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Effect of Health Expenditure on Economic Growth in East Africa: Empirical Evidence from Dynamic Panel Estimation Techniques

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Abstract

Health spending significantly boosts long-run economic growth in East Africa, supporting greater investment in health and productive infrastructure. There is contentious evidence on the effect of health expenditure on economic growth across the globe, with no single piece of evidence explaining the impact of health expenditure on economic growth in East Africa. This study finds that health expenditure plays a significant and positive role in promoting long-run economic growth in East Africa. Using panel data from 2000 to 2020 and a Panel ARDL model, the results show that investing in health alongside capital formation, labour force growth, trade openness, money supply, and stable inflation strongly supports economic performance. The study recommends that East African governments increase investment in health infrastructure, improve health worker remuneration, and raise budget allocations to meet the Abuja Declaration target. It also encourages greater investment in productive infrastructure, such as transport, electricity, and ICT, to further stimulate growth.

Keywords: Health Expenditure, Economic Growth, East Africa, Panel ARDL

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Introduction

Health care expenditure benefits most of the country by enhancing population productivity, contributing significantly to the population's economic well-being, increasing labour force participation, and supporting higher economic growth rates. Evidence indicates a significant relationship between a healthy population and economic growth and development, whereby maintaining a sustainable level of growth and development provides individuals with considerably better nutrition and access to medical treatment, as well as broader access to preventive medical technologies. Consequently, sustainable growth and development create room for better health, increasing the percentage of healthy individuals. Thus, slackening labour or effort does not materialise in society, and hence the amount of labour supply increases. On the other extreme, healthy individuals, who are more suitable for both physical and mental activities, are expected to contribute to production more productively than an ill person and thereby increase productivity, thereby positively impacting economic growth. It is assumed that when individuals are healthy, their life expectancy increases, which in turn stimulates savings and private investments in education. Therefore, the contributions are made to investments and the development of human capital, creating opportunities for healthy individuals to benefit more from the investments they have made in the long run.

Regarding the expenditure side, health care expenditures are a significant component, with a multiplier effect: increased health expenditures lead to higher total expenditures and aggregate demand. Different from the aforementioned aspect, the health sector encompasses an area of employment in the economy. Thus, increased health expenditures increase the number of

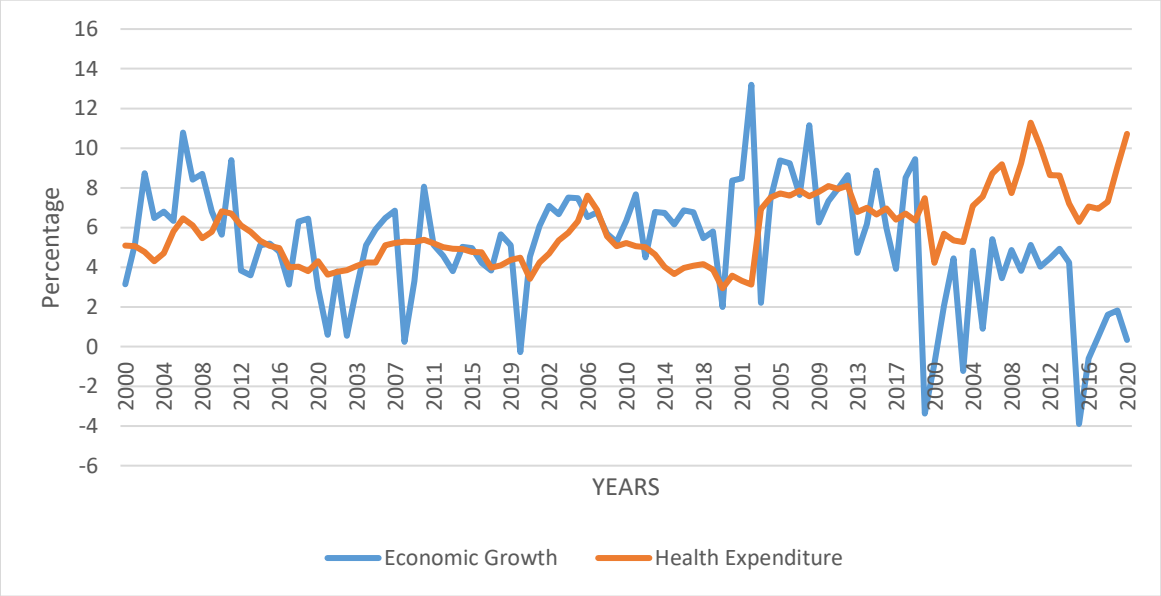
individuals employed in the health sector and the total income of employed individuals, thereby increasing total expenditures and aggregate demand. Such health care expenditures on total expenditures, aggregate demand, and total production are referred to as direct effects, which are expected to be positive. Moreover, sick individuals are less productive and inflict burdens on their families and countries due to reasons associated with their diseases. As such, production disturbances arise that thwart expenditures in the health sector and divert them to less productive activities, such as infrastructure investments in the health sector, inter alia. Relatedly, sustainability in the healthcare market extends to other sectors associated with the health sector and can bolster these sectors as well, increasing trade and production volumes in these segments. These are known as indirect effects, which may be positive or negative.

In developing countries, labour is a scarce factor of production, while capital is an abundant one. It is averred that an increase in the rate of unhealthy individuals in the community reduces workforce and productivity in developing countries, whose economies are grounded in labour, and creates more significant impacts and losses on production power than in developed countries. Consequently, developing countries cannot fully exploit the cheap labour factor to the extent needed, as these countries fall further behind, even more disadvantaged than in an already disadvantaged situation. Thus, the health of society and labour markets, as well as health expenditures, are more essential for developing countries, as they apply to all countries, because a sufficient and effective way of making health expenditures is important in East African countries.

The asserts that improved health of individuals fostes economic growth in various ways. Firstly, better health care minimises production losses caused by absenteeism due to workers' illness. Secondly, improved health enables a country to redirect resources that would have been spent on treating illnesses to other areas, thereby contributing to economic growth. Previous evidence indicates that the link between health expenditure and economic growth can be explained by Total Factor Productivity (Halıcı-Tuluce et al., 2016). Therefore, health impacts economic growth through Total Factor Productivity, while poor health tends to decrease overall productivity.

According to the current health expenditure as a share of GDP for Sub-Saharan African countries averages 5.1% as of 2021. This explains the high burden of health spending in the region, which does not translate into significant economic growth rates. Conversely, the average economic growth rate for Sub-Saharan African countries stands at 3.4% as of 2023, which minimally supports the region's health care expenditures, explaining the increased risk of health disasters in the region. Narrowing down to the East African Community countries, the average current health care expenditure as a share of GDP is 5.8%, far below the 15% suggested by the African Union for African countries to allocate to health expenditure as per the Abuja Declaration. Additionally, the average economic growth rate for East African countries as of 2023 is 5.4%, which at any moment could meet the 15% budget allocation to health following instructions by the African Union as per the Abuja Declaration. Figure 1 below presents the trends in current health expenditure and economic growth of East African countries between 2000 and 2020.

Figure 1: Trends of Current Health Expenditure and Economic Growth (2000 - 2020)



Source: World Bank (2023)

Accordingly, the trend analysis shows a zigzag relationship between health expenditure and economic growth in East Africa. The researchers have not tackled the relationship between health

expenditure and economic growth in East Africa. Therefore, this study empirically examines the effect of health expenditure on economic growth in East Africa.

In East Africa, a significant portion of budget has been allocated to the health sector to improve the health care outcomes within these countries. For instance, in Uganda, the health sector expenditure has been on a steady increase in both nominal and real terms. Since the financial year 2016/17 Financial Year, Health Sector Budget has more than doubled from UGX 1, 456 billion to UGX 4,053 billion in the approved financial 2023/24 budget. In real terms, the Uganda Health Budget has also been on an increasing path, doubling from UGX 1,456 billion in the financial year 2016/17 to UGX 3,094 billion in the financial year 2023/24 approved Budget. The highest rate of increase was reported in the 2020/21 and the 2021/22 financial years, which also coincided with the COVID-19 pandemic phase. If sustained, the recent increase in the health budget provides the opportunity for the country to build on past investment gains to accelerate progress towards the 2030 health targets.

In Kenya, after 2013, the health function was decentralised to county governments, with most roles and responsibilities still managed by the central government. Over the years, actual health expenditure has remained low compared to nominal expenditure. Both nominal and real expenditures have shown an increasing trend. However, the sector experienced a decline in expenditure in the financial year 2017/18, mainly due to electoral effects and health workers' discontent, which impacted health outcomes and service delivery. Since devolution began, the healthcare budget at both county and national levels has increased. For example, in the financial year 2022/23, the health budget rose to 7.0% from 6.0% in 2021/22. Despite this rise, Kenya has yet to meet the Abuja Declaration target of 15%. Consequently, Kenya spends around US$78 per capita on health, according to the National Health Accounts 2015. This is below the World Health Organization (WHO) recommended rate of US$86 per capita, which is deemed the minimum required to provide basic health services to the population.

In Tanzania, the 2023/24 financial year's budget allocated TZS 2.44 trillion to the health sector, marking a 13.5% increase from the previous year. The growth of the health sector budget has been

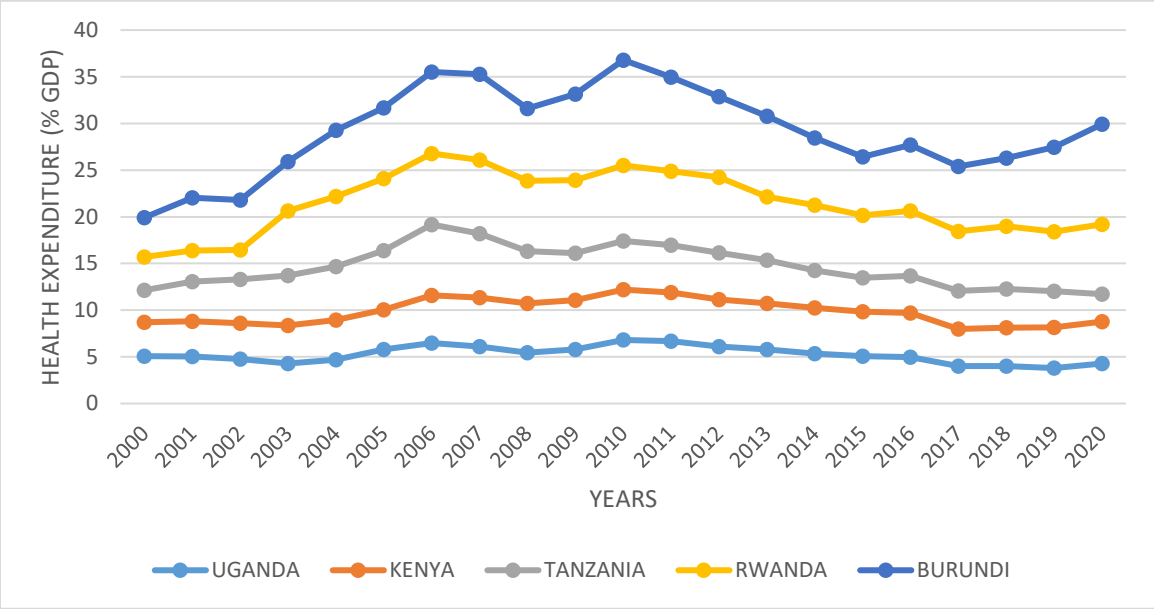
declining over the years. As a proportion of the national budget, the sector's allocation reveals a downward trend over nearly a decade, with 8.2% in 2013/14, 7.99% in 2014/15, 8.1% in 2015/16, 6.7% in 2016/17, 7% in 2017/18, 3% in 2018/19, 3% in 2019/20, 5% in 2020/21, 4.8% in 2021/22, 5.2% in 2022/23, and 5.5% in 2023/24. The Abuja Declaration, to which Tanzania is a signatory, requires governments to allocate at least 15% of their budgets to health to tackle pressing health issues. The health sector is the fifth largest recipient of government funding, after general public services. There was a notable increase in the health sector's share of the national budget from 5.2% in 2022/23 to 5.5% in the 2023/2024 budget. Nonetheless, this falls short of the Abuja target, which stipulates that member countries allocate at least 15% of their budgets to health.

In Rwanda during the fiscal year 2023/24, the budget allocated to the health sector slightly decreased from FRW 367.1 billion in the revised budget for 2022/23 to FRW 363.7 billion. As a proportion of the national budget, the health sector's share fell from 7.8% in 2022/23 to 7.2% in 2023/24, and from 2.9% to 2.4% of GDP over the same period. This is the second consecutive year recording a reduction in health sector funding after an increase, with previous trends in government spending during 2021/22 largely due to COVID-19. There is an urgent need to boost allocations and reverse this downward trend, recognising the sector’s vital role in Rwanda’s human capital development and commitments at regional and national levels, such as the 2019 Addis Ababa Call to Action to increase health-financing budgets.

Finally, in Burundi, the per capita budget allocations to health are BIF 25,512 (USD 9) for the 2023/2024 financial year, compared with BIF 17,640 (USD 8.7) for the 2022/2023 financial year. Budget allocations to the health sector increased from 2016 to 2023/2024, rising from BIF 99.3 billion to BIF 337.4 billion in nominal terms, representing an overall growth of 1.5% over the period. This trend holds in real terms as well. This situation reflects the government’s \commitment to implement the measures taken in the area of health, essentially free care for children under five and mothers giving birth. As a share of GDP, the health sector's budgetary allocations increased from 2.8% in 2022/23 to 3.3% in 2023/24, an increase of 0.5%. However, this remains below the 15% of the total budget, a binding commitment to which Burundi subscribed as part of the Abuja Declaration.

The East African countries are capable of meeting the 15% budget allocation target for their health sectors, as stipulated by the Abuja Declaration. However, based on their previous allocations for the health sector, these countries fall short of contributing the required 15% of their national budgets to health. Figure 2 below shows the percentage of expenditure on the health sector among the selected East African countries between 2000 and 2020.

Figure 2: Trends of Current Health Expenditure in East Africa in Percentage (2000 – 2020)



Source: World Bank (2023)

From Figure 2 above, it is evident that the East African countries have attempted to increase health care expenditure, although they have not reached the 15% budget allocation required by their commitments in the Abuja Declaration. The health care expenditure as a percentage of GDP has received significant attention from policymakers and scholars alike. The relationship between health expenditure and economic growth has been examined in other regions such as Sub-Saharan Africa, West Africa, Asia, and Europe, among others. To the best of my knowledge, no such study has been presented in East Africa regarding the effect of health expenditure on economic growth.

This study aims to empirically investigate the impact of health expenditure on economic growth in East Africa.

Healthcare expenditure is of immense importance to a nation's economic growth. Over the years, East African countries have allocated a significant part of their budgets to healthcare, which consequently leads to increased productivity and notable economic growth rates. As of 2021, the average healthcare spending as a proportion of GDP for these countries is 5.8%, with Burundi contributing the highest at 9.1%, followed by Rwanda with 7.32%, Kenya with 4.55%, Uganda with 4.7%, and Tanzania with 3.4%. This is well below the 15% target set by African Union countries for the health sector in the Abuja Declaration.

On the other end of the spectrum, the average economic growth rate of East African countries as of 2023 stands at 5.4%, with Rwanda having the highest rate at 8.24%, followed by Kenya at 5.43%, Uganda at 5.23%, Tanzania at 5.2%, and Burundi with the lowest at 2.7%. It is suggested that investment in health promotes economic growth, as increased expenditure on health leads to a healthier population with higher workforce participation, which subsequently fosters economic development. The relationship between health expenditure and economic growth has been explored in sub-Saharan African nations (Odhiambo, 2021), OECD countries, and G8 nations. To the best of my knowledge, no study has specifically examined in East Africa the impact of health expenditure on economic growth. It is within this context that this study aims to empirically analyse the effect of health expenditure on economic growth in East Africa between 2000 and 2020.

This study focuses on empirically analysing the impact of health expenditure on economic growth in East Africa. Although numerous studies have been conducted on the effect of health expenditure on economic growth in various countries, there is limited evidence on this relationship in a panel of African nations, with few studies offering mixed or inconclusive results. (Ercelik, 2018). Moreover, the few available studies face methodological flaws. For example, most early research relied heavily on the bivariate causality model to examine the causal link between health expenditure and economic growth, despite the model's susceptibility to the problem of omitted

variable bias. Adding one or more additional variables to a bivariate framework can alter both the magnitude and direction of causality between these two variables. Overall, existing evidence on the impact of health expenditure is mainly based on country-specific analyses, neglecting panel data analysis across multiple countries. Only and Odhiambo (2021) have explored this effect in Sub-Saharan African countries and OECD nations, respectively. Additionally, studies conducted in East Africa primarily focus on the influence of government expenditure on economic growth, overlooking the crucial aspect of health expenditure's effect. To address these gaps, this research aims to examine the impact of health expenditure on economic growth in East Africa employing dynamic panel data analysis using the pooled mean group estimation technique.

Literature Review

Theoretical Review

The Harrod-Domar model, developed by Harrod in 1939 and extended by Domar in 1946, is a theory that suggests capital accumulation contributes to economic growth. The model states that the rate of economic growth is proportional to the rate of capital accumulation at a given level of technology. Additionally, established an exogenous growth model known as the Neo-classical growth model by extending the Harrod-Domar model to include labour as a factor of production for analysing economic growth. Nevertheless, the exogenous growth theory faced criticism for its assumptions that do not consider the long-term economic growth path. The endogenous growth theory, developed by argues that economic growth is driven from within the system. Thus, economic growth can be achieved through changes in human capital.

Mushkin's health-led growth hypothesis outlines the significance of healthcare expenditure in fostering economic growth. Accordingly, health is viewed as a form of capital, and therefore, investing in health can increase income and support overall economic development. Thus, health can influence economic growth through its effect on the accumulation of human and physical capital. The fact that healthcare is a fundamental component of human capital investment suggests that increasing national healthcare spending would enhance labour productivity, improve the population's quality of life, and promote general welfare. Additionally, healthcare expenditure is recognised for extending life expectancy and reducing morbidity and infant mortality rates as

health outcomes. Therefore, it can be argued that health is a vital form of human capital, emphasising a strong connection between the health level of society and its economic growth and development.

The positive link between healthcare spending and economic growth is captured by the Health Led Growth Hypothesis (HLGH). This theory mainly states that healthcare expenditure drives economic development because health is a form of capital. Therefore, investing in health can enhance both human and physical capital accumulation, leading to broader economic development. The Health Led Growth Hypothesis proposes that a healthier population indicates a rise in total factor productivity, as healthier individuals can work longer hours, be more efficient, earn higher wages, possess better learning capabilities, and generally improve the economy's human capital efficiency, thereby contributing to economic growth. This hypothesis also relates to the endogenous growth theory put forward by which highlights the vital role of human capital accumulation and/or investment in fostering economic growth. As a result, increasing individual human capital not only improves a person's efficiency but also boosts the productivity of all production factors. This underscores the importance of healthcare expenditure in promoting the country's economic growth.

Finally, develops a human capital theory where health functions as a form of capital. The theory assumes that increasing the amount of health capital reduces the time spent being ill. Furthermore, it states that humans are born with initial endowments of health, which decline with age and can be enhanced through investment in health. Therefore, among the key propositions of the Grossman theory is that good health enables more effective performance at work and in studies. Grossman also suggests that the main determinants of health capital and demand for health services are wages, age, and education. All the above points highlight the importance of health expenditure in promoting the economic growth of a nation.

Empirical Review

Employed the ARDL approach and the Kaldor filter modelling procedure to examine the health-led growth hypothesis for the Turkish economy from 1975 to 2013. The scholars empirically

investigated the cointegrating relationship between economic growth and health expenditure. The findings of their analysis indicated that an increase in per-capita health expenditure boosts economic growth.

Employed the Gregory-Hansen (1996) cointegration technique, estimated by a VECM, to investigate the causal relationships between health expenditure and real GDP for Iran from 1970 to 2008. Their analysis showed evidence of a long-term relationship between health expenditure and economic growth, with income elasticity for health care expenditure exceeding one after the Islamic Revolution. Additionally, the Granger Causality test results indicated a strong unidirectional effect from real GDP to health expenditure, but did not support the idea that health expenditure drives long-term economic growth.

Employed the Johansen cointegration method to empirically assess the impact of health expenditure on economic growth in Turkey from 1975 to 2018. The authors also incorporated household consumption, life expectancy at birth, trade, and foreign direct investment as control variables. Their analysis revealed evidence of short-term cointegration between health expenditure and economic growth. Additionally, the findings indicated long-term cointegration among all variables. Furthermore, the Granger causality test results demonstrated unidirectional causality from health expenditure to economic growth in the short term.

Used a balanced-panel fixed-effects model to empirically explore how government expenditure affects economic growth in East Africa from 1980 to 2010. The study tested panel unit root and found that only two variables, namely GDP and investment expenditure, are stationary at level. Their analysis results supported the traditional view that relative investment expenditure encourages economic growth, while consumption hampers it.

Zaidi and Saidi used the ARDL technique to model both long-term and short-term relationships, as well as the VECM Granger causality test to determine the direction of causality, in order to examine the link between health expenditure, environmental pollution (CO2 emissions; Nitrous oxide emissions), and economic growth in Sub-Saharan African countries from 1990 to 2015. The

ARDL findings revealed that economic growth positively influences health expenditure, while CO2 emissions and Nitrous oxide negatively impact health expenditure in the long run. Additionally, the VECM Granger causality results indicated a one-way relationship from health expenditure to GDP per capita, as well as a two-way causality between CO2 emissions and GDP per capita, and between health expenditure and CO2 emissions.

Applied the Feder–Ram model to investigate the direct and indirect effects of health expenditures on economic growth in Turkey from 2006 to 2013. The author utilised both aggregate and manufacturing industrial production as measures of total output, alongside total government health expenditures, general government expenditure on cure and pharmaceutical products, and general government healthcare and medicine expenditure series, all based on seasonally adjusted and real monthly data. The results generally indicated a positive and significant direct effect of government health expenditures on economic growth, but also revealed a negative and significant indirect effect on economic growth.

Halıcı-Tuluce et al. (2016) employed dynamic panel data techniques on twenty-five high-income and nineteen low-income economies to investigate the relationship between health expenditure and economic growth from 1995 to 2012 and 1997 to 2009, respectively. The results of their analysis revealed a reciprocal relationship between health expenditure and economic growth in the short run, and one-way causality from economic growth to public health expenditure in the long run. A two-way causality for both private and public health expenditures was found in the short run in high-income countries, while a one-way causality between economic growth and private health expenditures was observed in the long run.

Using quantile regression analysis, examined the causality between an increase in health care expenditure and economic growth across 31 countries from 1986 to 2007. The researcher utilised international total health care expenditure data and discovered that health expenditure growth stimulates economic growth, while economic growth diminishes health expenditure growth [89]. Concerning quantile regression, when economic growth is at a certain quantile, in countries with low levels of growth, the influence of expenditure growth on economic growth varies, whereas in

countries with medium and high levels of economic growth, the influence is positive. However, when health care expenditure growth is at a quantile, the influence of economic growth on expenditure growth differs more significantly.

Using a panel ECM-based Granger-causality model, Odhiambo (2021) examined the causal relationship between health expenditure and economic growth with panel data from sub-Saharan African countries from 2008 to 2017. The author broke down health expenditure into public and private health expenditures and categorised countries into low-income and middle-income groups. The findings showed that, when public expenditure served as a proxy, there was a clear unidirectional causality from health expenditure to economic growth in low-income countries, but no causality was observed in middle-income countries. However, when private health expenditure was used as a proxy measure, a short-term causality from economic growth to health expenditure existed in middle-income countries, while no causality was present in low-income countries.

Adopted the ARDL approach to analyse the link between health expenditure and economic growth in Iran from 1970 to 2007. The scholar found a cointegrating relationship among real GDP, health expenditure, capital stock, oil revenues, and education, although health expenditure explains only a small part of the economic growth among them. The findings further showed that, while health care expenditures are among the most important factors in reducing infant mortality, they do not make a significant marginal contribution to economic growth in Iran.

Ozturk and employed the Kao (1999) panel cointegration method to investigate the impact of health expenditure on economic growth in G8 countries from 1995 to 2012. Their analysis indicated the existence of a long-run equilibrium between health expenditure and economic growth. Additionally, the results showed the presence of a growth hypothesis in the short run, but a growth-detriment hypothesis in the long term.

Ogundipe and employed the multiple Ordinary Least Squares technique to investigate the effects of health expenditure on Nigerian economic growth, using data on life expectancy at birth, fertility

rate, capital, and recurrent expenditures between 1985 and 2009. The results of their study indicated a significant impact of health expenditure on economic growth.

Examined the relationship between income and health expenditures in developing countries from 1995 to 2013. The author used a modified version of the Granger causality test proposed by Toda and Yamamoto and Dolado and Lütkepohl in emerging markets across Europe, the Middle East, Africa, and Asia. The results showed a two-way causality for the Czech Republic and the Russian Federation, while data from Egypt, Hungary, Korea, South Africa, and the Philippines support the health view over the income view. However, the evidence from Greece, Poland, the United Arab Emirates, China, Indonesia, and Korea supports the income view over the health view. The empirical findings indicate that income plays a significant role in explaining variations in healthcare expenditure among countries.

Employed the Pedroni panel cointegration method and Dumitrescu Hurlin panel causality analysis to investigate the causality relationship between health expenditure and economic growth in emerging E7 economies from 1996 to 2016. The results showed a long-term relationship between economic growth and total health expenditure, as well as public health expenditure, but no binding relationship was found between private health care expenditure and economic growth. On the other hand, the Dumitrescu Hurlin panel causality analysis indicated no evidence of a causality link from health expenditure to economic growth.

Using the Ordinary Least Squares analysis, examine the association between health care expenditures and economic growth in Nigeria from 1970 to 2008. The findings of their analysis reveal a significant positive relationship between health care expenditures and economic growth.

Employed the Generalized Method of Moments estimation system to examine the impact of health care expenditure on economic growth in Nigeria from 1980 to 2016. The authors found health care expenditure has a positive effect on economic growth.

Employed panel ordinary least squares, fully modified ordinary least squares, and dynamic ordinary least squares methods to analyse the impact of health expenditure on economic growth in the CEMAC sub-region and five other African countries.

Employed the ARDL bounds testing approach to cointegration to investigate changes in public and private health expenditure from 1980 to 2015. The results showed evidence of cointegration with a significant relationship between health expenditure and economic growth in the long term.

Employed the System GMM method to assess the optimal health care expenditure's impact on economic growth among countries within the Organisation for Economic Co-operation and Development (OECD) from 1990 to 2009. The findings indicated that when the ratio of health expenditure to gross domestic product is below the optimal level of 7.55%, increases in health expenditure significantly contribute to improved economic performance.

Used panel data from 21 developing countries from 2000 to 2016 to examine the link between national health expenditures and economic growth under different levels of human capital. The author employed a panel threshold model and found evidence that health expenditure and economic growth have significant interval effects due to varying levels of human capital. In particular, the results showed that when human capital levels are low, health expenditure is significantly negatively related to economic growth, whereas when human capital is at a medium level, health expenditure has a positive but not significant impact on economic growth. However, when the level of human capital is high, the positive economic impact of health expenditure is significantly amplified.

Generally, the studies reviewed regarding the effect of health expenditure on economic growth are few, albeit with inconclusive and mixed results, but they consistently demonstrate the fundamental role of health expenditure in enhancing economic growth (Ercelik, 2018). Most studies primarily focus on country-specific analysis, which does not accurately reflect the actual impact of health expenditure on regional economic growth. In East Africa, the only available study on this subject examined the effect of government expenditure on economic growth alone. Other studies on the

topic were conducted in Sub-Saharan African countries and OECD nations (Odhiambo, 2021). No study has specifically investigated the impact of health expenditure on economic growth in East Africa. This research addresses this knowledge gap by empirically analysing the effect of health expenditure on economic growth in East Africa.

Methods and Data Sources

Theoretical Framework

The study is based on endogenous growth theories that examine the impact of health expenditure on economic growth. The use of these theories is supported by empirical works of and Borenzstein et al. (1998). In this context, the augmented Solow growth model is employed, which assumes that the savings rate, population growth, and technological progress are exogenously determined. Consequently, there are two inputs—capital and labour—which are remunerated according to their marginal products. The model assumes a Cobb-Douglas production function of the following form, where production at time is given below;

$Y(t) = K(t)\hat{}\alpha\ A(t)L(t)\hat{}(1-\alpha)\ 0 < \alpha <$

1……..……...(1)

Based on the standard expression where Y is output; K is capital stock; L is labour and A is the level of technology adopted by countries in the form of health equipments. L and A are said to grow exogenously at the rates n and g as presented below;

$L(t) = L(0)\ e\hat{}nt$…….(2)

$A(t) =$

$A(0)\ e\hat{}gt$……...……

…….(3)

The number of effective units of labour $A(t)L(t)$ grows at the rate of $n + g$

The model assumes that a constant proportion of output s is invested. By denoting k as capital stock per effective unit of labour, $k = K/AL$, and y as the level of output per effective unit of labour, $y = Y/AL$, thus, the evolution of k is prompted by the following function;

$\dot{k}(t) = sy(t) - (n + g + \sigma)k(t)$ …….....

$\dot{k}(t) = sk(t)^{\alpha} - (n + g + \sigma)k(t)$

.....(4)

Where σ denotes the rate of depreciation of capital. Thus, equation 4 shows that k converges to a steady state value k^*as given by the following equation;

$sk^{*\alpha} = (n + g + \sigma)k^*$or $k^* = \left[\frac{s}{(n+g+\sigma)}\right]^{1/1-\alpha}$.....(5)

The steady state capital-labour ratio is positively related to the rate of saving and negatively related to the growth rate of the population. Thus, the Solow growth model's predictions highlight the impact of savings and population growth on real income. Therefore, equation 5 can be substituted into the production function (equation 1) and by taking natural logarithms; the steady state income per capita is expressed as follows;

$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt + \frac{\alpha}{1-\alpha}\ln(s) - \frac{\alpha}{1-\alpha}\ln(n + g + \sigma)$..... (6)

The fact that the Solow model hypothesises that factors are paid their marginal products; its predictions are not only for the signs but also for the magnitudes of the coefficients on savings and population growth.

We now incorporate health expenditure into the growth model. Thus, the empirical model linked to the endogenous growth theory is presented below;

$Y_{it} = \beta_0 + \beta_1 HEXP_{it} + \beta_2 X_{it} + \varepsilon_{it}$.....(7)

Where Y is economic development measured by real GDP growth, $HEXP$ is health expenditure measured as a percentage of GDP, X denotes a vector of control variables specified by the growth theory. The subscripts i and t indicate country and time-specific components respectively, β_0 is an intercept while β_1 to β_2 are the coefficients of the explanatory variables, while ε is the stochastic disturbance error term. Thus, the general health-economic growth relationship can be specified below;

$RGDP_{it} = \beta_0 + \beta_1 GFCF_{it} + \beta_2 LBR_{it} + \beta_3 HEXP_{it} + \beta_4 INFL_{it} + \beta_5 TO_{it} + \beta_6 MS_{it} + \varepsilon_{it}$.....(8)

Where RGDP is real GDP growth rate as a measure of economic growth, HEXP is health expenditure as a share of GDP, GFCF is gross fixed capital formation as a percentage of GDP as

a measure of physical capital. LBR is the labour force participation rate as a percentage of the total population, INFL is the inflation rate measured by the annual consumer price index, TO is the trade openness measured as a percentage of GDP, and MS is the broad money supply as a percentage of GDP.

This paper highlights the immediate and long-term relationships between health expenditure and economic growth, as well as the effects of various control variables. Therefore, the straightforward regression model used in the analysis incorporates individual effects.

Following this study adopts a dynamic heterogeneous panel data framework by specifying a panel ARDL (p, q) model, where p represents the number of lags of the dependent variable and q indicates the number of lags of the explanatory variables. The standard panel ARDL specification can be written as follows:

$$y_{it} = \eta_i + \sum_{j=1}^{p} \psi_{ij} y_{i,t-j} + \sum_{j=0}^{q} \mu_{ij} X_{it} + e_{it} \quad \text{.....(9)}$$

Where the number of panels $i = 1,2\ldots6$ and time $t = 1,2\ldots,6$ years, η_i is the fixed effects component, X_{it} is a $(k \times 1)$ vector of regressors, ψ_{ij} is a scalar and μ_{it} is a $(k \times 1)$ vector of coefficients (coefficients of the independent variables). Equation 3.17 can be reparametrized and transformed into the form of a linear combination of variables in levels and first differences to check for both the short-run and long-run coefficients as given below;

$$y_{it} = \eta_i + \phi_i' y_{i,t-1} + \varphi_i' X_{it} + \sum_{j=1}^{p-1} \psi_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \mu_{ij}^{*} X_{i,t-j} + e_{it} \quad \text{.....(10)}$$

Where $\phi_i = -\left(1 - \sum_{j-1}^{p} \psi_{ij}\right)$, $\varphi_i = \sum_{j=0}^{p} \psi_{ij}$, $\psi_{ij} = -\sum_{m=j+1}^{p} \psi_{i,m}$ and $\mu_{ij} = -\sum_{m=i+1}^{q} \mu_{i,m}$, with $j = 1,2,\ldots p-1$ and $i = 1,2,\ldots q-1$.

If the variables are grouped in levels, then this can be represented as follows;

$$\Delta y_{it} = \eta_i + \phi_i[y_{i,t-1} - \theta_i X_{it}] + \sum_{j=1}^{p-1} \psi_{ij}\, \Delta y_{i,t-j} + \sum_{i=0}^{q-1} \mu_{ij} \Delta X_{i,t-1} + e_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where $\theta_i = -\phi^{-1}\varphi_i$ explains the long-run equilibrium relationship between the variables involved and ϕ_i is the speed of adjustment with which economic growth corrects towards the long-run equilibrium, given the change in X_{it}. If $\phi_i = 0$, $\phi_i > 1$or $\phi_i > -1$, then this implies that there is no convergence to the long-run relationship between economic growth and the independent factors. However, with a long-run relationship, the coefficient is expected to be negative and statistically significant, indicating that variables converge to the long run after a particular shock. Thus, equation (11) can also be given as;

$$\Delta y_{it} = \eta_i + \phi_i y_{i,t-1} - \phi_i \theta_i' X_{it} + \sum_{j=1}^{p-1} \psi_{ij}\, \Delta y_{i,t-j} + \sum_{l=o}^{q-1} \mu_{ij}^{*\prime}\, \Delta X_{i,t-l} + e_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

$$\Delta y_{it} = \eta_i + \beta y_{i,t-1} + \alpha X_{it} + \sum_{j-1}^{p-1} \psi_j\, \Delta y_{i,t-1} + \sum_{l=0}^{q-1} \mu_{ij}'\, \Delta X_{i,t-l} + e_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Where $\beta = \phi_i$, $\alpha = -\phi_i \theta_i'$ and the long run coefficients $\theta_i' = -\frac{\alpha}{\phi_i}$. Thus, the typical panel ARDL model used in this study is expressed as follows;

$$RGDP_{it} = \textstyle\sum_{j=1}^{p} \delta_i\, RGDP_{i,t-j} + \displaystyle\sum_{j=0}^{q} \lambda_{ij}'\, X_{it-j}' + \varphi_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Where GDP_{it} is economic growth, which is the dependent variable; $X_{it}$is a $k \times 1$ vectors that are known to be purely cointegrated; $\delta_{ij}$is the coefficient of the lagged dependent variables known as scalars; α_{ij}' and λ_{ij}' are $k \times 1$ coefficient vectors; $\varphi_i$denote the unit-specific fixed effects; $i = 1, \ldots, N$; $t = 1,2, \ldots, T$; p, q are optimal lag orders; X denote a set of control variables that are considered to have significant effect on economic growth and ε_{it} is the ideal error term. The reparameterized panel ARDL $(p, q, q, \ldots, q)$ model is expressed below;

$$\Delta RGDP_{it} = \theta_i(RGDP_{i,t-1} - \gamma_i' X_{it}) + \sum_{j=1}^{p-1} \delta_{ij}' \Delta RGDP_{i,t-j} + \sum_{j=0}^{q-1} \lambda_{ij}' \Delta X_{i,t-j} + +\varphi_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Where $\theta_i = (1 - \sigma_i)$ represent the group specific adjustment coefficient (expected that $(\theta_i < 0)$; γ_i is a vector of long run relationships; $ECT = (I_{it} - \gamma_i X_{it})$is the Error Correction Term; X represents a set of control variables; and δ_{ij}, α_{ij} are the short run dynamic coefficient values.

$$\Delta RGDP_{it} = \varphi_0 + \varphi_1 RGDP_{i,t-1} + \varphi_2 GFCF_{i,t-1} + \varphi_3 LBR_{i,t-1} + \varphi_4 HEXP_{i,t-1} + \varphi_5 INFL_{i,t-1} + \varphi_6 TO_{i,t-1} + \varphi_7 MS_{i,t-1} + \phi_1 \sum_{i=0}^{p-1} \Delta RGDP_{i,t-1} + \phi_2 \sum_{i=0}^{q-1} \Delta GFCF_{i,t-1} + \phi_3 \sum_{i=0}^{q-1} \Delta POPN_{i,t-1} + \phi_4 \sum_{i=0}^{q-1} \Delta HEXP_{i,t-1} + \phi_5 \sum_{i=0}^{q-1} \Delta INFL_{i,t-1} + \phi_6 \sum_{i=0}^{q-1} \Delta TO_{i,t-1} + \phi_7 \sum_{i=0}^{q-1} \Delta MS_{i,t-1} + \theta_i ECT_{i,t-1} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

Where $p - 1$ represents lags of the dependent variables; $q - 1$ represents lags of the regressors; $i = 1,2,3,\ldots,N$ number of panels; $t = 1,2,3,\ldots,T$ number of periods; ECT is the Error Correction Term and θ_i is the coefficient of the speed of adjustment to the long-run equilibrium relationship and is supposed to be negative and statistically significant.

In evaluating the impact of health expenditure on economic growth in East Africa, this study uses the Mean Group (MG) and Pooled Mean Group (PMG) estimators introduced by respectively. These estimators are selected because the study aims to capture both the short-term and long-term effects of health expenditure on economic growth. The MG and PMG approaches assume that slope and intercept coefficients vary across countries, unlike the Dynamic Fixed Effects (DFE) and Common Correlated Effects (CCE) estimators, which assume equal slope coefficients across countries while allowing intercepts to differ. Additionally, it is well established that a cointegrating relationship among variables requires them to share the same order of integration. However, emphasise that the panel ARDL framework can accommodate a mix of I(0) and I(1) variables.

The study uses the Mean Group (MG) and Pooled Mean Group (PMG) estimators, introduced by to examine the impact of trade liberalisation on economic growth within the East African Community. These estimators are suitable because the analysis aims to capture both short-term and long-term effects of health expenditure on economic performance. The MG and PMG

approaches are chosen because they allow slope and intercept coefficients to vary across countries, unlike the Dynamic Fixed Effects (DFE) and Common Correlated Effects (CCE) estimators, which assume homogeneity in slope coefficients while only allowing the intercepts to differ [72,74].

Furthermore, the presence of a cointegrating relationship requires the involved variables to share the same order of integration. However, argue that the Panel ARDL framework can accommodate a mix of I(0) and I(1) variables, making it suitable for this analysis. The literature also recommends using the Schwarz Bayesian Information Criterion (SBIC) to choose optimal lag lengths due to its better performance in small samples suggest a maximum lag length of two when working with annual data. Therefore, all the variables used in this study were obtained from the World Bank's World Development Indicators.

Analysis of Findings

This paper examines how health expenditure affects economic growth in East Africa. The analysis starts by examining the dataset's characteristics through descriptive statistics and correlation analysis, which also help evaluate the potential for multicollinearity within the model. Table 1 presents the descriptive statistics for all variables used in the study. The results show that the mean is a suitable measure of central tendency, as it falls within the minimum and maximum values for each variable. Additionally, the relatively small standard deviations indicate a lack of outliers in the dataset.

Table 1: Descriptive Statistics Results

	1	2	3	4	5
VARIABLES	N	mean	sd	min	max
RGDP	105	5.18	2.96	-3.9	13.19
GFCF	105	9.089	14.54	-26.91	114.3
LBR	105	2.843	0.567	1.246	5.078
HEXP	105	5.84	1.753	2.94	11.28
INFL	105	7.469	5.105	-2.815	26.24
TO	105	39.98	10.13	20.96	64.48
MS	105	24.2	8.432	13.06	46.25

Source: Author's computations

The study further examines the potential presence of multicollinearity among the explanatory variables in the regression model by conducting a pairwise correlation analysis. This analysis also evaluates the strength of the linear relationships between the variables included in the model. The results of the pairwise correlation analysis are shown in Table 2.

Table 2: Pairwise Correlation Analysis Results

	RGDP	GFCF	POPN	HEXP	INFL	TO	MS
RGDP	1						
GFCF	0.213*	1					
LBR	-0.063	-0.0552	1				
HEXP	-0.044	-0.0555	0.320***	1			
INFL	-0.164	0.211*	0.109	0.138	1		
TO	0.172	-0.018	0.157	-0.022	0.268**	1	
MS	-0.386***	-0.136	0.0128	-0.0514	0.0817	0.353***	1

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's computation

The results of the pairwise correlation analysis indicate no signs of perfect multicollinearity among the variables, as all correlation coefficients are below the threshold of 0.8 in absolute value. This implies that the regression model is unlikely to be impacted by multicollinearity.

Panel Unit Root Tests

This study uses two panel unit root tests to analyse the stationarity properties of the variables: Levin, Lin, and Chu (LLC), which assumes homogeneous autoregressive parameters across countries, and Im, Pesaran, and Shin (IPS), which allows for heterogeneous coefficients among the study variables. These tests are frequently employed in the literature because of their differing alternative hypotheses. Both LLC and IPS tests, unlike some other panel unit root methods, account for heterogeneity in individual deterministic components, such as a constant and a linear

trend, and allow coefficients to vary across groups under the alternative hypothesis. This indicates that not all cross-sectional units are required to converge to the same equilibrium rate. The results of the panel unit root tests for both levels and first differences are shown in Table 3 below.

Table 3: Panel Unit Root Test Results

	LLC Test			IPS Test		
Variables	**Levels**	**First Difference**	**Order of Integration**	**Levels**	**First Difference**	**Order of Integration**
RGDP	0.2126 (0.5842)	-5.7668*** 0	**I(1)**	-3.8461*** -0.0001		**I(0)**
GFCF	-1.6483** -0.0496		**I(0)**	-5.1225*** 0		**I(0)**
LBR	-4.1599*** 0		**I(0)**	0.7561 (0.7752)	-2.3141*** -0.0103	**I(1)**
HEXP	-1.1296 -0.1293	-3.5208*** -0.0002	**I(1)**	-0.4066 -0.3421	-3.6734*** -0.0001	**I(1)**
INFL	-3.5044*** -0.0002		**I(0)**	-3.5569*** -0.0002		**I(0)**
TO	0.5235 -0.6997	-4.4949*** 0	**I(1)**	1.0416 -0.8512	-4.2533*** 0	**I(1)**
MS	1.6337 -0.9488	-2.9348*** -0.0017	**I(1)**	1.4711 -0.9294	-4.1158*** 0	**I(0)**

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Probability values in parenthesis

Source: Author's computations

The LLC unit root test results suggest that variables such as gross fixed capital formation, labour force participation rate, and inflation are stationary at levels, as their probability values fall below the conventional significance thresholds (0.01, 0.05, and 0.1). The remaining variables, however, are non-stationary at levels, with probability values exceeding these thresholds, but they become stationary after first differencing. Likewise, the IPS unit root test results show that variables including real GDP growth rate, gross fixed capital formation, and inflation are stationary at levels, while other variables are non-stationary at levels but achieve stationarity after first differencing. Based on these findings, the study concludes that the variables meet the conditions necessary for applying the Panel ARDL approach. Consequently, the Panel ARDL method is suitable, as it enables the estimation of long-run relationships among variables with mixed orders of integration.

The Hausman Specification Test

The Hausman specification test was used to identify the most suitable model. The null hypothesis, which assumes slope homogeneity, suggests that the PMG estimator is preferred. Since this hypothesis is not rejected, it is considered valid. As a result, the PMG model is deemed the most appropriate framework for analysing the determinants of economic growth. The regression results support this conclusion: the Hausman h-statistic is 2.55 with a p-value of 0.8634. Because the p-value exceeds the 5% significance level, the null hypothesis of slope homogeneity cannot be rejected, confirming that the PMG model provides the best explanation of the relationship between economic growth and the explanatory variables. Thus, the evidence supports accepting the null hypothesis and indicates that the PMG estimator is the most suitable for capturing the link between economic growth and the chosen regressors. Consequently, the subsequent analysis concentrates on the results from the PMG model.

Pooled Mean Group Estimated Model Results

Based on the null hypothesis of the Hausman test, the Pooled Mean Group (PMG) estimator was selected as the preferred method over the Mean Group (MG) estimator. Since the analysis confirmed the existence of a long-run relationship between economic growth and all the included variables, the PMG estimator is appropriate for assessing the magnitude of this relationship. The standard PMG output provides estimates for both long-run and short-run dynamics. Table 4 below reports the PMG estimation results.

Table 4: Short Run and Long Run Results

VARIABLES	MG	PMG
Error Correction Term	-1.226***	-0.949***
	-0.12	-0.168
SHORT RUN RESULTS		
D.Gross Fixed Capital Formation	0.0968**	0.0611**
	-0.0406	-0.0273
D.Labour Force Participation Rate	-2.778	1.201
	-3.224	-4.552
D.Health Expenditure (% GDP)	0.359	0.335
	-1.161	-0.821

D.Inflation Rate	-0.189***	-0.133***
	-0.0532	-0.0517
D.Trade Openness	0.0764	-0.00925
	-0.14	-0.154
D.Money Supply	-0.415***	-0.446**
	-0.109	-0.227
LONG RUN RESULTS		
L.Gross Fixed Capital Formation	0.121**	0.00721
	-0.0557	-0.0137
L.Labour Force Participation Rate	2.335	1.027***
	-2.34	-0.306
L.Health Expenditure (% GDP)	-0.157	0.708***
	-0.881	-0.161
L.Inflation Rate	-0.292***	-0.176***
	-0.0654	-0.0422
L.Trade Openness	0.0848	0.0744***
	-0.0851	-0.0258
L.Money Supply	-0.156	-0.138***
	-0.131	-0.0473
Constant	1.214	-0.589
	-6.809	-1.365
Hausman h-Statistic		2.55
		-0.8634
Observations	100	100

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computations

The results for the Error Correction Term (ECT) regarding the impact of health expenditure on economic growth show how swiftly the system returns to its long-run equilibrium after a shock. According to the PMG estimates shown in Table 4, the coefficient of the lagged ECT is -0.949, which is both negative as expected in theory and statistically significant at the 1% level. This strongly indicates a long-term relationship between economic growth and the explanatory variables in East Africa. Specifically, the coefficient suggests that about 94.9% of the disequilibrium caused by a shock is corrected within one period, reflecting a rapid return to the long-run equilibrium.

Health expenditure shows a positive and statistically significant long-run impact on economic growth, with significance at the 1% level. The estimated coefficient of 0.708 indicates that a 1% rise in health expenditure leads to a 70.8% increase in economic growth, assuming all other explanatory variables remain unchanged. The long-run positive influence of health spending in East Africa can be linked to substantial government investments aimed at enhancing population health. These investments stem partly from commitments made by African heads of state at the African Union Summit, where member countries pledged to allocate 15% of their national budgets to the health sector. Additionally, efforts to curb corruption in the health systems may have ensured that allocated resources are more effectively channelled toward service delivery. These improvements have contributed to higher labour productivity, a healthier workforce, and overall economic growth across East Africa. This result aligns with the Health-Led Growth Hypothesis, which posits that increased health investment fosters long-term economic expansion. It is also consistent with the empirical findings of and Ercelik (2018), all of whom reported a positive relationship between health expenditure and economic growth. In contrast, the short-run effect of health expenditure on economic growth remains positive but statistically insignificant.

Gross fixed capital formation, used as a proxy for physical capital, showed a positive but statistically insignificant effect on economic growth in the long term. However, in the short term, gross fixed capital formation demonstrated a positive and statistically significant impact on economic growth at the 5% significance level. The coefficient of 0.0611 indicates that a 1% increase in gross fixed capital formation results in a 6.11% rise in economic growth in East Africa, assuming other explanatory variables remain constant. The short-term positive effect of gross fixed capital formation on economic performance can be attributed to the substantial investments made by East African governments in productive sectors, especially infrastructure development. Major projects such as the Standard Gauge Railway in Tanzania, Rwanda, and Kenya, and road construction initiatives like Uganda's Second Kampala Institutional and Infrastructure Development Project (KIIDP II) and Kampala City Roads Rehabilitation Project (KCRRP) under Kampala Capital City Authority (KCCA), significantly contribute to boosting economic activity in the region. This finding aligns with economic theory, particularly the work of, which emphasises the importance of capital accumulation in fostering economic growth. Moreover, the results are

consistent with, who also identified a positive and significant relationship between gross fixed capital formation and economic growth in Pakistan.

The labour force participation rate was found to have a positive and statistically significant long-term effect on economic growth, significant at the 1% level. The estimated coefficient of 1.027 indicates that a 1% increase in labour force participation results in a 102.7% rise in economic growth in East Africa, assuming all other variables remain constant. The long-term positive impact of labour force participation on economic performance may be linked to increased government investment in human capital, particularly in education and health across East African countries. These investments have enhanced labour productivity, expanded employment opportunities, reduced poverty, and ultimately supported stronger economic growth in the region. This finding aligns with economic theory notably which suggests that higher population growth, and consequently a larger labour force, contributes to improved economic performance. The result is also consistent with empirical evidence from, who all reported a significant positive impact of population growth on economic growth.

Inflation was found to have a negative and statistically significant impact on economic growth in both the short run and the long run, with significance at the 1% level. The coefficients of 0.133 and 0.176 indicate that, holding other variables constant, a 1% increase in inflation reduces economic growth in East Africa by 13.3% and 17.6%, respectively. The adverse effect of inflation on economic performance in the region may be linked to recent global shocks, most notably the Covid-19 pandemic and the Russia-Ukraine conflict that have driven up commodity prices, disrupted supply chains, reduced production levels, and ultimately slowed economic growth. This result aligns with previous empirical studies, including those of all of which documented a negative relationship between inflation and economic growth.

Trade openness was found to have a positive and statistically significant long-term impact on economic growth, with significance at the 1% level. The estimated coefficient of 0.0744 indicates that a 1% increase in trade openness boosts economic growth in East Africa by 7.44%, assuming other factors remain constant. This positive long-term effect may be linked to various initiatives

led by East African heads of state aimed at promoting the goals of the East African Community. These initiatives include trade and investment promotion, financial cooperation, and infrastructure development, all aimed at improving market efficiency, lowering the cost of doing business, and strengthening the region's integration into the global economy. Additionally, East African countries have actively enhanced regional integration through the implementation of the customs union, which has significantly facilitated trade by creating a more unified and efficient trading environment among member states. Such regional cooperation has increased the benefits for member countries and contributed to overall economic growth across the region. These findings align with economic theory, which suggests that increased trade among member states substantially fosters economic growth. They also support empirical evidence from all of whom reported a positive and significant effect of trade openness on economic growth. Conversely, in the short run, trade openness was found to have a negative but statistically insignificant impact on economic growth in East Africa.

Finally, it was found that money supply has a negative and statistically significant impact on economic growth in both the short and long term, with significance levels at 5% and 1%, respectively. The estimated coefficients of 0.446 and 0.138 indicate that, all other factors being equal, a 1% increase in money supply reduces economic growth in East Africa by 44.6% in the short run and 13.8% in the long run. The negative effect of money supply on economic performance in the region may be linked to high inflation rates, which have been worsened by factors such as rising commodity prices, the Covid-19 pandemic, and the Russia-Ukraine conflict. These shocks have curtailed economic activity, increased unemployment, and raised poverty levels, thereby negatively affecting growth across East African countries. These findings align with those of who also reported a significant negative relationship between money supply and economic growth. Overall, the results support the health-Led Growth Hypothesis and are consistent with economic theory and previous empirical studies that identified significant effects of health expenditure and other key factors on economic growth.

Conclusion and Recommendations

Conclusion

The study empirically examined the effect of health expenditure on economic growth in East Africa from 2000 to 2020. To meet the study's aims, the panel ARDL model proposed by was used to analyse both the long-term and short-term relationships between economic growth and the variables considered. Before estimating the Panel ARDL model, the study conducted two panel unit root tests—Levin, Lin, and Chu (LLC) and Im, Pesaran, and Shin (IPS)—to evaluate the stationarity and order of integration of the variables. The analysis showed that the variables were integrated of order zero (I(0)) and order one (I(1)), indicating the appropriateness of the Panel ARDL approach for estimation. The Pooled Mean Group (PMG) estimator was preferred over the Mean Group (MG) estimator based on the Hausman test. Results confirmed that both short-term and long-term relationships exist between economic growth and the explanatory variables in East Africa. Specifically, health expenditure as a share of GDP had a strong, positive, and statistically significant long-term effect on economic growth. Additionally, gross fixed capital formation, population growth, and trade openness were found to positively and significantly influence economic growth, while inflation and money supply had a negative and significant impact both in the short term and the long term.

Recommendations

The study's findings offer several policy implications for fostering economic growth in East Africa. First, governments should boost investment in the health sector, including modern hospitals, skilled personnel, and increased budget allocations, to improve population health and productivity, in line with the Abuja Declaration. Second, investment in physical capital, especially infrastructure such as roads, electricity, and ICT, should be prioritised to drive growth in industrial, agricultural, and manufacturing sectors. Third, human capital development through education and health investments needs to be reinforced to create a productive workforce. Fourth, policies supporting trade openness and export-led growth, particularly in manufacturing and industrial sectors, should be adopted to strengthen regional competitiveness and foreign exchange earnings. Finally, supportive monetary policies aimed at maintaining low and stable inflation are essential for controlling money supply, reducing economic shocks, and ensuring sustainable growth across the region.

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References

1. Aboubacar B, Xu D (2017) The Impact of Health Expenditure on the Economic Growth in Sub-Saharan Africa. Theoretical Economics Letters 7: 615-622.
2. Adegoke Y O, Mbonigaba J, George G (2023) Health and Total Factor Productivity Nexus in Selected Sub-Saharan African Countries: Quadratic and Threshold Modelling. BMJ Open 13: 066970.
3. Adeleye J O, Adeteye O S, Adewuyi M O (2015) Impact of International Trade on Economic Growth in Nigeria (1988-2012). International Journal of Financial Research 6: 163-172.
4. Agbo S (2024) Perspective Chapter: Improving Health Budgeting and Management Practices in Low Middle-Income Countries (LMIC): Using 3 Country Case Studies-Nigeria, Kenya and Tanzania.
5. Ali G U (2015) Gross Fixed Capital Formation and Economic Growth of Pakistan. Journal of Research in Humanities, Arts and Literature Applied 1: 21-30.
6. Ali S, Ali A, Amin A (2013) The Impact of Population Growth on Economic Development in Pakistan. Middle-East Journal of Scientific Research 18: 483-491.
7. Allen E R (2016) Analysis of Trends and Challenges in the Indonesian Labor Market.
8. Arellano M, Bover O (1995) Another Look at the Instrumental Variable Estimation of Error-Components Models. Journal of Econometrics 68: 29-51.

9. Arellano M, Bond S (1991) Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. The review of economic studies 58: 277-297.
10. Atilgan E, Ertuğrul H M, Baycan O, Ulucan H (2024) Health-Led Growth Hypothesis and Health Financing Systems: An Econometric Synthesis for OECD Countries. Frontiers in Public Health 12: 1437304.
11. Atilgan E, Kilic D, Ertugrul H M (2017) The Dynamic Relationship between Health Expenditure and Economic Growth: Is the Health-Led Growth Hypothesis Valid for Turkey? The European Journal of Health Economics 18: 567-574.
12. Atun R A, Fitzpatrick S (2005) Advancing Economic Growth: Investing in health. Royal Institute of International Affairs.
13. Bakare A A, Olubokun S (2011) Health Care Expenditure and Economic Growth in Nigeria: An Empirical Study. Journal of Emerging Trends in Economics and Management sciences 2: 83-87.
14. Bakare A A, Olubokun S (2011) Health Care Expenditure and Economic Growth in Nigeria: An Empirical Study. Journal of Emerging Trends in Economics and Management Sciences 2: 83-87.
15. Baltagi B H, Lagravinese R, Moscone F, Tosetti E (2017) Health Care Expenditure and Income: A Global Perspective. Health economics 26: 863-874.
16. Barro R J (2013) Health and Economic Growth. Annals of Economics and Finance 14: 329-366.
17. Barro R, Sala-i-Martin X (1995) Economic Growth. Cambridge, MA: McGraw-Hill, 1995.
18. Bedir S (2016) Healthcare Expenditure and Economic Growth in Developing Countries. Advances in Economics and Business 4: 76-86.
19. Bernhardt A (2012) The Role of Labor Market Regulation in Rebuilding Economic Opportunity in the United States. Work and Occupations 39: 354-375.
20. Bloom D E, Kuhn M, Prettner K (2019) Health and Economic Growth. In Oxford Research Encyclopedia of Economics and Finance.
21. Bloom D, Canning D (2003) Health as Human Capital and its Impact on Economic Performance. The Geneva Papers on Risk and Insurance. Issues and Practice 28: 304-315.

22. Blundell R, Bond S (1998) Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. Journal of econometrics 87: 115-143.
23. Borensztein E, De-Gregorio J, & Lee J W (1998) How does Foreign Direct Investment Affect Economic Growth? Journal of International Economics 45: 115-135.
24. Cole M A, Neumayer E (2006) The Impact of Poor Health on Total Factor Productivity.The Journal of Development Studies 42: 918-938
25. Dao M Q (2012) Population and Economic Growth in Developing Countries. International Journal of Academic Research in Business and Social Sciences 2: 6.
26. Dinçer H, Yuksel S (2019) Identifying the Causality Relationship between Health Expenditure and Economic Growth: An Application on E7 Countries Journal of health systems and policies 1: 5-23.
27. Dinda S (2008) Social Capital in the Creation of Human Capital and Economic Growth: A Productive Consumption Approach. The Journal of Socio-Economics 37: 2020-2033
28. Eberhardt M (2012) Estimating Panel Time-Series Models with Heterogeneous Slopes. The Stata Journal 12: 61-71.
29. Erçelik G (2018) The Relationship between health Expenditure and Economic Growth in Turkey from 1980 to 2015. Journal of Politics Economy and Management 1: 1-8.
30. Esen E, Çelik-Keçili M (2021) Economic Growth and Health Expenditure Analysis for Turkey: Evidence from Time Series. Journal of the Knowledge Economy 1-15.
31. Galadima M D, Ngada M H (2017) Impact of Money Supply on Economic Growth in Nigeria (1981–2015). Dutse Journal of economics and development studies 3: 133-144.
32. Gatawa N M, Abdulgafar A, Olarinde M O (2017) Impact of Money Supply and Inflation on Economic Growth in Nigeria (1973-2013). IOSR Journal of Economics and Finance (IOSR-JEF) 8: 26-37.
33. Ghatak S, Siddiki J U (2001) The Use of the ARDL Approach in Estimating Virtual Exchange Rates in India. Journal of Applied Statistics 28: 573-583.
34. Giles D (2013) Advanced Research Methods in Psychology Routledge.
35. Gong L, Li H, Wang D (2012) Health Investment, Physical Capital Accumulation, and Economic Growth. China Economic Review 23: 1104-1119.

36. Graff Zivin J, Neidell M (2013) Environment, Health, and Human Capital. Journal of Economic Literature 51: 689-730.
37. Gries T, Redlin M (2012) Trade Openness and Economic Growth: A Panel Causality Analysis. In International Conferences of RCIE, KIET, and APEA, March 16: 18.
38. Grossman M (2000) The Human Capital Model. In Handbook of health economics. Elsevier 347-408.
39. Gumbau-Albert M (2021) The Impact of Health Status and Human Capital Formation on Regional Performance: Empirical Evidence Papers in Regional Science 100: 123-139.
40. Gyimah-Brempong K, Wilson, M (2004) Health Human Capital and Economic Growth in Sub-Saharan African and OECD Countriesp. The quarterly review of economics and finance 44: 296-320.
41. Halıcı-Tülüce N S, Doğan İ, Dumrul C (2016) Is Income Relevant for Health Expenditure and Economic Growth Nexus? International Journal of health Economics and Management 16: 23-49.
42. Harris R, Sollis R (2003) Applied Time Series Modelling and Forecasting Wiley.
43. Hye Q M, Wizarat S, Lau W Y (2016) The Impact of Trade Openness on Economic Growth in China: An Empirical Analysis. The Journal of Asian Finance, Economics and Business 3: 27-37.
44. Im K S, Pesaran M H, Shin Y (2003) Testing for Unit Roots in Heterogeneous Panels Journal of econometrics 115: 53-74.
45. Isham A, Mair S, Jackson T (2021) Worker Wellbeing and Productivity in Advanced Economies: Re-Examining the Link. Ecological Economics 184: 106989.
46. Jack W, Lewis M (2009) Health Investments and Economic Growth: Macroeconomic Evidence and Microeconomic Foundations Washington, DC: World Bank.
47. Johansen S (1995) A Stastistical Analysis of Cointegration for I (2) Variables. Econometric Theory 11: 25-59
48. Joshua O O (2016) The Impact of Physical and Human Capital Development on Economic Growth in Developing and Developed Countries: A Comparative Panel Data Approach Economy 3: 1-18.

49. Karki S, Banjara S, Dumre A (2020) A Review on Impact of Inflation on Economic Growth in Nepal. Archives of Agriculture and Environmental Science 5: 576-582.
50. Kasidi F, Mwakanemela K (2013) Impact of Inflation on Economic Growth: A Case Study of Tanzania. Asian Journal of empirical research 3: 363-380.
51. Keho Y (2017) The Impact of Trade Openness on Economic Growth: The Case of Cote d'Ivoire. Cogent Economics & Finance 5: 1332820.
52. Kurt S (2015) Government Health Expenditures and Economic Growth: A Feder-Ram Approach for the Case of Turkey. International Journal of Economics and Financial Issues 5: 441-447.
53. Levin A, Lin C F, Chu C S (2002) Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. Journal of econometrics 108: 1-24.
54. Lopreite M, Zhu Z (2020) The Effects of Ageing Population on Health Expenditure and Economic Growth in China: A Bayesian-VAR Approach. Social Science and Medicine 265: 113513.
55. Madurapperuma W (2016) Impact of Inflation on Economic Growth in Sri Lanka. Journal of World Economic Research 5: 1-7.
56. Maitra B (2018) Investment in Physical, Human Capital, Economic Growth and Life Expectancy in Bangladesh: An Empirical Investigation. South Asia Economic Journal 19: 251-269.
57. Mankiw N G, Romer D, Weil D N (1992) A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics 107: 407-437.
58. Marino A, Morgan D, Lorenzoni L, James C (2017) Future Trends in Health Care Expenditure: A Modelling Framework for Cross-Country Forecasts.
59. Mehmood A, Siddique H M, Ali A (2022) Impact of Health on Worker Productivity: Evidence from South Asia.
60. Mehrara M (2011) Health Expenditure and Economic Growth: An ARDL Approach for the Case of Iran. Journal of Economics and Behavioral Studies 3: 249-256.
61. Mehrara M, Musai M (2011) The Causality between Health Expenditure and Economic Growth in Iran. Int j eco res 2: 13-19.

62. Moscone F, Tosetti E (2010) Health Expenditure and Income in the United States. Health economics19: 1385-1403.
63. Mose N G (2014) Effect of Government Expenditure on Economic Growth in East Africa: A Disaggregated Model (Doctoral Dissertation, Egerton University).
64. Mose N, Kalio A, Kiprop S, Kibet L, Ochieng J (2014) Effect of Government Expenditure on Economic Growth in East Africa: Panel Data Analysis. Journal of International Academic Research for Multidisciplinary 2: 428-444.
65. Obere A, Thuku G K, Gachanja P (2013) The Impact of Population Change on Economic Growth in Kenya.
66. Ogundipe M A, Lawal N A (2011) Health Expenditure and Nigerian Economic Growth. European Journal of Economics, Finance and Administrative Sciences 30: 125-129.
67. Ogundipe M A, Lawal N A (2011) Health Expenditure and Nigerian Economic Growth. European Journal of Economics, Finance and Administrative Sciences 30: 125-129.
68. Omodero C O (2019) Effect of Money Supply on Economic Growth: A Comparative Study of Nigeria and Ghana. Int'l J Soc Sci Stud 7: 16.
69. Ozturk S, Topcu E (2014) Health Expenditures and Economic Growth: Evidence from G8. International Journal of Economics and Empirical Research 2: 256-261.
70. Ozturk S, Topcu E (2014) Health Expenditures and Economic Growth: Evidence from G8. International Journal of Economics and Empirical Research 2: 256-261.
71. Patterson A C (2023) Is Economic Growth Good for Population Health? A Critical Review. Canadian Studies in Population 50: 1.
72. Pesaran M H, Shin Y (1995) An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. Cambridge, UK: Department of Applied Economics, University of Cambridge 9514: 371-413.
73. Pesaran M H, Shin Y, Smith R J (2001) Bounds Testing Approaches to the Analysis of Level Relationships. Journal of Applied Econometrics 16: 289-326.
74. Pesaran M H, Shin Y, Smith R P (1999) Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. Journal of the American statistical Association 94: 621-634.
75. Phillips P C, Hansen B E (1990) Regression with I(1) Processes.

76. Piabuo S M, Tieguhong J C (2017) Health Expenditure and Economic Growth: A Review of the Literature and an Analysis between the Economic Community for Central African States (CEMAC) and Selected African Countries. Health Economics Review 7: 23.
77. Ridhwan M M, Nijkamp P, Ismail A, Irsyad M L (2022) The Effect of Health on Economic Growth: A Meta-Regression Analysis. Empirical Economics 63: 3211-3251.
78. Romer P M (1990) Endogenous Technological Change. Journal of Political Economy 98: 71-S102.
79. Romer P M (1994) The Origins of Endogenous Growth. Journal of Economic perspectives 8: 3-22.
80. Roodman D (2006) How to Do xtabond2. In North American Stata Users' Group Meetings 2006 (No 8) Stata Users Group.
81. Solow R M (1956) A Contribution to the Theory of Economic Growth.The Quarterly Journal of Economics 70: 65-94.
82. Studenmund A H (2001) "Using Econometrics: A Practical Guide" Addison Wesley Longman Inc New York.
83. Swan T W (1956) Economic Growth and Capital Accumulation. Economic Record 32: 334-361.
84. Tartiyus E H, Dauda T M, Peter A (2015) Impact of Population Growth on Economic Growth in Nigeria. IOSR Journal of Humanities and Social Science (IOSRJHSS) 20: 115-123.
85. Tullao Jr, T S (2012) Transforming the ASEAN Economic Community (AEC) into A Global Services Hub: Enhancing the Competitiveness of the Health and Wellness and Creative Services Sectors. Developingasean Economic Community (Aec) Into A Global Services Hub 1.
86. Udeorah S A, Obayori J B, Onuchuku O (2018) Health Care Expenditure and Economic Growth in Nigeria. International Journal of Research and Innovation in Social Science 2: 54-61.
87. Unicef (2024) SUSTAINING PUBLIC INVESTMENTS IN HEALTH SECTOR: UGANDA BUDGET BRIEF | FINANCIAL YEAR 2023/24. United Nation International Children Education Fund.

88. Wang F (2015) More Health Expenditure, Better Economic Performance? Empirical Evidence from OECD Countries Inquiry. The Journal of Health Care Organization, Provision, and Financing 52: 0046958015602666.
89. Wang K M (2011) Health Care Expenditure and Economic Growth: Quantile Panel-Type Analysis. Economic modelling 28: 1536-1549.
90. WHO (2002) Improving Health Outcomes of the Poor: the Report of Working Group 5 of the Commission on Macroeconomics and Health. World Health Organization
91. Wilkie J, Young A (2009) Why Health Matters for Economic Performance. Economic Round-up 57-72.
92. World Bank (1993) World Development Report 1993. World Bank Group.
93. World Bank (2023) World Development Indicators. World Bank Group.
94. Yang X (2020) Health Expenditure, Human Capital, and Economic Growth: An Empirical Study of Developing Countries. International Journal of Health Economics and Management 20: 163-176.
95. Zaidi S, Saidi K (2018) Environmental Pollution, Health Expenditure and Economic Growth in the Sub-Saharan Africa Countries: Panel ARDL Approach. Sustainable Cities and Society 41: 833-840.