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DETERMINANTS OF ECONOMIC GROWTH AMONG THE EAST AFRICAN COMMUNITY COUNTRIES (1990-2020)

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ABSTRACT

This study examines the factors influencing economic growth within the member states of the East African Community (EAC), including Uganda, Tanzania, Rwanda, Kenya, and Burundi, for the period from 1990 to 2020. Utilizing panel time series data, the analysis commences with descriptive statistics to investigate the trends of essential variables. The stationarity of the data is evaluated using the Pesaran-Shin unit root test, followed by the application of both Fixed Effects and Random Effects Generalized Least Squares (GLS) regression models. The Breusch-Pagan Lagrangian multiplier test is conducted to ascertain the appropriate model specification. The empirical findings identify four critical determinants of economic growth: inflation, defense expenditure, population growth, and imports. Specifically, inflation and population growth are shown to have a positive impact on economic growth, whereas defense expenditure and imports are negatively correlated with growth. Policy recommendations for EAC governments include the enhancement of foreign direct investment (FDI) policies, the maintenance of moderate inflation levels, an increase in government consumption expenditure, the promotion of sustainable population growth, and the regulation of defense spending, internet usage, mobile phone subscriptions, and imports to improve economic performance.

1.1 INTRODUCTION

The East African Community (EAC), initially established in 1967 and reconstituted in 1999 through the East African Community Treaty, is a regional organization structured around four core pillars: the Customs Union, Common Market, Monetary Union, and Political Federation (EAC, 2017). Mwasha (2012) posits that this regional integration facilitates private investment, stimulates economic growth, and contributes to job creation. Arne and Kayizzi (1999) underscore the mixed economic performance across Africa despite the continent's shift toward free-market systems. Limited economic growth has constrained efforts to reduce poverty; however, advancements in infrastructure and the establishment of new institutions present prospects for future improvement. For growth to be sustainable, it must be inclusive, ensuring that the benefits reach the impoverished, with key drivers including asset ownership and market access, complemented by essential political reforms. Economic growth is commonly defined as the sustained increase in the production of goods and services over time (Kimberly, 2018). Raisova and Durcova (2014) emphasize this as the enhanced ability of an economy to produce goods and services from one period to the next. Babatunde (2018) characterizes economic growth as the rise in the monetary value of a nation's goods and services, typically measured by Gross Domestic Product (GDP). Alina (2012) conceptualizes economic growth as the expansion of national economies, indicated by increasing GDP per capita. Similarly, Bashier and Wahban (2013) define economic growth as the augmentation of a country's total output, measured through either GDP or Gross National Product (GNP), with GDP reflecting domestic production and GNP encompassing outputs from international sources.

1.2 THEORETICAL PERSPECTIVE

The Neoclassical Growth Theory

Neoclassical growth theory, as formulated by Robert Solow (1956) and Trevor Swan (1956), posits that a stable rate of economic growth can be attained through the optimal allocation of capital, labor, and technological progress. The model emphasizes the role of these three key factors in driving long-term economic growth, suggesting that sustained growth is primarily dependent on technological advancements, given diminishing returns to capital and labor. The growth model is mathematically represented as: yt=f(kt,lt)y_t = f(k_t, l_t)yt=f(kt,lt) where yty_tyt is output, ktk_tkt

is capital, and ltl_tlt is labor at time ttt. The principle of motion for capital is: kt+1= (1−σ) kt+μytk_{t+1} = (1 - \sigma)k_t + \mu y_tkt+1= (1−σ) kt+μyt, where σ\sigmaσ is the depreciation rate and μ\muμ is the savings rate. Substituting the production function into this equation yields: kt+1=(1−σ)kt+μf(kt,lt)=g(kt)k_{t+1} = (1 - \sigma)k_t + \mu f(k_t, l_t) = g(k_t)kt+1=(1−σ)kt+μf(kt,lt)=g(kt). A steady state is reached when: k=g (k) k = g (k) k=g (k).

Abramovitz (1956) and Solow (1957) introduced the growth accounting model: Y∗(t)Y(t)−L∗(t)L(t)=αk(t)(K∗(t)K(t)−L∗(t)L(t))+R(t)\frac{Y^*(t)}{Y(t)} - \frac{L^*(t)}{L(t)} = \alpha_k(t) \left(\frac{K^*(t)}{K(t)} - \frac{L^*(t)}{L(t)} \right) + R(t)Y(t)Y∗(t)−L(t)L∗(t)=αk(t)(K(t)K∗(t)−L(t)L∗(t))+R(t) where Y∗(t)Y(t)\frac{Y^*(t)}{Y(t)}Y(t)Y∗(t) is the growth rate of output, L∗(t)L(t)\frac{L^*(t)}{L(t)}L(t)L∗(t) is the growth rate of labor, K∗(t)K(t)\frac{K^*(t)}{K(t)}K(t)K∗(t) is the growth rate of capital, αk(t)\alpha_k(t)αk(t) is the elasticity of output with respect to capital, and R(t)R(t)R(t) represents the Solow Residual, indicating technological progress.

De Gregorio (1996) extended the neoclassical view to explain how inflation affects long-run growth: yt=θf(kt,lt)y_t = \theta f(k_t, l_t)yt=θf(kt,lt) where θ\thetaθ is a technological parameter. Log-differentiating this equation provides the growth rate of production: γ=θf′ (kt, lt) i\gamma = \theta f'(k_t, l_t) iγ=θf′ (kt, lt) i where γ\gammaγ is the rate of growth of production, f′ (kt, lt) f′ (k_t, l_t) f′ (kt, lt) is the marginal productivity of capital, and iii is the investment rate. According to this equation, growth can be driven by increased investment or higher marginal productivity of capital. On the other hand, if we assume that fff is linear in kkk, such that f′f'f′ is an increasing function of ltl_tlt; a decrease in f′ (kt, lt) f′ (k_t, l_t) f′ (kt, lt) leads to a decrease in the rate of growth, since capital accumulation becomes less efficient. If people have to choose between consumption and leisure, and to buy consumption goods, people will face a cash-in-advance constraint. Since people will be required to have cash in order to buy consumption goods, the effective price of consumption goods will include the rate of inflation. Thus, a rise in the inflation rate will increase the price of consumption with respect to the price of leisure, inducing substitution from consumption to leisure and thereby decreasing the labor supply. Hence, a rise in inflation will decrease the efficiency of investment and the rate of growth (Xiao, 2009).

2 EMPIRICAL REVIEW

Research on the determinants of economic growth has yielded diverse results, largely due to variations in both focus and methodological approaches. Inflation, a frequently analyzed variable, has been extensively studied in works such as Fischer (1993), Azam and Khan (2020), Ekinci et al. (2020), Dammak and Helali (2017), and Rutayisire (2015). The findings on its impact have been mixed; while some studies suggest a positive contribution of inflation to economic growth, others report negative or negligible effects, highlighting the complexity of its influence across different economic contexts. Azam and Khan's (2020) study, employing fixed effects and generalized least squares (FGLS) analysis across 27 countries, found that inflation negatively affects economic growth when it exceeds 12.23% in low-income countries and 5.36% in middle- and high-income nations, aligning with Hector's (2002) assertion that high inflation can destabilize economies. Similar findings were reported by Tarawalie and Kamara (2022) and Rutayisire (2015), who also observed a negative relationship between inflation and growth. However, contrasting evidence was presented by Vinayagathasan (2013), who found no significant link between inflation and economic growth in Kenya, further underscoring the context-specific nature of inflation's impact on economic performance.

Rahman (2015) identified a negative relationship between Foreign Direct Investment (FDI) and economic growth in Bangladesh, attributing this to challenges within the investment climate. Similarly, Alege and Ogundipe (2013) found that FDI had adverse effects on economic growth in the ECOWAS region. However, other studies present contrasting findings. Mohsin and Carmen (1990) and Upreti (2015) demonstrated that FDI positively impacts economic growth in developing countries, while Hlavacek and Bal-Domanska (2016) and Agrawal (2015) emphasized FDI's significant contribution to GDP growth in Central and Eastern Europe and BRICS economies, respectively. In the context of government expenditure, Gisore et al. (2014) discovered that spending on health and defense positively influenced economic growth in East Africa, whereas expenditure on education and agriculture showed insignificant effects. They noted, however, certain methodological limitations in their analysis. Hasnul and Gifari (2015) observed a negative correlation between government spending and growth in Malaysia, while Maingi (2017) reported a positive impact in Kenya. Additionally, Babatunde (2018) highlighted the benefits of infrastructure

investment in Nigeria, and Kimaro et al. (2017) underscored the role of such spending in accelerating growth in low-income Sub-Saharan African countries.

Acemoglu and Johnson (2007) found no significant link between life expectancy and per capita income growth, whereas Aghion et al. (2011) observed a positive relationship between life expectancy and GDP growth within OECD countries. Similarly, Karim (2016) and Eggoh et al. (2015) reported weak or negative effects of health expenditure on economic growth in Nigeria and across Africa, respectively. In contrast, more recent studies, such as those by Manzoor et al. (2023) and Söyük (2023), highlight the positive role of healthcare investment in enhancing economic growth and mitigating financial risks. This view is further supported by Boduroglu and Omay (2023) and Ivankova and Khouri (2022). Regarding information and communication technology (ICT), while ICT infrastructure generally contributes positively to economic growth, disparities in access persist. Bongomin et al. (2020) identified a significant gap in East Africa, where high mobile phone penetration coexists with limited internet access. Conversely, Adeleye and Eboagu (2019) and Chavula (2013) found telecommunications to have a positive impact on economic growth in Africa. Further emphasizing ICT's importance, studies by Asongu and Nwachukwu (2016), Maneejuk and Yamaka (2020), and Appiah-Otoo and Song (2021) underscore its critical role in fostering growth, particularly in emerging economies.

Research on the relationship between defense expenditure and economic growth presents mixed results. Shahbaz et al. (2017) found that in Pakistan, high defense spending boosts short-term demand but inhibits long-term economic growth. Similarly, Pieroni (2016) reported that while moderate defense spending in the European Union supports growth, excessive expenditure has a detrimental effect. Benoit (2018) emphasized that the impact of defense spending on growth is highly context-dependent. Yildirim et al. (2020) noted that excessive defense expenditure can crowd out other productive investments, while Kollias and Paleologou (2019) and Collier and Hoeffler (2006) found weak positive effects on growth and improvements in security, respectively. In terms of trade, Cuadros et al. (2020) highlighted that export growth significantly drives economic development in emerging economies, especially when exports are diversified. Yanikkaya (2019) emphasized the importance of capital goods and technology imports in enhancing productivity and

fostering growth. Hye and Lau (2018) concluded that both exports and imports positively influence long-term growth, advocating for balanced trade policies to optimize economic outcomes.

Kremer and Willis (2018) found that historically, population growth has driven economic expansion, particularly during early development stages, by promoting innovation and market expansion. Ashraf et al. (2019) observed that while initial population growth may strain resources, a demographic transition marked by declining birth and death rates can lead to a demographic dividend, positively impacting economic growth. Acemoglu and Johnson (2020) emphasized that although rapid population growth can pose development challenges, it also presents opportunities if supported by investments in education and healthcare. Distidar, Mohan, and Chatterji (2013) highlighted the crucial role of educational investment in driving economic growth in India but noted that education alone is insufficient for substantial progress. Similarly, Oluwatobi and Ogunrinola (2011) found a positive relationship between education expenditure and economic growth in Nigeria, especially when paired with healthcare investments. Sinha (1998) identified a long-term relationship between education and growth in Malaysia, while Idrees and Siddiqi (2013) reported a more pronounced effect in developed economies. Chandra (2010) attributed the boom in India's software industry to educational investments made in the 1950s and 1960s. However, other studies, such as those by Nurudeen et al. and Beine et al. (2001), suggest that in certain contexts, education expenditure may negatively impact economic growth.

3.1 METHODOLOGY

This study adopted a quantitative research approach, well-suited for addressing research questions involving numerical data and statistical analysis (Williams, 2011). As noted by Amin (2005), quantitative research enables the systematic collection and analysis of data, facilitating hypothesis testing and the identification of patterns. By relying on numerical data and applying statistical tools, this approach provides a rigorous framework for examining key variables related to economic growth and unemployment. In line with the quantitative methodology, the study employed an ex-post facto research design, focusing on the analysis of pre-existing panel data from 1990 to 2020. Booth (2001) highlights that ex-post facto research is effective in examining existing conditions and exploring potential causal relationships between variables. Additionally, Dixon-Woods et al. (2007)

underscore its utility in investigating the determinants of economic growth, as it allows for the analysis of historical data to uncover long-term trends, offering valuable insights for future policy formulation.

3.2 Nature and Sources of Data

This research employed secondary data from reputable sources to ensure both reliability and comprehensiveness. The primary data sources included the following:

1. **World Bank Development Indicators (WDI)**: A comprehensive resource providing global economic, social, and environmental data. This study used WDI to obtain various economic indicators relevant to the analysis.
2. **African Development Indicators (ADI)**: A specialized database offering data on Africa's economic and social development, which was crucial for conducting a regional analysis within the East African Community (EAC).
3. **United Nations Conference on Trade and Development (UNCTAD)**: This source provides essential data on international trade, investment, and development, instrumental for analyzing foreign direct investment (FDI) and trade-related variables.
4. **International Monetary Fund (IMF)**: The IMF supplies critical macroeconomic data, including inflation rates and other key economic indicators, essential for examining the relationship between economic growth and unemployment.
5. **Organisation for Economic Co-operation and Development (OECD)**: The OECD provides data on inflation and other economic variables, which were incorporated into the analysis.

The study utilized time-series data spanning 1990 to 2020, resulting in a comprehensive 31-year dataset. A panel data approach was employed to estimate the effects of these variables on economic growth, with Friedman's theoretical framework serving as the foundational model. The analysis aimed to explore the relationships among these variables to provide insights into their influence on the economic growth dynamics within the EAC.

Table 1: Description and measurement of variables

Variables	Descriptions	Variable Measurement	Data source
GDP	Gross domestic product (Economic growth measure)	Yearly % change of (GDP)	WDI
UE	Unemployment	% of total labour force	WDI
FDI	Foreign Direct Investment	Net inflows (% of GDP)	WDI
Inf	Inflation	GDP deflator (annual %)	WDI
GCE	General Government consumption expenditure	Annual percentage change of (GDP)	WDI
EdExp	Education Expenditure	As a % of GDP	WDI
HExp	Health Expenditure	As a percentage of GDP	WDI
Defexp	Defense Expenditure	Expressed as a % of GDP	WDI
IntUse	Internet Use	Individuals using Internet (% of population)	WDI
MPU	Mobile telephone use	Mobile cellular subscriptions (per 100 people)	WDI
PG	Population Growth	Annual % change	WDI
Exp	Exports	As a percentage of GDP	WDI
Imp	Imports	Expressed as a % of GDP	WDI

WDI = World Development Indicator

3.3 Model Specification

In this study the model specification was developed as follows;

(i) Determinants of economic growth in East African community.

The study considered a neoclassical Cobb-Douglas production function;

$$Y_{it} = A_{it} K_{it}^{a} L_{it}^{\beta} \quad \text{..... (1)}$$

Where Y_{it} represents total output of economy i at time t and A_{it} is the productivity which indicates the stock of knowledge, production technology or blue print.

K_{it} and L_{it} are conventional factors of the production function indicating the stock of capital and labour since inflation, FDI, government expenditures, internet use, mobile phone subscription, population growth, exports and imports affect economic growth through production.

$$A_{it} = f\left(AINFL_{it}, FDI_{it,} GCE_{it} \text{Inf}_{it}, \text{GCE}_{it}, \text{EdExp}_{it}, \text{HExp}_{it}, \text{DefExp}_{it}, \text{IntUse}_{it}, \text{MPU}_{it}, \text{PG}_{it}, \text{Exp}_{it}, \text{Imp}_{it}\right)$$

…… (2)

Imposing factor shares on each of the components makes it simple to substitute back into the equation (1)

$A_{it} = AINFL_{it-s}^{\gamma}\ FDI_{it-s}^{\lambda}\ GCE_{it-s}^{\mu}$ …… (3)

Where AINFL, FDI, GCE, etc. are the determinants of economic growth.

Combining equation 3 and 1 we obtain;

$\Delta GDPGR_{it} = AINFL_{it-s}^{\gamma} FDI_{it-s}^{\lambda} GCE_{it-s}^{\mu} K_{it}^{a} L_{it}^{\beta}$ …… (4)

Where $\gamma, \lambda, \mu, \alpha$ and β are elasticities of economic growth rates with respect to the determinants of economic growth given in equation (2). Taking natural logs (l) on both sides of equation (4) gives an estimable linear function;

$\Delta GDPGR_{it} = C + \gamma\ lAINFL_{it-s} + \lambda lFDI_{it-s} + \mu lGCE_{it-s} + \alpha lK_{it} + \beta lL_{it} + \ell_{it}$ …… (5)

From equation (5) all the coefficients are constant elasticities, for all the determinants of economic growth in equation 2, C is the intercept parameter and ℓ_{it} is the error term which is assumed to be well behaved with zero mean and constant variance (white noise). The parameters of interest in this study are learning coefficients γ, λ and μ which serve to measure the effect of inflation, foreign direct investment, government expenditures, internet use, mobile phone subscription, population growth, exports and imports on economic growth (GDP).

3.4 Techniques of Data Analysis

The analysis techniques included; Descriptive statistics, Unit root tests, Kao test for Cointegration, hausman fixed random effect test and Vector Error Correction Model (VECM) for Granger causality.

Descriptive Statistics

This involved computing means and standard deviations, Skewness, Kurtosis, minimum and maximum outcomes of the study variables.

Pre-Estimation tests

a. Normality test

Before proceeding with estimation, a normality test is conducted to assess whether the sample data originates from a normally distributed population. Normality is essential for many statistical tests, such as linear correlations and ANOVA, which rely on the assumption of a bell-shaped data distribution. In instances of small sample sizes, visual inspection may be inadequate for confirming normality. To address this limitation, a quantile-quantile (Q-Q) plot can be employed to compare the sample data distribution with a theoretical normal distribution, using the same mean and variance. Any significant deviations from the regression line in the Q-Q plot may indicate non-normality (Szekely & Rizzo, 2005).

b. Heteroscedasticity test

The heteroscedasticity test assesses whether the variance of the errors in a regression model depends on the values of the independent variables. Typically, this is tested using a χ^2 test by examining the residuals in relation to the fitted values and independent variables. Ordinary Least Squares (OLS) regression assumes that the errors have constant variance, a condition known as homoscedasticity. When this assumption is violated, and the error variance differs across levels of an independent variable, the condition is referred to as heteroscedasticity (Jacquier et al., 1994).

c. Trend Analysis

Trend analysis is a statistical method used to forecast future movements of a variable by analyzing historical data. By examining past patterns, such as changes in prices or trade volumes, it seeks to predict long-term market directions (Bayazit, 2015). This approach evaluates current trends to anticipate future trajectories, providing comparative insights into whether ongoing developments such as gains in specific market sectors are likely to persist and how they may affect other areas (Guclu, 2018). Trend analysis is particularly useful for identifying and tracking market trends, such as bull markets, until indicators signal potential reversals (Caloiero et al., 2018). However, while this method offers valuable insights for investors by aligning with existing trends, it is important to recognize that trend analysis is based on historical data and does not guarantee predictive accuracy (Caloiero et al., 2018).

Post-Estimation tests

a. Hausman test

The Hausman test is commonly used in panel data analysis to evaluate model specifications and determine whether a fixed effects or random effects model is more appropriate. This test assesses the correlation between the unique errors in the model and the regressors, helping to identify the best model fit for the data.

- **Null Hypothesis (H_o)**: The random effects model is appropriate, indicating no correlation between the unique errors and the regressors.
- **Alternative Hypothesis (H_1)**: The fixed effects model is preferred, suggesting a correlation between the unique errors and the regressors.

The Hausman test compares the estimates from both the fixed effects and random effects models to detect any potential model misspecifications. If the test statistic shows a significant difference, it indicates possible bias in the random effects model, leading to the conclusion that the fixed effects model is more suitable (Vogt, 2005).

Panel Unit Root Test

To assess the stationarity of the variables, a panel unit root test was conducted. Stationarity implies that a variable does not have a unit root, meaning its statistical properties remain stable over time (Breitung & Das, 2005). The presence of unit roots in the data can result in spurious regression outcomes. The Im-Pesaran-Shin (IPS) panel unit root test was selected for its effectiveness in handling unit roots within panel data and its capacity to analyze long-term causal relationships even with limited observations (Im, Pesaran, & Shin, 1997). The hypotheses for the IPS test are as follows:

- **H_o**: All panels contain unit roots, indicating non-stationarity.
- **H_1**: Some panels are stationary.

Variables with p-values greater than 0.05 are considered non-stationary and may require transformation or differencing to achieve stationarity (Obwona, 1996; Obwona, 1998).

Tests for Autocorrelation

To detect autocorrelation, the study utilized two tests: Baltagi and Wu's LBI test and the Durbin-

Watson modified test. Both tests are highly effective for identifying autocorrelation in panel data. Furthermore, the Kmenta-Parks method was applied due to its flexibility in addressing both fixed and random variables that may exhibit temporal changes, thus managing clustering errors efficiently.

Cointegration Test

Before conducting the multivariate analysis, a cointegration test was performed to evaluate both long-term and short-term relationships within the time series data. This test followed the procedures outlined by Pedroni (1999, 2004) and Westerlund (2007), which are crucial for analyzing non-stationary time series data (Osuala & Onyeike, 2013). The Johansen Maximum Likelihood Method, along with Kao's (1999) cointegration test, was employed to ensure robust results. The hypotheses for the cointegration test are as follows:

- **H_0**: No cointegration exists among the variables.
- **H_1**: The variables are cointegrated across all panels.

4.0 RESULTS AND INTERPRETATION

4.1 DESCRIPTIVE STATISTICS

Descriptive statistics were run to facilitate understanding of the nature and trends of the data for the key study variables. The results of the descriptive analysis are presented in Table 2.

Table 2: The Summary Statistics for the Series of the Dataset

Variable		Mean	Std. Dev.	Min	Max	Observations	
econom~h	overall	4.330576	6.316281	-50.24807	35.22408	N =	155
	between		2.052349	1.157427	6.340775	n =	5
	within		6.041839	-51.37534	34.0968	T =	31
fdi	overall	1.588312	1.593439	-.1373	6.656597	N =	155
	between		1.052918	.4281174	2.895759	n =	5
	within		1.283113	-1.444747	5.921445	T =	31
inflat~n	overall	10.5936	9.720468	-5.228091	52.44	N =	155
	between		1.465795	8.96079	12.17723	n =	5
	within		9.631069	-3.595285	53.90995	T =	31
gce	overall	14.14142	4.552043	6.585332	31.3443	N =	155
	between		3.542416	11.08668	19.81734	n =	5
	within		3.258364	5.092475	25.66838	T =	31
educexp	overall	4.061057	1.482185	1.31835	8.356489	N =	155
	between		1.271723	2.76748	5.923709	n =	5
	within		.9458592	2.16871	6.493838	T =	31

health~p	overall	3.381066	1.635395	.6462694	7.598279	N =	155
	between		1.584458	1.566521	5.138868	n =	5
	within		.8081263	2.040248	6.344086	T =	31
defexp	overall	2.144847	1.335621	.6078029	6.572272	N =	155
	between		.9903119	1.226084	3.723446	n =	5
	within		.9971028	.2920523	5.200589	T =	31
unempl	overall	4.737553	3.686136	.871	13.01	N =	155
	between		4.060553	2.268194	11.96668	n =	5
	within		.5581004	3.34036	7.121053	T =	31
intern~e	overall	4.073381	6.199846	0	25.53294	N =	154
	between		2.253298	.8580562	6.627039	n =	5
	within		5.859864	-2.553658	23.20279	T-bar =	30.8
popgro~h	overall	2.655109	2.737532	-16.88063	16.6255	N =	155
	between		.4193679	1.968245	3.091782	n =	5
	within		2.711545	-16.19377	17.31237	T =	31
mobile~r	overall	24.93202	30.82102	0	118.1264	N =	155
	between		7.38005	14.78919	34.98957	n =	5
	within		30.10116	-10.05755	108.0688	T =	31
export~p	overall	13.97968	6.697318	4.54932	38.90363	N =	155
	between		5.539745	7.661026	21.99757	n =	5
	within		4.488164	1.62251	30.88574	T =	31
import~p	overall	26.21252	7.47613	13.17178	64.79305	N =	155
	between		2.300173	23.6733	29.73481	n =	5
	within		7.185568	13.28914	64.01264	T =	31

Source: Author's computation from Stata 17

Economic growth in the East African Community (EAC) over 31 years recorded an overall mean of 4.33%, with a standard deviation of 6.32%. The highest GDP growth rate recorded was 35.22%. The GDP growth rate across the five EAC countries showed a deviation of 2.05%, with a mean range between 2.28% and 6.38%. The GDP growth varied between -1.71% and 10.37%, with the highest rate being 34.10%. These results indicate significant variations in economic growth rates among EAC countries, with Rwanda exhibiting the most variability. Foreign direct investment (FDI) recorded an overall mean of 1.59% of GDP, with a standard deviation of 1.59%, and the highest rate being 6.66%. The FDI deviation among the five countries was 1.05%, with a maximum of 2.90% and a minimum of 0.43%. These results suggest relative stability in FDI flows within the EAC. Over the 31 years, FDI flow deviations were slightly higher, with a standard deviation of 1.28%, the highest value being 5.92%, and the minimum flow being -1.44%. Inflation recorded an overall mean of 10.59%, with a standard deviation of 9.72%, and the highest increase was 52.44%. The lowest recorded inflation rate was -5.23%, indicating significant fluctuations in inflation rates over the study period. Inflation recorded an overall deviation of 1.47%, with a maximum of 12.18% and a minimum of 8.96%. Over the 31-year period, inflation averaged a deviation of 9.63%, reaching a high of 53.91% and a low of

-3.60%. These results indicate significant fluctuations in inflation, with an average regional rate of 10-20%. For general consumption expenditure (GCE), the overall average was 14.14% of GDP, with a standard deviation of 4.55%. The maximum rate was 31.34%, and the minimum was 6.55%. GCE showed an average deviation of 3.54% between the five EAC countries, with a maximum of 19.82% and a minimum of 11.09%. Over the study period, GCE deviated by an average of 3.26%, with a high of 25.67% and a low of 5.09%, indicating a relatively stable increase in government spending. Regarding expenditures on education, health and defense, defense had the lowest overall mean expenditure at 2.14% of GDP, followed by health at 3.38%, and education at 4.06%. The standard deviations were generally low, indicating minimal differences between the maximum and minimum values. The deviations were relatively low (1.27%), with education expenditure ranging from a minimum of 2.77% to a maximum of 5.92%. Within the 31-years, the deviations for education (0.9458592), health expenditure (0.8081263) and defense expenditure (0.9971028) were generally low. This suggests that the East African Community (EAC) countries have not varied their expenditures much, except for consumption expenditure, which has seen a steady relative increase.

To find out which of 12 variables are significant determinants of economic growth, a number of statistical tests were conducted including; Pearson correlations (pairwise), the cointegration tests, fixed random effect model (GLS) regression model and Hausman test. The results are presented in tables 2, 3 and 4.

4.2 COINTEGRATION TEST

The Panel Pedroni (1999, 2004) and Westerlund (2007) cointegration tests were performed to determine the existence of long-run and short-run relationships among the time series. These tests are necessary when variables are non-stationary at level (Osuala & Onyeike, 2013). Given that some variables were non-stationary, a cointegration test was essential. The Johansen's Maximum Likelihood Method of cointegration analysis was employed, suitable for multivariate analysis models (Kasindi & Mwakanemela, 2013). The results of the cointegration test, proposed by Kao (1999), are presented in Table 3.

Table 3: Kao test for Cointegration

```
. xtcointtest kao economicgrowth fdi inflation gce educexp healthexp defexp internet_use popgrowth mobile_phone_
> subscr exportsgdp importsgdp

Kao test for cointegration
--------------------------

Ho: No cointegration                    Number of panels       =      5
Ha: All panels are cointegrated         Avg. number of periods =   28.4

Cointegrating vector: Same
Panel means:          Included          Kernel:           Bartlett
Time trend:           Not included      Lags:             2.00 (Newey-West)
AR parameter:         Same              Augmented lags:   1
```

	Statistic	p-value
Modified Dickey-Fuller t	-7.3966	0.0000
Dickey-Fuller t	-7.9426	0.0000
Augmented Dickey-Fuller t	-5.2045	0.0000
Unadjusted modified Dickey-Fuller t	-17.6170	0.0000
Unadjusted Dickey-Fuller t	-10.0506	0.0000

The null hypothesis is rejected, since the P- value is less than 0.05, suggesting that all panels in the data are cointegrated (Wursten & Leuven, 2018).

4.3 MODEL SPECIFICATION

This test determined whether to use a fixed effect (FE) model or a random effect (RE) model in estimating predictors of economic growth, based on the F-test and a p-value of 0.05 suggesting presence of fixed time effects and so a RE model is preferred. The Hausman test was employed to decide between FE and RE models, with a p-value less than 0.05 favouring the FE model (Wooldridge, 2010; Baltagi, 2021). Based on the test results in Table 3, a fixed effect model was used since the p-value (0.0075) is significantly less than 0.05.

Table 4: Hausman Test for Fixed Random Effects Model Specification

Hausman test for the GDP model

```
. hausman fixed ., sigmamore
Note: the rank of the differenced variance matrix (4) does not equal the number of coefficients
being tested (10);
be sure this is what you expect, or there may be problems computing the test.  Examine the
output of your estimators for anything unexpected and possibly consider scaling your variables so
that the coefficients are on a similar scale.
```

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed          .          Difference          S.E.
-------------+----------------------------------------------------------------
         fdi |    .1368681     .4367194       -.2998513        .1210168
   inflation |    .0795636     .0637982        .0157654        .0076712
         gce |   -.1133367    -.1353399        .0220032        .0930712
     educexp |   -.0785416     .1402455       -.2187871        .3236944
      defexp |   -2.313026    -2.251866       -.0611595        .2839781
   healthexp |    .6095904    -.5892945        1.198885        .5061194
internet_use |   -.1581566    -.0970824       -.0610742        .0401968
   popgrowth |     .672934     .6712222        .0017118        .0292288
  exportsgdp |     .052489    -.0791889        .1316779        .0714654
  importsgdp |   -.3001757    -.2436225       -.0565533        .0202792
------------------------------------------------------------------------------
```

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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 8.49

Prob>chi2 = 0.0075

(V_b-V_B is not positive definite)

```
.xtreg economicgrowth fdi inflation gce_d1 educexp_d1 healthexp_d1 defexp internet_use_d2
popgrowth mphonesub_d1 exportsgdp_d1 importsgdp, fe
Fixed-effects (within) regression               Number of obs      =       143
Group variable: countrycode                     Number of groups   =         5
R-sq:                                           Obs per group:
     within  = 0.2725                                         min =        27
     between = 0.4063                                         avg =      28.6
     overall = 0.2746                                         max =        29
                                                F(11,127)          =      4.32
corr(u_i, Xb)  = -0.2744                        Prob > F           =    0.0000
------------------------------------------------------------------------------
 economicgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
            fdi |   .3510805   .3994125     0.88   0.381    -.4392847    1.141446
      inflation |   .1312045   .0583722     2.25   0.026     .0156965    .2467125
        gce_d1 |   .3110835   .2596004     1.20   0.233    -.2026188    .8247858
     educexp_d1 |   .2600966   .7245652     0.36   0.720    -1.173687     1.69388
   healthexp_d1 |  -.0271981   1.086092    -0.03   0.980    -2.176378    2.121982
         defexp |  -2.035091   .5574383    -3.65   0.000    -3.138161   -.9320217
internet_use_d2 |  -.0120945   .3862354    -0.03   0.975    -.7763847    .7521957
      popgrowth |   .6786581   .1768203     3.84   0.000     .3287627    1.028553
   mphonesub_d1 |  -.0150968   .1290602    -0.12   0.907    -.2704837      .24029
  exportsgdp_d1 |  -.0875234   .2009432    -0.44   0.664    -.4851538    .3101069
     importsgdp |  -.3152131    .071336    -4.42   0.000    -.4563742    -.174052
          _cons |   13.21465   2.649989     4.99   0.000     7.970802    18.4585
----------------+-------------------------------------------------------------
        sigma_u |   1.958754
        sigma_e |  5.5790891
            rho |  .10973665   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(4, 127) = 3.01                     Prob > F = 0.0205
```

Table 5: General (OLS) Regression Model

Source	SS	df	MS		
Model	1660.29249	11	150.935681	Number of obs	= 143
Residual	4328.33453	131	33.0407216	F(11, 131)	= 4.57
				Prob > F	= 0.0000
Total	5988.62703	142	42.1734298	R-squared	= 0.2772
				Adj R-squared	= 0.2166
				Root MSE	= 5.7481

economicgrowth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fdi	.3782171	.3471723	1.09	0.278	-.3085726	1.065007
inflation	.0924569	.058729	1.57	0.118	-.0237231	.2086369
gce_dl	.3353034	.2654341	1.26	0.209	-.1897886	.8603953
educexp_dl	.1931174	.7438084	0.26	0.796	-1.278313	1.664548
healthexp_dl	.1666622	1.111963	0.15	0.881	-2.033066	2.366391
defexp	-1.68078	.4351186	-3.86	0.000	-2.541548	-.8200115
internet_use_d2	.0188599	.3934147	0.05	0.962	-.7594083	.7971281
popgrowth	.5785265	.1782239	3.25	0.001	.2259571	.931096
mphonesub_dl	.0076044	.1286329	0.06	0.953	-.2468622	.262071
exportsgdp_dl	-.0162118	.2051438	-0.08	0.937	-.4220353	.3896117
importsgdp	-.2808373	.0693236	-4.05	0.000	-.4179758	-.1436987
_cons	12.11166	2.584488	4.69	0.000	6.998928	17.2244

Comparing the results from the fixed effect regression model and the Pooled OLS regression model, Table 2 shows that, based on the fixed effect model, four independent variables (inflation, defense expenditure, population growth, and imports) are significant predictors of economic growth among East African countries. However, the Pooled OLS regression model identifies only three significant predictors: defense expenditure, population growth, and imports. The R-square from the Pooled OLS regression model (0.2772) is slightly higher than that of the fixed effect regression model (overall = 0.2746), suggesting that the FE model is preferable to both the Pooled OLS and the RE models.

From the fixed effect regression model results in Table 3, five factors (FDI, inflation, government consumption expenditure, education expenditure, and population growth) have positive coefficients, indicating they contribute positively to economic growth among the EAC countries.

The remaining six factors (health expenditure, defense expenditure, internet use, mobile phone subscriptions, exports, and imports) had negative coefficients, indicating they negatively impact economic growth in the EAC countries. This implies that an increase in any of these factors reduces economic growth. From the fixed effect regression model results in Table 3, the coefficient for inflation (0.1312045) is positive, suggesting that an increase in the inflation rate boosts economic

growth within the EAC countries. The corresponding p-value (0.026) is less than 0.05, indicating that inflation is a significant determinant of economic growth in these countries.

Additionally, the coefficient for general government expenditure (GCE, Beta = 0.3110835) is positive, meaning that increased government consumption expenditure enhances economic growth in the EAC. However, the p-value (0.233) is above 0.05, showing that government consumption expenditure has not significantly contributed to economic growth from 1990 to 2020. Furthermore, the coefficient for education expenditure (educexp_d1, Beta = 0.2600966) is positive, implying that increased education expenditure boosts economic growth in the EAC countries. However, the p-value (0.720) is above 0.05, indicating that education expenditure did not significantly contribute to economic growth among these countries. Finally, results in Table 27 also indicate that the coefficient for population growth (pop growth, Beta=.6786581) is positive, meaning that an increase in population growth rate, increases economic growth within the EAC countries and vice versa. The corresponding p-value (0.000) is below 0.05, indicating that population growth contributed significantly to economic growth among the EAC countries, in the period between 1990 and 2020.

It is indicated in Table 27 results that health expenditure (healthexp_d1), defense expenditure (defexp), internet usage (internet_use_d2), mobile phone subscription (mphonesub_d1) and exports (exportsgdp_d1) have a negative effect on economic growth of EAC countries. These results imply that an increase in health expenditure, defense expenditure, internet usage, mobile phone subscription and exports on average have not helped the EAC economies to grow, instead they have reduced the growth. Generally, only four factors came out as significant determinants of economic growth within the EAC countries but with varying strength and direction. The four significant predictors include; inflation rate (Beta = .1312045, p = 0.026); defense expenditure (Beta = -2.035091, p = 0.000); population growth (Beta = .6786581, p = 0.000); and imports (Beta = -.3152131, p = 0.000). Of these four significant factors, only two factors (inflation and population growth) contribute positively to economic growth. The other two significant factors (defense expenditure and imports) have a negative effect on economic growth. The results suggest that a one unit increase in inflation rate, will increase economic growth rate by 0.1312045, while a one unit increase in population growth will increase economic growth rate by 0.6786581 and vice versa.

In this model, population growth rate proved to be the strongest determinant of economic growth among the EAC countries.

On the overall, the results in Table 3 indicate that all the 11 variables in Table 2 taken together, contribute 27.46% (overall adjusted R^2 = 0.2746) towards changes in economic growth of EAC countries. This suggests that other factors (not investigated in this study) contribute more than 70% towards economic growth of EAC countries. Thus, the 11 independent variables in the model can be used to explain only 27.46% of the variations in the economic growth of the five countries studied.

4.4 DISCUSSION OF FINDINGS

This study analyzed the key determinants of economic growth in the East African Community (EAC) from 1990 to 2020, employing a fixed effects multiple regression model. It examined the influence of eleven predictors: Foreign Direct Investment (FDI), inflation, government consumption expenditure, education expenditure, population growth, health expenditure, defense expenditure, internet use, mobile phone subscriptions, exports, and imports. The results identified five significant positive drivers of economic growth: FDI, inflation, government consumption expenditure, education expenditure, and population growth. In contrast, health expenditure, defense expenditure, internet use, mobile phone subscriptions, exports, and imports were found to negatively impact economic growth. Among these factors, population growth emerged as the most substantial positive contributor, underscoring its role in boosting market demand and production, in line with the EAC's objective of leveraging a larger regional market for integration.

These findings diverge from prior studies. For example, unlike Tahir and Azid (2015), who reported a negative effect of inflation on growth, this study identified a positive relationship. Additionally, it contrasts with Zarra-Nezhad, Hosseinpour, and Arman (2014), who found positive effects of trade openness, as this research revealed a negative impact of imports. While government expenditure had a significant overall impact on growth, defense expenditure was the only government spending category with a negative effect, differing from Murungi et al. (2023), who observed a positive overall effect of government expenditure on growth.

The negative effect of defense expenditure observed in this study is consistent with the crowding-out effect, wherein increased government spending, typically financed through borrowing, leads to higher interest rates, discouraging private investment and thus dampening aggregate demand and economic growth. This finding aligns with Weinstock (2021), who emphasized the varied effects of government spending on economic activity, depending on the composition and financing of such expenditures. In terms of health expenditure, this study reported a negative and statistically insignificant impact on economic growth, which contrasts with the positive effects documented in other studies, such as Boussalem, Boussalem, and Taiba (2014), Beheshti and Sojoudi (2008), and Arabi and Abdalla (2013), highlighting the context-specific nature of these relationships.

4.5 CONCLUSIONS

The study concludes that, over the 31-year period, five key factors; Foreign Direct Investment (FDI), inflation, government consumption expenditure, education expenditure, and population growth positively contributed to economic growth in the East African Community (EAC), with population growth emerging as the most significant positive determinant. In contrast, six factors; health expenditure, defense expenditure, internet use, mobile phone subscriptions, exports, and imports were found to have negative impacts on economic growth in the region.

4.6 RECOMMENDATIONS

To stimulate economic growth, EAC governments should focus on strengthening the five positive growth determinants through targeted policy interventions:

a) **Enhancing FDI Policies**: Governments should introduce incentives for foreign investors, improve infrastructure, create a more favorable investment climate, and promote regional integration. Encouraging export-oriented investments will further attract Foreign Direct Investment (FDI).

b) **Managing Inflation**: Policies aimed at maintaining moderate inflation are essential. Keeping inflation within an optimal range ensures its continued positive contribution to economic growth, while avoiding the harmful effects of excessive inflation.

c) **Increasing Government Consumption Expenditure**: Policymakers should prioritize enhancing government spending, particularly by increasing budgetary allocations and promoting the consumption of domestically produced goods within government institutions.

d) **Boosting Education Expenditure**: Greater investment in education and human capital development is crucial. This includes improving the quality of education and allocating a substantial portion of the national budget toward educational initiatives.

e) **Promoting Steady Population Growth**: Governments should adopt policies that ensure balanced population growth in conjunction with human capital development, ensuring that population expansion contributes positively to economic development.

f) **Addressing Negative Growth Factors**: Strategies are needed to mitigate the negative impacts of health expenditure, defense spending, internet use, mobile phone subscriptions, and imports on economic growth.

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