–conductors should be scaled up. There should also be a deliberate plan to fast track the development of industrial parks in order to spur manufacturing growth and in so doing accelerate the region's growth opportunities.

In conclusion, manufacturing in East Africa influences economic growth. However, there exist great potential that is yet to be exploited. This study therefore enhances the empirical evidence of Kaldor's growth hypothesis by establishing that, manufacturing sector drives economic growth even in developing economies where agriculture and service sectors form the backbone of economies.

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