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East Africa's economic growth and macroeconomic indicator variables: an ARDL approach

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Abstract. Economic growth is a crucial indicator of a nation's production capacity, allowing for evaluation of both its extent and performance. A hopeful growth occurs when macro-indicators' annual average rates surpass the average population growth rhythms. However, unpredictable economic growth can negatively impact an economy's performance due to fluctuations resulting from various factors. Nevertheless, factors driving growth have varying impacts across nations and regions. The study investigates the impact of macroeconomic indicators on East Africa's growth from 1980 to 2023, aiming to identify correlations and formulate policy recommendations. This study period has been chosen because East African countries like Tanzania, Kenya, Ethiopia, and Uganda began implementing structural adjustment programs, interventionist economic policies, and reforms after the 1980s. The study employed the ARDL approach to estimate the short- and long-run coefficients. The approach helps to solve the problems of endogeneity and serial correlation in analysis and successfully captures both short- and long-term relationships. The short-run model reveals that government spending and exports significantly boost regional growth, while unemployment, FDI inflows, inflation, and imports have a significant negative impact. Moreover, the long-term model shows that despite the negative impact of foreign debt, inflation, FDI inflows, and unemployment have significantly and positively impacted the regional economy. The study's findings hold significant policy implications for East Africa's economy, potentially paving the way for further research on growth dynamics and policy development.

Keywords: development dynamics, causal relationships, growth drivers, ARDL model, short-and long-run

Authors' contribution. Teka H.S. — startup idea, model formation, data collection and analysis, text writing and editing; Korchagina E.V. — research concept and design, technical checking, text writing and editing.

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Экономический рост и макроэкономические показатели Восточной Африки: подход ARDL

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Аннотация. Экономический рост является важнейшим показателем производственной мощности страны, позволяя оценить как ее масштаб, так и производительность. Обнадеживающий рост происходит, когда среднегодовые темпы макропоказателей превышают средние ритмы роста населения. Однако непредсказуемый экономический рост может негативно сказаться на производительности экономики из-за колебаний, вызванных различными факторами. Тем не менее, факторы, стимулирующие рост, оказывают различное по степени и положительное или отрицательное воздействие на страны и регионы. Рассмотрено влияние макроэкономических показателей на рост Восточной Африки с 1980 по 2023 г. с целью установления корреляций и формулирования рекомендаций по политике. Этот период исследования был выбран, поскольку страны Восточной Африки, такие как Танзания, Кения, Эфиопия и Уганда, начали реализовывать программы структурной перестройки, интервенционистскую экономическую политику и реформы после 1980-х гг. Использован подход ARDL для оценки краткосрочных и долгосрочных коэффициентов. Данный метод помогает решать проблемы эндогенности и последовательной корреляции в анализе и успешно охватывает как краткосрочные, так и долгосрочные связи. Краткосрочная модель показывает, что государственные расходы и экспорт заметно стимулируют региональный экономический рост, в то время как безработица, приток прямых иностранных инвестиций, инфляция и импорт оказывают большое негативное влияние. Более того, долгосрочные результаты модели показывают, что, несмотря на негативный эффект от внешнего долга, инфляция, приток прямых иностранных инвестиций и безработица значительно и позитивно повлияли на региональную экономику. Результаты исследования имеют важные политические последствия для экономики Восточной Африки, потенциально прокладывая путь для дальнейшего изучения динамики роста и разработки политики.

Ключевые слова: динамика развития, причинно-следственные связи, драйверы роста, модель ARDL, краткосрочные и долгосрочные

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Introduction

Maintaining rapid and sustained growth is the macroeconomic target for any economy. Indeed, economic growth takes place when people rearrange resources to make them more valuable (Madurapperuma, 2023). Moreover, economic growth is a top development priority for emerging economies, such as those in East Africa. In the 1970s, East Africa experienced severe economic crises due to weak national policies, institutional frameworks, and external factors like trade, oil prices, and global recession. In fact, since the 1980s, numerous East African nations, such as Tanzania, Kenya, Ethiopia, and Uganda, have been implementing major structural adjustment initiatives, interventionist policies, and economic reforms promoting import-substitution industrialization. East Africa is renowned for its unique geographical, historical, and cultural features, as well as its significant resource potential in the continent. Regional organizations like the East African Community significantly influence the regional economy through shared market protocols, best practices, efficiency promotions, policies, and regulatory frameworks. The EAC member nations benefit from increased trade, regional economic and political collaboration, investment, environmental responsibility, and global competitiveness. For example, Tanzania's trade with EAC Partner States increased from $1,003.6 million in 2019 to $1,136.9 million in 2020, showing the ongoing benefits of regional integration. Kenya benefits from East African integration by eliminating trade barriers and seizing the faster economic growth of its regional partners[1]. The USA, UAE, France, and India are making substantial investments in consumer goods, ICT services, and communications in the region. The region is predicted to experience the highest real GDP growth of 5.7% in 2025, driven by positive growth rates and political stability in nations like Ethiopia, Kenya, Tanzania, and Mauritius[2].

East African nations face several internal and external challenges that might undermine their economic future, despite their expanding economies. Global economic slowdown, geopolitical tensions, political instability, internal conflicts, commodity prices, trade policies, exchange rate issues, macroeconomic imbalances, and climate change are among the major challenges[3]. Political instability and a lack of economic diversification have been exacerbated by the performance of countries

[1] The benefits and opportunities of EAC. East African Community, 2023. Retrieved April 21, 2025, from https://sonna.so/en/

[2] Annual report of World Bank. World Bank, 2022. Retrieved February 29, 2025, from https://scorecard.worldbank.org/

[3] Crises upon crises. IMF, 2022. Retrieved December 23, 2024, from https://www.imf.org/external/pubs/ft/ar/2022/

like Burundi, Somalia, South Sudan, and Sudan. The Covid-19 pandemic significantly impacted the regional economy, with tourism-dependent nations like Seychelles suffering the most. East Africa, despite climate change policies, continues to face severe weather events such as droughts, floods, heat waves, storms, and unpredictable rainfall, impacting agriculture, food security, health, and incomes. Countries with floating exchange rate regimes, like Burundi, Kenya, and Rwanda, face high debt vulnerability due to exchange rate depreciation and deficits. Inflation in the region is a major concern, with Sudan experiencing the highest annual rate of 382.8% in 2021, followed by Zimbabwe (98.8%), Ethiopia (26.84%), and Zambia at 22%. Furthermore, low HDI scores, high unemployment, and inadequate infrastructures are among the major developmental challenges of the region[4]. Policy differences have had a significant impact on the economies of the East African countries. For instance, varying inflation rates are caused by monetary policies in Ethiopia, Uganda, and Kenya. In 2011, food inflation was 18.9% in Kenya, 17.9% in Tanzania, 45.6% in Uganda, and 40% in Ethiopia[5].

The purpose of this study is to explore the short- and long-term influence of macroeconomic indicators on East Africa's economic growth over the period 1980 to 2023.

Literature review

GDP growth rate is a crucial metric for evaluating an economy's size and performance, often measured through the real GDP growth rate or GDP per capita (Madurapperuma, 2023). Since the 1990s, growth theorists have examined factors that drive economic growth, covering macroeconomics, innovation, trade, natural resources, institutional frameworks, and governance, but reaching an agreement remains controversial. The Solow (Solow, 1956) growth model suggests short-term growth is primarily caused by capital accumulation, while long-term growth is driven by technological innovation. Keynesians emphasize the effect of geography, macroeconomic stability, population growth, consumption, investment, and savings on a nation's growth. Fischer S. (Fischer, 1993) identifies government expenditure, inflation, exchange rate stability, international trade, and population as macroeconomic determinants. Heckscher-Ohlin's comparative advantage theory suggests that countries export goods that maximize their abundant and low-cost production components while importing products that make best use of their limited resources (Morrow, 2010). Hymer highlights the role of FDI inflows in developing economies, including job creation and export promotion. According to Solow, FDI inflow enhances domestic economies through productivity, human capital, and technological transfer (Deb Nath, Ambia Begum, Abdul Maleque, 2024). Conversely,

[4] Annual report of Africa Development Bank group. Africa Development Bank, 2023. Retrieved December 18, 2025, from https://www.afdb.org/en/

[5] Private sector development as an engine of Africa's Economic Development. Africa Development Bank, 2011. Retrieved May 12, 2025, from https://www.afdb.org/

M. Hadush, K. Gebregziabher, S. Biruk (Hadush, Gebregziabher, Biruk, 2023) argues that FDI inflows can negatively impact host economies by reducing entrepreneurial opportunities, shutting down local businesses, interfering with politics, and exposing countries to foreign exploitation. Regarding the relationship between population expansion and economic growth, Malthus T. (Malthus, 2023) in 1789 proposes population control as a means of maintaining food supplies and balance. He predicted geometric population growth, doubling every 30–40 years, while food supply grew at an arithmetic pace. However, Romer P.M. (Romer, 1990) argues that population expansion contributes to the emergence of scientists and innovators, thereby influencing productivity and human capital.

Keynesians suggest prudent borrowing impacts growth via capital formation and investment. The twin deficit theory highlights the role of borrowings to finance fiscal and current account deficits, yet indebted developing nations struggle to maintain their current account balances. The theory identifies two gaps: insufficient domestic savings to meet investment needs and differences in foreign exchange rates between developing and advanced nations. However, Malthus and Ricardo argue that excessive debt loads negatively impact a nation's growth by distorting capital formation (Bilan, 2016). Keynesians further argue that unemployment results from a lack of aggregate demand during particular business cycles, which hinders adequate employment from being created. According to Okun A.M. (Okun, 1963), higher unemployment rates correlate with GDP gaps, but technologically advanced industries' case may make this argument irrelevant. The capitalization effect theory suggests that higher growth correlates with lower unemployment if the adaptation cost of new technologies is less than the job creation cost. The pool of saving effect theory emphasizes how unemployment affects savings and capital accumulation, supporting the negative connection between the two variables (Alan, 1987). In contrast, Aghion and Howitt's creative destruction effect theory suggests that the introduction of new technologies into production systems can lead to economic destruction, workforce replacement, and increased unemployment. The theory argues that promoting the adoption of digital machines like robotics may result in job losses (Chen, Pinar, Stengos, 2020). There are various theories suggesting the correlations between inflation and a nation's growth. Keynesians assert that moderate inflation stimulates investment and spending, viewing inflation as a sign of an expanding economy. Mundell-Tobin Effect theory suggests firms gain from inflation because it encourages investment in assets that yield interest, which increases capital accumulation. According to the Phillips Curve theory, inflation can increase economic growth by lowering unemployment. But the cost-push theory suggests that inflation is caused by growing production costs, which has a detrimental effect on people's standards of life, particularly for those who do not see increases in their wages or income (Alan, 1987).

Empirical studies provide diverse insights into the causes of economic growth, but their conclusions on specific factors have been inclusive. For instance, according to a study by Abdelkreem Y., Sisay D. (Abdelkreem, Sisay, 2021), inflation has a positive impact on Ethiopia's economic growth but a negative impact on the economies of Sudan and Kenya. Aden Mohamed A., Shire Mohamed Mohamed S.

(Aden Mohamed, Shire Mohamud, 2023) found a negative association between FDI inflows and growth in Somalia, while Issa Moh'd Hemed's (Moh'd Hemed, Suleiman, 2017) study revealed a significant growth boost from FDI inflows in Kenya, Rwanda, Uganda, and Tanzania. According to Tile A., Utouh H.M., & Sesabo J.K. 's (Tile, Utouh, Sesabo, 2024) study, external debt reduces GDP growth in Burundi, Tanzania, and Kenya while improving economic growth in Uganda. Naftaly G.M. (Naftaly, 2021) suggests Kenya's government expenditure positively influences the nation's growth, while Bol Y. and Muturi W.M. (Bol, Muturi, 2016) found its negative impact on South Sudan's economy. The study by H. Moussaoui (Moussaoui, 2022) indicates that exports positively influence Tanzania's economy, while Aden Mohamed A. & Shire Mohamud S. (Aden Mohamed, Shire Mohamud, 2023) suggests a significant negative impact of exports on Somalia's growth. The study by Tesfaye D., Sintayehu S., Tizazu T. (Tesfaye, Sintayehu, Tizazu, 2023) shows that imports negatively impact Ethiopia's economy, while Hadush's (Hadush, Gebregziabher, Biruk, 2023) study found a positive influence of imports on East African economies. C. Niyongabo's (Niyongabo, Zhong, 2023) study suggests a negative impact of unemployment on Burundi's economy, while Suleiman S., Kassim S., Hemed I. (Suleiman, Kassim, Hemed, 2017) asserts that unemployment positively impacts Tanzania's economy. Ayanaw Alemu T., & Belay Zegeye M. (Ayanaw Alemu, Belay Zegeye, 2022) argues that population growth supports Ethiopia's growth, while Thomas Opiyo Okumu's (Okumu, 2024) study indicates that it hinders Kenya's growth. According to Chen's (Chen, Pinar, Stengos, 2020) conclusion, the use of renewable energy has varying effects on economic growth, with developed economies benefiting and developing economies experiencing losses.

Therefore, the current study is motivated to fill in the knowledge gaps in East African nations by exploring the causal relationship between macroeconomic indicators and regional economic growth, given the aforementioned mixed results.

Methodology

The study investigates the impact of macroeconomic indicators on East Africa's growth from 1980 to 2023, utilizing data from the World Bank and Africa Development Bank databases. The WDI[6] provides data on GDP per capita growth, inflation, government spending, unemployment, foreign debt, and renewable energy consumption, while AUC/OECD[7] provides data on FDI inflows, population growth, exports, and imports. The study utilized GDP per capita growth as an outcome variable due to its reliability in indicating economic growth and improvements in a nation's average living standards. The ARDL approach was employed in order to examine the correlation among variables in short- and long-term periods. The model was chosen for its ability to accurately capture short- and long-term relationships, correct endogeneity, and resolve

[6] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[7] The Statistical Annex to the annual Africa's Development Dynamics. Africa Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

serial correlation issues[8]. The median imputation technique was used to address missing values in the data, replacing them with the entire column's median due to its lower outlier sensitivity. The study utilized ADF unit root test, AIC, and ARDL bounds co-integration tests to evaluate model stationarity, optimal lag length, and short- and long-term co-integration among variables, respectively. The model's validity and reliability were confirmed through diagnostic testing, such as serial correlation, heteroscedasticity, multicollinearity, normality, and model specification concerns. The multicollinearity among variables was evaluated using the correlation matrix and VIF approaches. Initially, with a VIF value of 10.43, strong multicollinearity between population growth, imports, and FDI was discovered. But the mean VIF reduces to 4.72 after population growth is eliminated from the analysis. Following model assumption verification, the coefficients of the ARDL model were estimated using the following formula:

$$\Delta GDPC_t = \alpha_0 + \sum_{i=1}^{k} \alpha 1i \Delta GDPC_{t-i} + \sum_{i=0}^{k} \alpha 2i \Delta FDI_{t-i} + \sum_{i=0}^{k} \alpha 3i \Delta POP_{t-i} +$$
$$+ \sum_{i=0}^{k} \alpha 4i \Delta GSPEND_{t-i} + \sum_{i=0}^{k} \alpha 5i \Delta DBT_{t-i} + \sum_{i=1}^{k} \alpha 6i \Delta INF_{t-i} +$$
$$+ \sum_{i=0}^{k} \alpha 7i \Delta EXPO_{t-i} + \sum_{i=0}^{k} \alpha 8i \Delta IMPO_{t-i} + \sum_{i=0}^{k} \alpha 9i \Delta UNEMP_{t-i} +$$
$$+ \sum_{i=0}^{k} \alpha 10i \Delta RNEC_{t-i} + \beta_1 GDPCG_{t-1} + \beta_2 FDI_{t-1} + \beta_3 POP_{t-1} + \beta_4 GSPEND_{t-1} +$$
$$+ \beta_5 DBT_{t-1} + \beta_6 INF_{t-1} + \beta_7 EXPO_{t-1} + \beta_8 IMPO_{t-1} + \beta_9 UNEMP_{t-1} + \beta_{10} RNEC_{t-1} \varepsilon_{it},$$

where Δ — the difference operator; k — the lag length; α_0 — the drift component; α_i — the short-run coefficient; β_i — the corresponding long-run multiplier; ε_{it} — the white-noise error term; $GDPC_t$ — the GDP per capita growth; FDI_t — the share of foreign direct investment inflows into the region; $GSPEND_t$ — government expenditure as a proportion of regional GDP; POP_t — the population growth rate; DBT_t — the share of external debt; INF_t — the annual inflation rate, measured by CPI; $EXPO_t$ — the share of exports; $IMPO_t$ denotes the proportion of imports from regional GDP; $UNEMP_t$ — regional unemployment; $RNEC_t$ — the proportion of renewable energy consumption from total energy consumption.

Results and discussion

The variables' descriptive statistics over the span of 43 years are shown in Table 1. As can be seen, across the sample periods, the regional economy has experienced an average real GDP growth of 4.78%, GDP per capita growth of 1.29%, FDI inflow of 1.47%, foreign debt at 51.6%, public spending at 15.37%, exports at 25%, imports at 25%, population growth at 2.77%, and a share of renewable energy consumption at 62.29%. With the highest rate of 15%, the region's average inflation rate is estimated to be 9.6%, while the average unemployment rate is 7.48%.

[8] Basic Econometrics. Gujarati, 2004. Fourth edition.

Table 1

Descriptive statistics result

Variable	Mean	Std. Dev.	Min	Max
Real GDP growth	4.78	1.53	1.13	8.01
GDP per capita growth	1.29	1.74	–2.59	2.79
Inflation	9.60	3.11	4.12	15.07
FDI Inflows	1.47	1.06	.03	4.84
Foreign Debt	51.59	11.61	29.33	83.75
Public Spending	15.37	1.13	12.64	17.40
Exports	25.10	3.24	18.76	35.83
Imports	25.04	5.53	15.89	36.38
Unemployment	7.47	.69	6.27	8.87
Population Growth	2.78	.14	2.57	3.00
Renewable Energy Consumption	62.29	2.89	56.04	66.12

Source: compiled by H.S. Teka, E.V. Korchagina on the basis of WDI[9] and AUC/OECD[10] data.

Unit root tests. Table 2 displays the results of the unit root test for the ADF and Phillips-Perron approaches. The ADF test results show that GDP per capita, FDI inflows, exports, public spending, inflation, population growth, and renewable energy consumption remain stationary at level I(0), while foreign debt and unemployment were stationary at I(1).

Table 2

Unit root test results

Variables	Unit Root Test Results (ADF)				Unit roots for the Phillips-Perron test			
	t-stat	5% critical	$P > \|t\|$	Decision	t-stat	5% critical	$P > \|t\|$	Decision
GDP per capita	–4.45	–3.53	0.00	I(0)	–5.02	–3.53	0.00	I(0)
FDI inflows	–1.96	–1.68	0.03	I(0)	–3.63	–3.53	0.00	I(0)
Exports	–2.51	–1.68	0.00	I(0)	–3.66	–3.53	0.01	I(0)
Public spending	–2.78	–1.68	0.00	(0)	–6.69	–3.53	0.00	(1)
Imports	–1.76	–1.68	0.00	I(0)	–6.22	–3.53	0.00	I(1)
Inflation	–4.06	–3.53	0.01	I(0)	–5.08	–3.53	0.00	I(0)
Foreign debt	–7.02	–3.54	0.00	I(1)	–14.39	–3.53	0.00	I(1)
Unemployment	–4.39	–1.69	0.00	I(1)	–8.29	–3.53	0.00	I(1)
Population growth	–1.72	–1.69	0.01	I(0)	–5.00	–3.53	0.00	I(1)
Renewable energy	–2.13	–1.69	0.00	I(0)	–4.28	–3.53	0.00	I(1)

Source: compiled by H.S. Teka, E.V. Korchagina based on data of WDI[11] and AUC/OECD[12].

[9] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[10] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

[11] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[12] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

The Phillips-Perron test indicates that GDP per capita, FDI inflows, exports, and inflation remain stationary at I(0), while government spending, imports, foreign debt, unemployment, population growth, and renewable energy consumption were at I(1). For this particular study, the ADF test approach was chosen for its ability to maintain a consistent mean over time.

Optimum lag length selection. The ARDL model uses a number of regressions to determine the appropriate lag length, using criteria such as the LR test statistic, FPE, AIC, HQIC, and SBIC. The optimal lag length selection criterion is outlined in Table 3. As can be seen, the study's analysis utilizes the lowest AIC values, allowing for a maximum of four feasible lag lengths, due to its higher likelihood of obtaining appropriate lag length. Finally, the ARDL of (1, 2, 1, 3, 1, 1, 1, 1, 1) regression was used to estimate the short- and long-term coefficients.

Table 3

Lag length selection criterion

Lag	L.L.	L.R.	Df	P	FPE	AIC	HQIC	SBIC
0	–547.37				2573.99	27.72	27.83	28.01
1	–440.97	212.79	49	0.00	151.68	24.85	25.70	27.21*
2	–362.96	156.03	49	0.00	44.79	23.40	25.00	27.83
3	–283.98	157.96	49	0.00	19.91	21.90	24.25	28.40
4	–169.86	228.23*	49	0.00	4.40*	18.64*	21.74*	27.21

Source: compiled by H.S. Teka, E.V. Korchagina based on data of WDI[13] and AUC/OECD[14].

ARDL bounds tests. The bounds co-integration test and the Johansen co-integration test are two alternative methods proposed to test the long-term co-integration of variables. The bounds co-integration test is an effective method for mixed I(0) and I(1) variables, while the Johansen co-integration test is used for all I(0) or I(1) order variables. As a rule of thumb, the F-statistic value is typically compared to the 5% crucial upper bound value, with the null hypothesis of H0: $\beta i = 0$, and accepted when it falls below the lower-bound critical value. A test is not conclusive if the estimated F-statistic falls between the lower-bound and upper-bound critical values (Pesaran, 2001). Table 4 provides a summary of the Bounds test results. Because the variables in a model have a mixed nature of integration of order I(0) and I(1), we used the ARDL bounds test to assess the long-term relationship among the variables.

[13] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[14] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

Table 4

Bounds Test for Co-integration

Pesaran M.H., Shin Y., Smith R.J. (Pesaran, Shin, Smith, 2001) ARDL bounds test F-statistic = 8.263 H_0: there is no co-integration t-statistic = –7.242				
(Pesaran, Shin, Smith, 2001) Narayan (2005)				
Significance	**I(0)**	**I(1)**	**I(0)**	**I(1)**
10%	1.95	3.06	–2.57	–4.40
5%	2.22	3.39	–2.86	–4.72
2.5%	2.48	3.70	–3.13	–5.02
1%	2.79	4.10	–3.43	–5.37

Source: compiled by H.S. Teka, E.V. Korchagina based on data of WDI[15] and AUC/OECD[16].

The short-run ARDL model results. Table 5 displays the estimated short-run coefficients of the ARDL model. The short-run coefficients show how variables dynamically adjust to their long-run equilibrium due to certain shocks within the variables. A dynamic model's rate of equilibrium restoration following disturbance is measured by the error correction term (ECT); a high ECT notes a long-term stable relationship. The ECT coefficient needs to be negative and significant. As can be seen, the system is in both short- and long-term equilibrium, rapidly correcting its previous period disequilibrium at an annual rate of 47.8% to achieve a long-run equilibrium steady-state position.

The short-run model indicates a positive correlation between regional growth, exports, and government spending. Accordingly, a 1% increase in exports results in a 1.13% increase in regional growth. Heckscher-Ohlin's and David Ricardo's comparative advantage theories support this result, suggesting that countries can enhance their current account balance by acquiring locally unavailable commodities (Morrow, 2010). The result is in line with the empirical study by Moussaoui H. (Moussaoui, 2022) in Tanzania. Moreover, a 1% increase in government expenditure results in a 1.14% growth in the economy, suggesting a positive correlation between the two variables. This result is consistent with the Keynesian viewpoint, which maintains higher government spending multiplies the growth in investment and production. The result is also comparable to the empirical findings by G.M. Naftaly (Naftaly, 2021) in Kenya. The short-run model also revealed a significant negative correlation of inflation, FDI inflows, imports, and unemployment with regional growth. Consequently, a 1% increase in current period inflation reduces short-term economic expansion by 0.72%, while a 1% increase in first lag period inflation causes economic contraction by 0.44%. In this view, higher inflation may impact consumer spending, lower investor confidence, and reduce saving incentives, especially for fixed-income consumers and investors with fixed-income assets. The result aligns with Abdelkreem & Sisay's (Abdelkreem, Sisay, 2021) conclusion, which indicates a significant negative

[15] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[16] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

correlation between inflation and economic growth in Sudan and Kenya. The study indicates a negative short-term correlation between FDI inflows and regional growth, with a 1% increase in FDI inflows causing a 1.37% reduction in the regional economy. In support of this result, S. Riddervold (Riddervold, 2011) asserts that excessive FDI inflows negatively impact Uganda's economy by reducing export competitiveness, overvaluing REER, affecting current account balance, and causing child labor, contributing to Dutch disease. Likewise, Aden Mohamed A., Shire Mohamud S. (Aden Mohamed, Shire Mohamud, 2023) argues that FDI exposes host countries like Somalia to foreign firm exploitation, including resource and workforce misuse for their own benefit. M. Hadush, K. Gebregziabher, S. Biruk (Hadush, Gebregziabher, Biruk, 2023) asserts that FDI inflows can hinder local businesses and negatively impact economies by affecting politics.

Table 5

Estimated coefficients for short-run relationships

Variables		Coefficients	Standard error	t-stat	Prob.>/t/
Inflation	INF	–.72	.19	–3.77	0.00
	ΔINF(–1)	–.44	.14	–3.14	0.00
FDI inflows	FDI	–1.37	.49	–2.82	0.01
	ΔFDI(–1)	–1.92	.53	–3.65	0.00
	ΔFDI(–2)	–.80	.44	–1.80	0.08
Foreign Debt	DEBT	.01	.05	0.04	0.96
Public spending	GSPEND	1.13	.48	2.36	0.02
Exports	EXPO	1.12	.41	2.71	0.01
Imports	IMPO	–1.36	.52	–2.61	0.01
	ΔIMPO(–1)	–.28	.35	–0.82	0.42
Unemployment level	UNEMP	–3.33	.89	–3.74	0.00
	ΔUNEMP(–1)	–.28	.64	–0.43	0.67
Renewable Energy Consumption	RNEC	.58	.41	1.42	0.17
	ΔRNEC(–1)	–.89	.46	–1.86	0.11
ECT (–1)		–.48	.16	–9.31	0.00

Source: compiled by H.S. Teka, E.V. Korchagina based on data of WDI[17] and AUC/OECD[18].

[17] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[18] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

Moreover, the model reveals a negative short-term correlation between a nation's growth and unemployment, indicating that a 1% increase in unemployment would slow the short-term regional growth by 3.33%. This finding is reinforced by the pool of savings effect theory, which contends that increased unemployment slows growth by reducing savings and capital accumulation (Alan, 1987). The result is empirically consistent with the conclusion of C. Niyongabo, T. Zhong (Niyongabo, Zhong, 2023) in Burundi. The short-run model further reveals a significant inverse connection between imports and regional growth, indicating a 1.36% decline in the economy due to a 1% increase in import share. Heckscher-Ohlin's theory suggests that while imports are cost-effective, they can potentially distort a nation's trade balance if they exceed exports (Morrow, 2010). The result is comparable to the finding of Tesfaye D., Sintayehu S., Tizazu T. (Tesfaye, Sintayehu, Tizazu, 2023) in Ethiopia.

Note: Foreign debt and renewable energy consumption have a positive short-term association with regional growth, but they both are statistically insignificant.

The long-run ARDL model results. Table 6 indicates that inflation, FDI inflows, foreign debt, and unemployment significantly impact long-term economic growth. The positive coefficient of inflation indicates that a 1% inflation increase leads to a 0.66% expansion in regional growth. Keynesians support this result, arguing that moderate inflation encourages investment and spending, taking inflation as an indicator of expanding economy. Likewise, as it is suggested by the Mundell-Tobin Effect theory, inflation benefits producers by promoting investment in interest-earning assets, leading to increased capital accumulation. According to the Phillips Curve theory, inflation can increase economic growth by lowering unemployment (Alan, 1987). Moreover, the endogenous growth theory contends moderate inflation promotes creativity, efficiency, and long-term economic growth. Empirically, as it is supported by S. Jednak, D. Kragulj (Jednak, Kragulj, 2019), in spite of a moderate 9.8% inflation rate, East Africa's economy experienced strong real GDP growth of 4.78% between the sample periods (see Table 1), demonstrating that one-digit inflation rates typically result in robust economic growth. Moreover, a study by Abdelkreem & Sisay (Abdelkreem, Sisay, 2021) reinforces this fact that Ethiopia's economy has expanded over the last 20 years despite moderate inflation, which has helped mobilize resources and stimulate current spending and investment. Likewise, a study by F. Kasidi and K. Mwakanemela (Kasidi, Mwakanemela, 2013) demonstrates that Tanzania's moderate inflation increased business investments in assets, R&D, and infrastructure, thereby promoting economic growth.

Long-term model results further show that FDI inflows and economic growth are positively correlated, with the regional growth expansion by 1.59% for every 1% increase in FDI inflows. The result is theoretically supported by Solow (Solow, 1956), who suggests that FDI greatly aids in a nation's growth by enabling the transfer of advanced technologies and management practices (Deb Nath, Ambia Begum, Abdul Maleque, 2024; Okumu, 2024). Empirically, Issa Hemed's (Moh'd Hemed, Suleiman, 2017) conclusion supports the result that FDI inflow is critical for revenue generation and investment capital in countries like Kenya, Rwanda, Uganda, and Tanzania. Likewise, the positive coefficient of unemployment indicates that a 1% increase in the

unemployment rate leads to a 3.34% growth in the long-term economy. In support of this result, the Aghion-Howitt's creative destruction effect theory suggests that demand-boosting strategies may result in the replacement of outdated machinery with advanced digital ones, reallocating the labor force and displacing existing workers (Chen, Pinar, Stengos, 2020). Empirically, Omonijo & Zhang (Omonijo, Zhang, 2025) and Kholmirzayeva A. (Kholmirzayeva, 2024) argue that the use of digitization and artificial intelligence technologies is transforming businesses and technologies in developing African countries while also leading to job displacement. From a particular country case, Njuguna R.W (Njuguna, 2024) noted that Kenya has difficulties in digitalizing its economy, which leads to a rise in unemployment because of the digital skills gap brought on by mismatched skills, lack of employability, and digital apprenticeships. Additionally, Suleiman S., Kassim S., & Hemed I. (Suleiman, Kassim, Hemed, 2017) suggests that unemployment in Tanzania stimulates entrepreneurs to establish new businesses, potentially encouraging investment. Moreover, the long-term model results suggest that foreign debt significantly and negatively impacts the East African economy, indicating that a 1% increase in the external debt causes the region's economy to drop by 0.09%. In this case, Malthus argues that excessive debt, as a significant portion of revenue goes to lenders, hinders capital accumulation and discourages investment in public sectors like education and health. Empirically, Tile A., Utouh H.M., Sesabo J.K.'s (Tile, Utouh, Sesabo, 2024) study indicates a significant negative correlation between economic growth and foreign debt in countries like Burundi, Kenya, South Sudan, Tanzania, and Ethiopia.

Table 6

Estimated coefficients for long-run relationships

Variables	Coefficients	Standard error	t-statistic	Prob.
Inflation	.659**	.26	2.58	0.01
FDI inflows	1.59** 1.817169***	.58	2.73	0.01
Foreign Debt	–.09**	.04	–2.44	0.02
Public spending	-.21	.33	–0.64	0.53
Exports	.09	.19	0.48	0.63
Imports	.42	.24	1.73	0.09
Unemployment	3.34***	.99	3.34	0.00
Renewable Energy Consumption	-.29	.20	–1.44	0.16
C	–26.96	9.60	–2.81	0.01

Source: compiled by compiled by H.S. Teka, E.V. Korchagina on the basis of data from WDI[19] and AUC/OECD[20].

[19] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[20] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

Note: Exports and imports positively impact long-term regional growth, while public spending and renewable energy consumption negatively impact it, but they are not statistically significant.

Post-estimation diagnostic tests. We verified the model's robustness and applicability through various tests, including Breusch-Godfrey LM, Breusch-Pagan-Godfrey, VIF, Jarque-Bera, Ramsey RESET, and recursive stability tests. The results of the diagnostic test for the model are presented in Table 7. Indeed, the test results confirmed the lack of serial correlation, heteroscedasticity, strong multicollinearity, normality, and model specification concerns, signifying that the model captures the desired econometric characteristics associated with the time series data.

Table 7

The post-estimation diagnostic test results

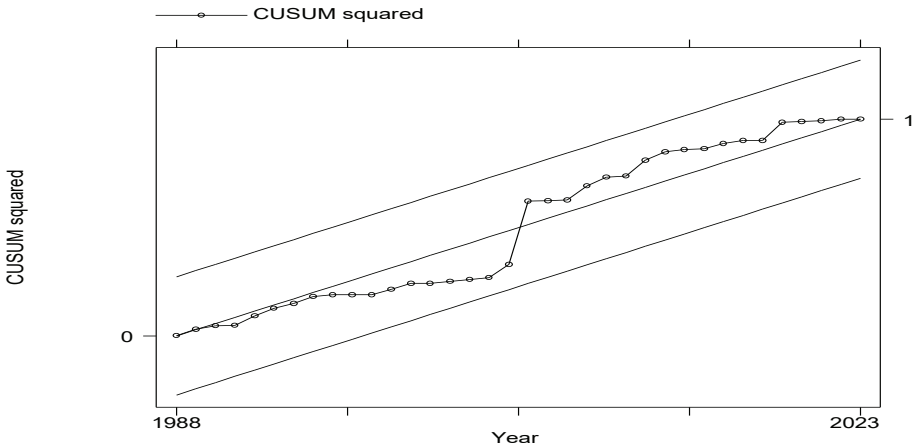
Assumptions	Tests	Results	Remarks
Autocorrelation	Breusch-Godfrey LM test & Durbin-Watson d-statistic	Prob. = 0.19 & D = 2.19	No statistical evidence for serial autocorrelation (D = 2.19 is nearly equal to 2 or Prob. = 0.19 > 0.05).
Heteroscedasticity	Breusch-Pagan/ Cook-Weisberg test	Prob. = 0.61	No evidence for heteroscedasticity (Prob. 0.61 > 0.05).
Multicollinearity	Mean VIF value	VIF = 4.72	No statistical evidence for strong multicollinearity (VIF 4.72 < 5).
Normality	Skewness/kurtosis tests	Joint Prob. = 0.67	Residuals are distributed normally (Joint Prob. = 0.67 > 0.05).
Model adequacy	Ramsey RESET test	Prob. = 0.14	No issue with model specification (Prob. = 0.14 > 0.05).

Source: compiled by H.S. Teka on the basis of data from WDI[21] and AUC/OECD[22].

Plots of the model stability test. The recursive tests were also conducted by visually examining the graphs of recursive parameter estimates. Figure depicts the CUSUMSQ at the 5% significance level. As can be seen, the results of the CUSUMSQ test reveal the variance stability, given that the residuals are within the 5% critical lines, confirming that our ARDL model is stable and suitable for investigating the association between economic growth and various indicator variables.

[21] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[22] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023



The stability test result using the CUSUMSQ Test

Source: compiled by H.S. Teka, E.V. Korchagina based on data of WDI[23] and AUC/OECD[24].

Conclusion

This study explores the influence of macroeconomic indicators on East Africa's growth from 1980 to 2023, using the ARDL approach. The short-run model reveals that inflation, FDI inflows, imports, and unemployment negatively impact regional economy, while government spending and exports positively influence it. The long-term model indicates that despite foreign debt's negative impact, inflation, FDI inflows, and unemployment have significantly and positively impacted the regional growth.

The study's findings hold significant policy implications for the East Africa countries' economies, including fiscal reforms, economic stimulus strategies, debt management, and employment creation. First, exports significantly and positively impact the region's short-term growth, while imports have a negative impact. Hence, it is advised that East African nations like Tanzania and Ethiopia should implement export-led policies, promoting exports and maintaining current account balance while reducing imports of consumable goods. Second, the short-term regional economy had been significantly and positively impacted by government expenditure. Thus, countries like Kenya should prioritize short-term investment in infrastructure, health facilities, and education while addressing corruption and bureaucracy. Third, long-term growth is significantly and negatively influenced by the share of foreign debt. Therefore, East African nations like Burundi, Djibouti, Kenya, Ethiopia, and Tanzania should manage their domestic deficits, reduce public debt, and ensure transparency through economic diversification, debt restructuring, revenue mobilization, and fiscal reforms. Fourth, the model demonstrated short-term negative and long-term positive impacts of inflation on regional growth. In this case, central banks of countries such

[23] World Bank Development Indicators database. WDI, 2022. Retrieved November 15, 2024, from https://databank.worldbank.org/

[24] Statistical Annex to the annual Africa's Development Dynamics. Africa's Development Bank, 2023. Retrieved November 15, 2024, from https://oe.cd/AUC/OECD-2023

as Sudan and Kenya should adopt strict monetary policies like higher bank rates and lower reserve ratios to keep inflation at a single digit. Whereas nations like Ethiopia are advised to implement long-term expansionary monetary policies to stimulate long-term economic growth. Fifth, FDI inflows have shown mixed results, with short-term negative and long-term positive effects on regional growth. Hence, nations like Rwanda are advised to prioritize long-term investment, fiscal reforms, and human capital development. However, in the short run, nations like Uganda and Somalia should implement policies promoting minimum wage and child labor prevention to address workforce issues linked to FDI. Implementing strict commercial laws in these countries is also crucial to address the issues with Dutch Disease by supporting the industrial sector, upgrading public administration, empowering communities, and addressing internal trading system weaknesses. Six, unemployment has revealed mixed effects, with short-term negative impacts and long-term positive effects. Hence, it is advisable that East African governments, like Burundi, should design policies that promote short-term job opportunities for the unemployed. For example, strengthening investments in high-labour absorption sectors like manufacturing, tourism, and agriculture can create job opportunities and stimulate short-term economic growth. But in the long run, governments like Kenya and Tanzania should invest in and coordinate digital skills through public-private partnerships to address unemployment issues in the digital economy.

Limitations of the study. Despite its significant contributions, the study has some shortcomings. First, the use of such lengthy 43-year regional aggregate data has made data collection challenging, potentially leading to the omission of some crucial variables. Second, because of its unique features, the informal economy could get overlooked, and differences between countries might be hidden. Third, the model displayed mixed results on some variables like inflation, unemployment, and FDI inflows.

Finally, the authors recommend that future studies focus on comparative analysis of East African countries, addressing mixed results as well as additional aspects like political and climate-related factors.

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