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Gross Fixed Capital Formation and Economic Growth in East Africa Community States

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Abstract
Purpose: The purpose of this paper is to examine the effect of Gross Fixed Capital Formation on economic expansion of East African Community Countries.
Design/Methodology: The research employed Panel longitudinal, cross sectional and correlational design study period from 2000 to 2022. The study subjected panel data from six (6) EAC member states to pooled OLS Estimation.
Findings: The study found that the rate of economic growth was influenced by the rate of gross fixed capital formation. The acquisition of capital assets such as roads, railways, schools, hospitals, machinery, plants, and new businesses greatly influenced the rate of economic growth of the EAC member's states.
Originality/Value: This study provides more knowledge on how EAC members' states can rely on the study findings to leverage on gross fixed capital formation to build their economic growth.
Implication to Policy: The study implications are that use joint policy on favorable tariffs on capital investments to boost the economic growth of the EAC bloc.

Keywords: *Gross Fixed Capital Formation, Economic Growth, and Pooled OLS*

Background of the Study

The link between economic expansion and gross fixed capital formation (GFCF) has received significant attention in economic discussions at the global, regional, and local levels. Through their various studies there has been mixed findings. (Dua & Kumar, 2021; Dumo, Ico & Magpantay, 2023; Kesar, Bandi, Jena & Yadav, 2022; Solo's, 1957; Barro, 1990; and Romer, 1990) in their studies found that GFCF has a favorable and significant influence on economic growth. In contrast (Fetai et al., 2017) showed impact of GFCF on economic development was negative while (Onyinye, Idenyi & Ifeyinwa, 2017) discovered insignificant relationship. (Ay, Kursunal & Baoua, 2017) discovered GFCF and economic growth to have a two-way relationship. (Ntamwiza & Masengesho, 2022) analyzed the correlation between GFCF and economic progress and came to the conclusion that there exists both the short- and long-term positive and significant relationship.

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Neoclassical Economic Growth Theory, which highlights the role GFCF plays in economic growth, will serve as the study's anchoring theory. The theory explains how a steady rate of economic growth is achieved by the interplay of labor, technology and capital and explains further that it can be considerably enhanced by technology, even in the lack of sufficient labor and capital.

Seven countries make up the East African Community (EAC), as it was once known, which was established in 1967 and includes the Democratic Republic of the Congo (DRC), Burundi, Tanzania, Kenya, South Sudan, Uganda, and Rwanda. With a total land area of more than 2.5 million square kilometers, the EAC nations have a GDP of around US$ 193 billion and a population of 177 million, of which 22 percent reside in urban areas (East African Community, 2017). With a goal of achieving growth, competition, safety, stability, and a politically united community, the EAC member nations treaty was signed in 1999 and put into effect in 2000 (East African Community, 2017). In contrast to its Vision 2050 average projections of 5.8% by 2014, 10% by 2030, and 9.9% by 2050 for East African Community (EAC) member states, the GDP growth rate in EAC member states has stayed at an average of 4.2% over the previous 20 years (East Africa Community, 2022; East Africa Community Vision, 2050). These observations have brought forth challenges of underperforming economic growth and low GFCF in EAC member state`s which needs to be addressed which is the main problem of this study proposal.

Gross Fixed Capital Formation

“Gross fixed capital formation is the gradual acquisition of assets such as schools, hospitals, airports, railways, roads, land improvements, equipment, and machinery” (World Bank, 2014). As stated by (Bakare, 2011), “gross fixed capital formation is the percentage of actual income that is saved and invested to increase production and revenue in the future”. The process by which society devotes a portion of its resources to the production of capital goods, such as machinery and transportation infrastructure, plants and equipment, tools and instruments, and all other real capital that can greatly increase the effectiveness of productive effort, is known as gross fixed capital formation (Owolabi & Ajayi, 2013).

According to (Kritikos, 2014), the formation of new businesses will increase gross fixed capital formation because the new businesses will compete for market percentage, reducing the market percentage of already-existing businesses. This will encourage existing businesses to become more efficient in their production and services. Existing businesses will be forced to increase their production efficiency as a result this will

promote economic growth. (World Bank, 2017) "Gross fixed capital formation (GFCF) as a percentage of GDP serves as a measure of gross fixed capital formation rate." This study will use the World Banks measure of Gross Fixed Capital Formation as percentage of GDP to measure the gross fixed capital formation rate. The justification of using this measurement is that it includes assets that are intended for use in production of goods and services for a period of more than one year.

Economic Growth

According to (Gale and Samwick, 2016), "Economic growth is the expansion of the supply side of the economy and of potential Gross Domestic Product.". (Baumol & Blinder, 1988) defined economic growth as "the process of producing goods and services for every consumer. (Kuznets, 1973) " Economic growth is the long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity is based on advancing technology and the institutional and ideological adjustments that it demands". (Todaro, 1977), "Economic growth is the increase in a nation's capacity to create more of the commodities and services necessary to enhance its residents' quality of life." (Landerfeld, Seskin & Fraumeni, 2008) "Real Gross Domestic Product (RGDP) rate of growth is measured by the percentage growth in the total market rate of all services and finished goods produced in a country by domestic production factors over a given time period." Gross National Product (GNP), GDP, and increases in per capita income have all been employed as indicators of economic growth in earlier research (Romer, 2018; World Bank, 2019; Aslam & Awan, 2018). The rate of real GDP growth will be used to gauge economic growth in this study. This is because real rate of GDP growth adjusts the numbers by fixing the currency value, thus eliminating any distortion caused by inflation or deflation.

East Africa Community Member States

Seven countries make up the East African Community (EAC), as it was once known, which was established in 1967 and includes the Democratic Republic of the Congo (DRC), Burundi, Tanzania, Kenya, South Sudan, Uganda, and Rwanda. With a total land area of more than 2.5 million square kilometers, the EAC nations have a GDP of around US$ 193 billion and a population of 177 million, of which 22 percent reside in urban areas (East African Community, 2017). With a goal of achieving growth, competition, safety, stability, and a politically united community, the EAC member nations treaty was signed in 1999 and put into effect in 2000 (East African Community, 2017). As the area works to accomplish these goals, the three broad themes of Transformation, Value Addition, and Economic Growth are underlined. " An Upper-

Middle Income Region that Competes Globally and Has a High Quality of Life for Its People Based on the Principles of Inclusiveness and Accountability " according to the EAC Vision 2050. The region's economic growth is expected to average 5.8% by 2014, 10% by 2030, and 9.9% by 2050.

Despite significant obstacles such a high unemployment rate, inadequate infrastructure, and low levels of industrialization, the EAC member nations have averaged 4.6% GDP growth annually for the past 22 years (East African Community, 2022). Researchers have been motivated to conduct additional research on how economic growth can be improved and sustained in EAC member states by the reasons behind the EAC member states' low, underperforming, and erratic economic growth when compared to its Vision 2050 EG targets.

Research Problem

Studies have persisted in attempting to explain how gross fixed capital formation influence economic growth in various nations, and their conclusions have produced a variety of opposing viewpoints on the issue. Some scholars have argued that gross fixed capital formation enhances economic growth (Kesa, Band, Jena & Yadav, 2022) while others like (Fetai et al., 2017) argue that gross fixed capital formation does not enhance economic growth. (Onyinye, Idenyi & Ifeyinwa, 2017) in their argument posit that the impact of gross fixed capital formation on economic growth is insignificant. According to (Ay, Kursunal & Baoua, 2017), gross fixed capital formation and Economic growth have a bidirectional interaction towards each other.

The EAC's Vision for the Year (2050) based on the values of inclusivity and accountability, within an East Africa that is politically unified and stable, the East African Community will grow into an upper-middle income region. According to the growth goals underpinning the EAC Vision 2050, member states' economies were to develop at a pace of 5.8% by 2014, 10% by 2030, and 9.9% by 2050 and sustain the growth. According to the EAC Development and Growth Strategy (2016), all of the member states place a high priority on achieving macroeconomic stability. As outlined in the third EAC Development Strategy (2006-2010). It acknowledges that the objectives and benchmarks for economic growth, including the GDP growth rate, GFCF rate, optimum interest rates, low inflation rates, and high national savings rates, as outlined in the third EAC Development Strategy (2006–2010), have not yet been met. The World average for GFCF rate over the period 2000-2021 was 25% compared to EAC member states average of 20% with

Burundi averaging 12%, DRC 18%, Kenya 20%, Rwanda 20%, South Sudan 10%, Tanzania 32% and Uganda 24% (World Bank, 2022). The average GDP growth rate for EAC member nations over the past 22 years has been 4.6%, which is less than what the EAC member nations had hoped to achieve in line with their vision (East African Community, 2022; World Bank, 2022). The EAC member nations have reported an average of high growth each year. After then, Rwanda saw tremendous development up until 2008, when it began to decline. In 2014, from 5.6% in 2013, real GDP growth jumped to 7.0%. In 2003 and 2008, Kenya had huge declines that were mostly caused by the post-election violence. With the exception of 2009, Uganda has seen consistent development; real GDP growth in 2014 was 6.6%, up from 5.2% in 2013 (EAC Facts and Figures, 2014). Researchers have been troubled by the low and fluctuating economic growth rate across EAC member states in comparison to the EAC Vision 2050 economic growth objectives, which has created a problem that needs to be investigated.

After researching the effect of GFCF on Bulgaria, Czech Republic, Hungary, Romania and Poland's economic growth, (Gibescu, 2010) came to the conclusion that there was strong connection between GFCF and EG. Correlation analysis was used to determine connection between GFCF and EG. He used annual data for the years 2003 through 2009. The EG of South Africa, Unemployment and GFCF between 1991 and 2020 was analyzed by Pasara & Garidzirai (2020), who found a favorable association by use of the Vector Autogressive (VAR) model. No discernible impact was discovered when between 1981 and 2015, Onyinye, Idenyi, and Ifeyinwa (2017) investigated the impact of GFCF on Nigeria's economic development. He made use of the Neoclassical Growth Theory, the Vector Error Correction Model (VECM), and the Johansen Cointegration Test. Endogenous growth theory was employed by Easterly & Rebelo (1993) in their investigation of GFCF and EG in 101 nations between 1960 and 1985. Studies on GFCF and EG has resulted to different viewpoints from different scholars; The first point of view was reached by (Harrod & Domar, 1946; Kanu & Ozurumba, 2014; Dua & Kumar; 2021; Kesa, Band, Jena & Yadav (2022); Barro, 1990; Romer, 1990; Solo, 1957 and Pasara & Garidzirai, 2020) who all agreed that there was a favorable and substantial link between GFCF and EG. The second view is by (Fetai et al., 2017) who's finding was negative and significant. The third opinion is held by (Onyinye, Idenyi & Ifeyinwa, 2017) who studied the impact of GFCF on EG and found insignificant effect. All these divergent and incompatible viewpoints on the ideas of GFCF and EG result in conceptual, contextual, methodological and theoretical gaps. The goal of this proposal is therefore to fill the conceptual, contextual, methodological and theoretical gaps mentioned in the foregoing discussion in order to ascertain how GFCF affects economic growth in EAC

member states. What connection exists between the GFCF and EAC member states' economic growth? Is the main research question driving this study?

Research Objectives

The general objective of this study is to establish relationships between GFCF and EG of EAC member countries. The specific aim of this research is to examine the result of gross fixed capital formation (GFCF) on economic growth (EG) of East African Community member states.

Literature Review

Neoclassical Economic Growth Theory

Solow & Swan (1956) developed this concept for exogenous growth. Long-term economic growth is modeled using neoclassical economics. The theory explains how a steady rate of economic growth is achieved by the interplay of labor, technology and capital. Technology according to this theory may contribute infinitely to growth even if the economy has limited labor and capital resources. According to the idea, the production function's variable quantities of labor and capital lead to short-term equilibrium. The theory goes on to claim that economic development depends on how individuals use their funds and how much capital is accumulated within an economy. According to this theory, technology will boost labor productivity and expand its capacity for output. Production is raised by funding or direct offering of capital investments such as infrastructure works, fundamental education, and healthcare costs that the private enterprise would not be able to do in sufficient numbers due to a number of market failures. The efficiency of the private sector could rise as a direct result of these investments (Romer, 1990).

Some of the proponents for this theory are (Barro, Mankiw & Sala, 1992) who supports the theory by showing that countries with higher investment rates and higher levels of human capital tend to grow faster. (Lucas, 1988) in his study explains how technological progress can lead to economic growth and (Mankiw, Romer & Weil, 1992) who in their study shows how significant variables of EG include investments in people and physical resources, population expansion, and technology advancement. On the contrary several scholars have criticized the theory; (Acemoglu, 2009) criticizes the theory for neglecting the role of institutions, politics and social norms in EG and for assuming perfect competition and perfect markets which do not exist in reality. (Romer, 1994) critiques the theory for supposing that technology is exogenous and ignores the part that R&D plays in EG. The theory is pertinent to this research proposal since it

hypothesizes how variations in gross fixed capital formation are reflected in changes in total factor productivity, which affects economic growth (Maingi, 2010). The EG in EAC member states is predicted to increase if enough funds are allocated to gross fixed capital accumulation initiatives.

Empirical Review

The premise by researchers that GFCF contributes to economic growth has led to many studies being done in this area; (Ainabor, Shuaib and Kadiri, 2014) examined how capital production impacted Nigerian development using data of 1960 to 2010 in time series to examined whether the Harrod-Domar framework does have a meaningful correlation to the Nigerian economy by incorporating it into the Nigerian growth model. In this study, stationarity, OLS, and co-integration were checked on Nigerian time series data. The outcome supported Harrod-Domar framework finding that capital accumulation and the rate of increase in national income are directly related. Since Nigeria's economy is different from that of the other EAC members in terms of size and rate of economic growth, the study's conclusions cannot be applied to the EAC as a whole.

Pasara & Garidzirai (2020) utilized data from time series spanning 1980 to 2018 in a (VAR) framework to investigate the causal effects of EG, GFCF and unemployment in South Africa. According to the outcome, EG and GFCF rate have a long-term positive connection. The results demonstrate a positive long-term relationship between gross fixed capital formation and economic growth. However, the first model contends that unemployment has no immediate effect on economic expansion. The results of the second model point to a substantial and positive correlation between unemployment and gross fixed capital production, whereas the third model shows an inverse link between GDP and unemployment. In light of these findings, the report recommends that fiscal authorities undertake expansionary fiscal policy, which increases investment, employment, and economic growth. Since the study employed specific data from South Africa's economy, which differs from the other EAC member states in terms of size and pace of economic growth, its results cannot be extended to the EAC environment.

Dumo, Ico & Magpantay (2023)" Use of the Harrod-Domar Model to Explain Economic Growth in the Philippines" The analysis encompassed the years 1981 through 2021 and included total savings and total capital formation. According to the findings, every single independent variable was shown to be significant positive driver of GDP growth when utilizing the multivariate Ordinary Least Squares (OLS) model.

Furthermore, no indication of convergence, self-correlation, or heterogeneity in the coefficient of regression framework is shown by any of the study's tests, which include the Variance Inflation Factor, Breusch-Godfrey, and Breusch-Pagan-Godfrey. The study's findings are not applicable to the EAC member states since it relied on particular information from Philippine's economy, that is different from the EAC's member countries' economies in terms of size, rate of growth, and other aspects.

Methodology

A longitudinal correlational research design is used in this study to explain trends in change in the variables that are studied over time. The target population for the research consisted of seven member states of the East African Community: Burundi, the Democratic Republic of the Congo, Kenya, Rwanda, South Sudan, Uganda, and Tanzania. Over a 23-year span, from 2000 to 2022, data was gathered and examined for the research variables. The data source for the GFCF and GDP growth was the World Bank's World Development Indicators. Secondary panel data yearly time series from 2000 to 2022 was collected for econometric analysis from the World Bank's World Development Indicators. The study left out South Sudan because of data paucity.

The study run stationarity Unit-Root Test by Levin-Lin-Chu and Woodridge test was run to determine any serial correlation of the data sets. The Breusch-Pagan test was also done to establish the homoscedasticity (variance of residuals). To determine which method to use, Hausman test was done to choose a method before fixed effects and random effects. The Random effect model was found to be appropriate. Hence LM test was further done to choose which method to use between fixed and pooled OLS. Once the diagnostic tests were done, a VCE robust pooled OLS was run to establish the effect.

In this instance Autoregressive Distributed Lag Model (ARDL) has been used to examine Co-integration within the framework of ARDL border research. Either the Wald or F statistics are used. "Under the null hypothesis, which asserts that there is no long-term relationship co-integration between the variables is evaluated. Two pairs of critical limits are presented based on the research of Pesaran & Pesaran (1997) and Pesaran et al (2001). The GFCF is then investigated to see if it has effect on EG. The anticipated OLS equation is given as per the table 1 below:

Table 1: Summary of Research Objective, Hypothesis, Analytical Model, Statistical Test and Interpretation

Objective	Hypothesis	Analytical Models	Interpretation
1. To examine the effect of gross fixed capital formation on economic growth of EAC member states.	**H01:** Gross Fixed Capital formation doesn't significantly impact economic growth of EAC countries.	***Multiple Regression Models***: $GDP_{it} = \beta_0 + \beta_1 GFCF_{it} + \varepsilon_{it}$ $Where, GDP = Economic\ growth\ rate, \beta_0 = Intercept, GFCF = Gross\ fixed\ capital\ formation\ rate, \beta_1 = coefficient, \varepsilon_{it} = Error\ term, i = individual\ country\ cross - section\ data\ and\ t = time\ series$	If β_1 is significant (p-value: $p<0.05$), a relationship exists. The F-statistics are used to test the significance of R^2. A statistically significant F-test is one where the p-value is less than 0.05.

Estimation Results and Discussion of Findings

Descriptive Statistics

Economic Growth

Table 2 shows the descriptive statistics for the GDP among the EAC member states. According to the results, the average GDP growth for the six (6) EAC member states from 2000-2022 was 5.14. The Country with the highest rate of growth was Rwanda at an average GDP growth of 7.4 followed by Tanzania at an average GDP growth of 5.98. The countries with the least GDP growth was Burundi at 2.40 and Kenya with an average GDP growth of 4.27. The data shows that over the last 2 decades it is only Rwanda and Uganda who had some years they recorded double digit GDP growth in one year.

Table 2: Descriptive Statistics on Economic Growth in EAC Countries

Country	N	Mean	Max	Min	Sd	Skewness	Kurtosis
Rwanda	23	7.416522	13.19	-3.38	3.348394	-1.425629	6.064615
Tanzania	23	5.98	7.67	1.99	1.32534	-1.230348	4.577996
Uganda	23	5.906522	10.78	2.95	2.180754	.5030457	2.428655
Congo, Dem. Rep.	23	4.878261	9.47	-6.91	3.652672	-1.693765	6.096252
Kenya	23	4.271739	8.06	-.27	2.263143	-.5450768	2.677175
Burundi	23	2.397826	5.41	-3.9	2.493178	-.7602928	2.808745
Total	**138**	**5.141812**	**13.19**	**-6.91**	**3.049095**	**-.7996319**	**4.749398**

A review of the skewness shows that most of the states GDP distribution was negatively skewed except Uganda (0.5030). This implies that most of the GDP growth rates were on the right of the mean and a long tail on the left. The results on kurtosis showed that Rwanda, Tanzania and Congo Republic had kurtosis of more than 3.0 indicating that they were leptokurtic (highly peaked). Highly peaked distributions indicate that the variable were prone to extremes as witnessed by Rwanda which had a minimum of -3.38 and a maximum GDP value of 13.19 among others.

Figure 4.1 shows the trend of the GDP growth rates over the period 2000-2022 when the current EAC has been in operation. A keen observation shows that except Tanzania, the other countries had erratic and wavy GDP growth rates with extremes. In the year 2020, all the states recorded reduced growth rates due to the COVID 19 pandemic. Rwanda experienced the highest reduction in growth rate.

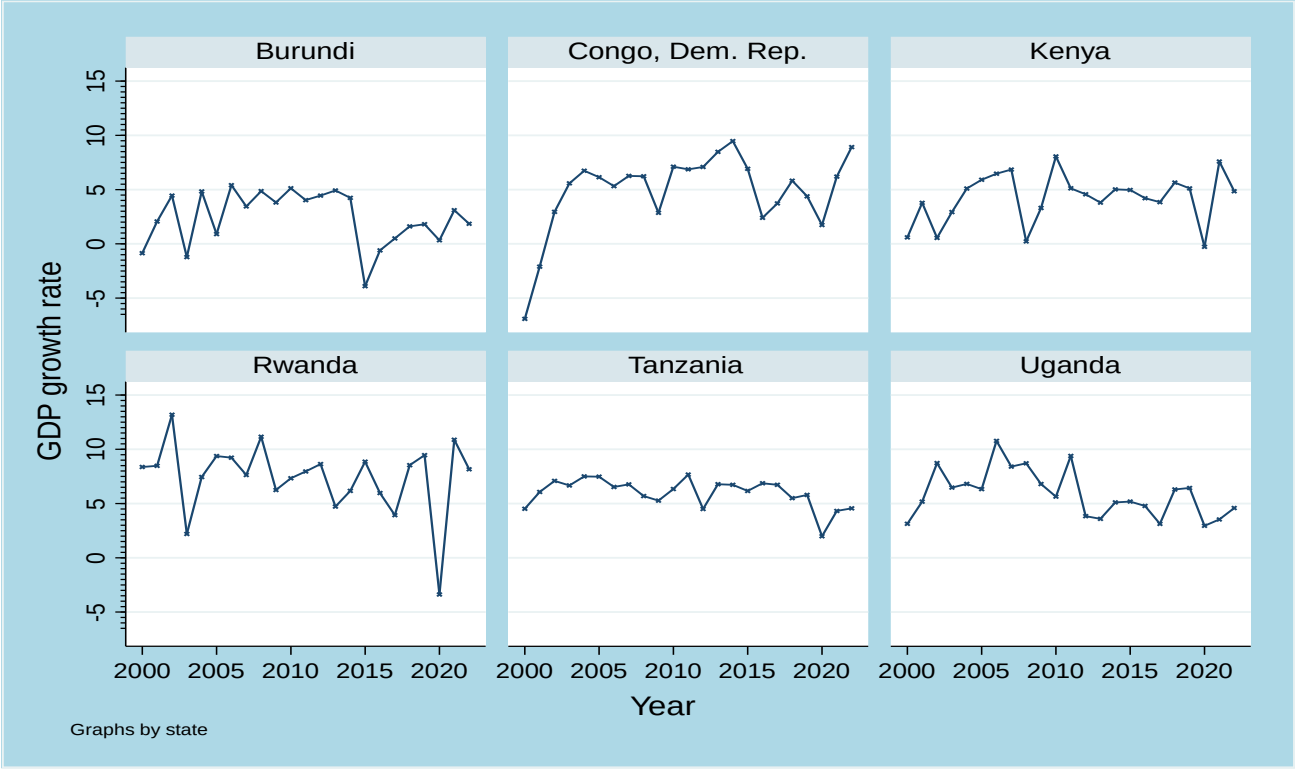

Figure 1: Trends on Economic Growth in EAC Countries

Gross Fixed Capital Formation

The study used the percentage of Nominal Gross fixed Capital Formation to GDP as a measure of GFCF rate. Table 3 shows that the average GFCF rate for EAC member states was 20.7% for the period 2000-2022. The state with the highest rate of gross fixed capital formation for the last 22 years was Tanzania at

32.09% followed by Uganda at 23.43%. The countries with the least GFCF rate were Burundi at an average of 12.17% and Democratic Republic of Congo at 17.20%.

The data on skewness shows that Tanzania (skew=-0.4508147), Rwanda (skew=-0.2692402) and Burundi (skew=-0.6840024) had negatively skewed distribution of GFCF. This implies that most of the rates for the years between 2000 to 2022 were on the right of the mean GFCF rate. This may indicate therefore that these countries had some years where the GFCF rate was very low thus pulling the mean downwards. Other States such as Uganda (skew=0.6587973), Kenya (skew=0.2565946) and Democratic Republic of Congo (skew=0.1521466) had positive skewed distributions of the GFCF rate. This implies that most of the GFCF rates were less than their average rates (were on the left of the mean).

The results on Kurtosis shows that the distributions for all the members states was highly peaked (kurt=3.46). This implies that most of the distributions were highly peaked and with a lot of extreme rates and high standard deviations which indicates that the GFCF rate has not been stable for the EAC member states for the period under review.

Table 3: Descriptive Analysis on the Gross Fixed Capital Formation

State	N	Mean	Max	Min	Sd	Skewness	Kurtosis
Tanzania	23	32.09043	42.69	18.76	7.190904	-.4508147	2.435109
Uganda	23	23.42652	31.47	19.05	2.879673	.6587973	3.833293
Rwanda	23	20.07609	27.14	12.29	5.056075	-.2692402	1.666477
Kenya	23	19.32261	23.88	15.84	1.872374	.2565946	3.226173
Congo Dem. Rep.	23	17.19913	28.72	6.66	6.346422	.1521466	1.971939
Burundi	23	12.16826	18.37	2.78	4.343327	-.6840024	2.737125
Total	**138**	**20.71384**	**42.69**	**2.78**	**7.841665**	**.5087326**	**3.459005**

The trends in GFCF rate for the EAC member states shows that Tanzania has had a progressive rate of GFCF over the years followed by Rwanda. This may imply that their GFCF have been increasing over the years. The results show that Kenya and Uganda have had almost stagnating rates of GFCF. The rate of GFCF acquired over this period is as shown in Fig. 2 below.

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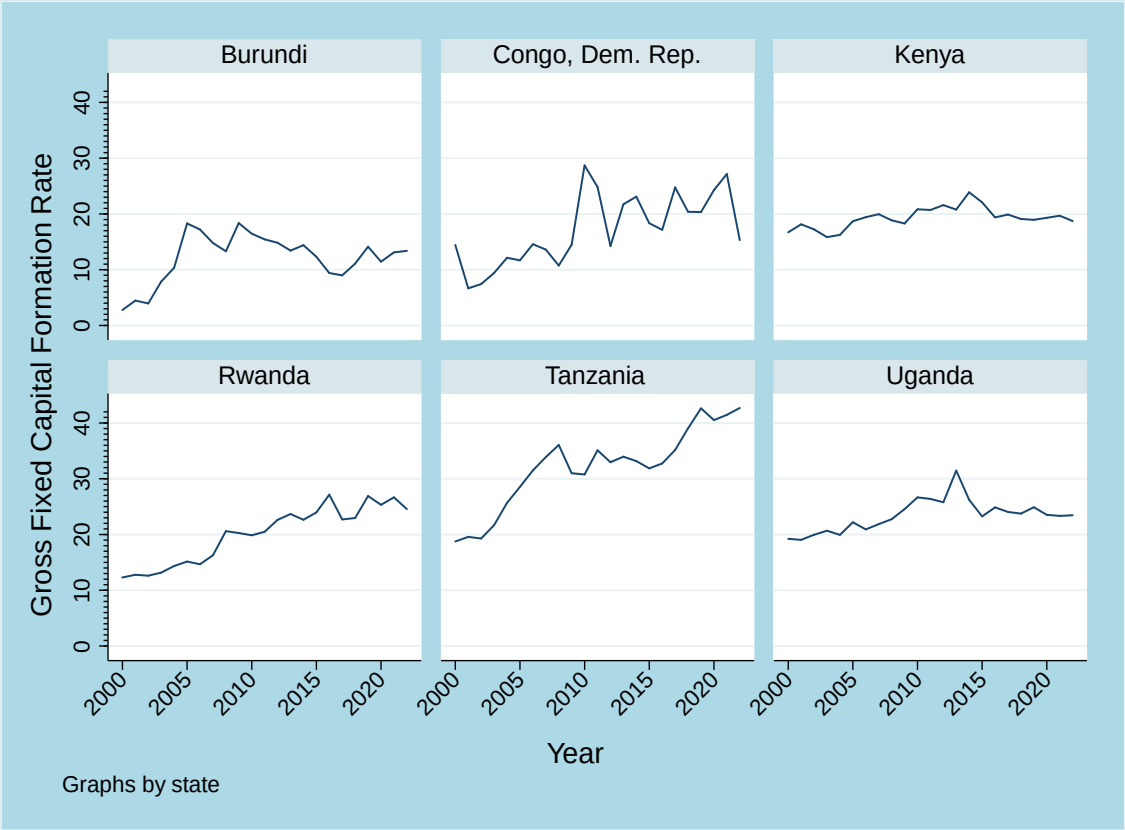

Figure 2: Trends in Gross Fixed Capital Formation rate

Diagnostic Tests

To ascertain whether the model was consistent, the diagnostic tests listed were used in this study.

Stationarity Test

Levin-Lin-Chu Unit-Root Test was employed to ascertain if the model variables exhibited time series properties. The Levin– Lin–Chu (2002) test has the null hypothesis that there is a unit root in each panel. This test assumes each individual unit in the panel to share the same Auto regression (1) coefficient, but allows for individual effects, time effects and possibly a time trend. The null hypothesis was that the distribution contains a unit root and the distribution was steady, according to an alternate hypothesis. In the event when $p>0.05$, we don't reject the null hypothesis and If the p-value is $P<0.05$, we reject the null hypothesis and accept the alternate hypothesis implying that the dataset is stationary (Levin–Lin–Chu, 2002).

Table Error! No text of specified style in document.**: Levin-Lin-Chu unit-Root Test for Stationarity**

Variable	**Adjusted t***	**P value**	**Decision**
GDP Growth	-7.5063	0.0000	Stationary
GFCF Rate	-3.2026	0.0007	Stationary

Autocorrelation Test

According to Gujarati (2003), correlation is a measurement that assesses how dependent two variables are on one another. The correlation between segments of a series and others from the same series that are separated by a specific interval known as autocorrelation. This study used Wooldridge test for autocorrelation in panel data to detect serial correlation. The standard errors of the coefficients are smaller and the R-squared is larger when there is serial correlation. The absence of serial correlation in the residual was the null hypothesis while the alternate hypothesis was that there was a serial correlation in the residual. When the p-value is greater than 0.05, the null hypothesis is not rejected. Should the p-value be less than 0.05, the alternate hypothesis is accepted instead of the null hypothesis.

Wooldridge test for autocorrelation in panel data

H_{01}: no first-order autocorrelation

F (1, 5) = 1.068

Prob > F = 0.3488

From the results, the p-value was insignificant (P>0.05) implying that the dataset's autocorrelation was not an issue and therefore suitable to undertake further regression analysis.

Heteroscedasticity Test

The study used Breusch-Pagan test to investigate the data for homoscedasticity. The presence of heteroscedasticity is the alternative hypothesis, whereas homoscedasticity is the null hypothesis. According to (Tabachnick and Fidell, 2013), the decision criteria was that if p-value was p>0.05, the null hypothesis would not be rejected and the decision would be showing homoscedasticity in the dataset. If the p-value was P<0.05, the null hypothesis would be rejected and accept the alternative hypothesis implying that the dataset would be heteroscedastic. The Breusch-Pagan test results are shown.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

H_{01}: Constant variance

Variables: fitted values of gdp2

chi2(1) = 23.72

Prob > chi2 = 0.0000

The results shown indicates that a p value of 0.000 ($p<0.05$) implying that the variance of the residuals was not constant and therefore the dataset exhibited heteroscedasticity. To overcome this challenge, the Variance Covariance Estimates (VCE) robust option for standardizing errors was used.

Hausman Test

The Hausman test was employed to determine whether fixed effects model or random effects model was more suitable. The alternative hypothesis was fixed effects, while the null hypothesis stated that random effects was the most appropriate model. The null hypothesis, which states that the Random effect model is the most appropriate, would be accepted in the tests if the p-value was $p>0.05$. The alternative hypothesis would be accepted and the null hypothesis would be rejected if the p-value was less than 0.05, suggesting that the fixed effect model would be the most suitable one. The Hausman test findings are displayed in Figure 3.

	——— Coefficients ———			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
gf2	**.5270124**	**.6936345**	**-.1666221**	**.1347309**

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(**1**) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= **1.53**
Prob>chi2 = **0.2162**

Figure 3: Hausman Test for Fixed and Random Effects

From the findings, the P value (<0.2162) was more than 0.05 implying that difference in coefficients was uneven and thus asymmetrical. Therefore, the null hypothesis was adopted that there were differences in coefficients and the appropriate model would be random effects.

Lagrangian Multiplier (LM Test)

To determine whether of the Random effects model or Pooled OLS model was the best, an LM test was conducted. The null hypothesis was that random effects model was appropriate model while the alternative was that pooled OLS regression model was the appropriate model. If the p>0.05, then the study would reject the null hypothesis and adopt the alternative hypothesis that there was no significant heterogeneity among the data for the EAC member States and therefore pooled OLS could be used.

Breusch and Pagan Lagrangian multiplier test for random effects

gdp2[state1, t] = Xb + u[state1] + e[state1, t]

Estimated results:

Var	sd = sqrt(Var)
gdp2	.6625764	.8139879
e	.540695	.7353196
u	.0276165	.1661822

Test: Var(u) = 0

chibar2(01) = 1.07

Prob > chibar2 = 0.1502

The results showed that there was no substantial heterogeneity across the EAC members, and that the Pooled OLS regression model was the most suitable model to examine the impact of the GFCF on GDP. The p value was 0.1502 (p>0.05).

Pooled OLS Regression Model:

Having determined that pooled OLS was the most appropriate model. A pooled OLS test was done on the data presented as shown. The results show a R square of 0.154 ~ 15.4%. This shows that GFCF accounted for 15.4% of the variation of the GDP and the rest was explained by other factors not in the model.

The F test showed that the model was significant as given by F(1,136) =16.060, p<0.05 indicating that the model was fit. This also showed that the GFCF had a significant influence on the GDP growth among the EAC member states.

Table 5: **Linear Regression With Standard Errors**

gdp2	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
gf2	.784	.196	4.01	0.000	.397	1.171	***
Constant	-.718	.621	-1.16	0.249	-1.945	.509	
Mean dependent var		1.637	SD dependent var			0.814	
R-squared		0.154	Number of obs			138.000	
F-test		16.060	Prob > F			0.000	

**** p<.01, ** p<.05, * p<.1*

Where:

gdp2 is Gross Domestic Product

gf2 is Gross Fixed Capital Formation

The resulting regression equation then became:

GDP_it=-0.718+0.784(GFCF)_it

Where, GDP=Economic growth rate,

β_0=Intercept,

GFCF=Gross fixed capital formation rate,

i=individual country cross-section data

t=time series

Conclusions and Recommendations

The findings show that GFCF had a significant influence on GDP since the p value was significant ($p<0.001$). This indicates that GFCF was a strong predictor or had a substantial effect on the growth of the GDP among the EAC member states. This suggests that accumulation of capital assets such as schools, hospitals, airports, railways, ports, roads, land improvements, equipment, and machinery" (World Bank, 2014) had a big impact on the GDP growth of the EAC member countries. The results validate the Neoclassical Economic Growth Theory (Solow & Swan, 1956), which postulates that the amount of capital accumulated in an economy and how people use their money determine economic progress. According to the theory, production is increased by funding or direct offering of capital investments such as infrastructure

works, fundamental education, and healthcare costs that the private enterprise would not be able to do in sufficient numbers due to a number of market failures.

The results resonate with the views of Romer (1990) that efficiency of the private sector could rise as a direct result of these investments. This argument agrees with Kritikos (2014) who held that formation of new businesses was a form of growing capital formation. According to the author, creating new business provides competition to the existing ones which improves their efficiency of operations leading to increased efficiency and productivity which in turn supports economic growth (World Bank, 2017). Therefore, as a measure investing in capital assets among the EAC member states could drive economic growth. Therefore, investing in infrastructure, plants, machinery, roads, railways, airport, and hospitals will not only provide services to the people but also contribute to the growth of the GDP rates in the region. This is because such assets support other productive segments of the economy or provides market for such segments which ensures their survival and a general improvement in the economy.

The goal of the study was to determine how gross fixed capital formation affected the EAC member states' economic growth. The findings reveal that gross fixed capital formation positively and significantly affected economic growth in EAC member states. The results point to the fact that gross fixed capital formation plays a critical role on economic growth. The results are consistent with Solow & Swan (1956) Neoclassical economic growth theory, (Ainabor, Shuaib and Kadiri, 2014; Molonko, 2017; Pasara & Garidzirai, 2020 and Dumo, Ico & Magpantay, 2023). A policy implication is that all EAC member states should invest in gross fixed capital formation programmes to realize a progressive economic growth in EAC bloc.

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