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ORIGINAL ARTICLE

The nexus between health expenditure, life expectancy, and economic growth: ARDL model analysis for Kenya

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Abstract

The study explored the causal effect analysis of healthcare spending and life expectancy on annual gross domestic product (GDP) growth in Kenya utilizing time series data from 2000 to 2020. Autoregressive distributed lag (ARDL) and error correction (ECM) models were applied to inspect the short-term and long-term equilibrium and the speed of adjustment to the long-run equilibrium owing to a disturbance in the short term, respectively. Bounds testing analysis confirmed the existence of a long-term linkage between the factors. The speed of adjustment from medium-term to long-run equilibria owing to structural breaks is statistically significant. This indicated that the system is convergent, but it takes longer to rectify the divergence. Health expenditure significantly influences the growth of GDP in the long run with an insignificant effect in the medium term. Life expectancy substantially and directly influences GDP growth in both the medium term and long term while terms of trade, a control factor, significantly but indirectly influences GDP growth. The Granger causality test reveals the existence of unidirectional causality from healthcare spending to economic growth, although providing no empirical support that healthcare spending enhances long-run economic growth. Thus, the findings conclude that health expenditure and longevity of life fundamentally enhance the growth of GDP in Kenya for the time considered.

KEYWORDS
ARDL model, GDP growth, health expenditure, life expectancy, terms of trade

1 | INTRODUCTION

Human capital is a fundamental engine of economic expansion in any economy in both microeconomic and macroeconomic aspects (Wilson & Briscoe, 2004). Its development boosts economic growth by increasing both labor market and non-market productivity (Grossman, 1972). Health is seen as both a consumer and an investment good. Healthcare boosts welfare as a consumer good, while it also improves the quality of human capital and labor productivity as an investment good (Kimalu et al., 2004). Increasing population healthcare demand is thus a critical policy concern in any growing country such as Kenya. Better healthcare satisfies basic human requirements while also significantly contributing to and enhancing peoples' productive potential (Kimalu et al., 2004). As a result, human health forms a key component of any nation's economic expansion and development path, and there is a direct positive nexus relating to peoples' health and productivity (Grossman, 1972). Humans demand improved healthcare services not because they value health as a commodity, but because it advances their productive stock of health, assuring a healthy labor force supply to help the economy recover after pandemics such as COVID-19. This link has been proven in industrialized countries, which are now reaping the benefits of years of healthcare spending (Schultz & Tansel, 1993).

Mushkin (1962) noted that human capital development entails social expenditure on education and health on the premise that individuals earn a future return by investing in health and education. The health-led growth theory proposed by Mushkin (1962) emphasizes that health is a kind of asset and investing in it boosts income and enhances long-run economic prosperity. Since health is a basic component of the stock of human capital, expanding healthcare expenditure improves output, labor productivity, and social wellbeing. As a result, it can be observed that health is an important kind of asset and that there is a noteworthy connection between a society's status of health and its social well-being. On the other hand, when people's living standards and quality of health are poor, a fueled economic upswing ensues (World Health Organization [WHO], 1999). Evidence from the research reveals that a healthy populace is a sort of long-term tool that contributes to and sustains economic prosperity (Fernandes, 2020; Yaqub et al., 2012).

Bloom and Canning (2000) concluded that a healthy population efficiently assimilates knowledge, implying higher market output. They found that education is the primary driver of human capital in their empirical investigation. However, extending the Solow growth model to include improved health because of healthcare spending has a significant impact on the economy's overall production. Workers who are in better health have higher marginal productivity, earn more income, and are less likely to miss work owing to illness, reducing the amount of time available for market labor (Strauss & Thomas, 1998). In the same vein, healthier workers have a longer life expectancy, which is an incentive for savings. The economic miracle experienced by the Asian 'tigers' was because of an increased life expectancy and an upsurge in savings (Bloom et al., 2004).

Since independence, there has been substantial concern about the percentage of gross domestic product (GDP) dedicated to healthcare expenditure for African countries. According to the African Union (2001), African leaders agreed to prioritize health spending in realizing the Sustainable Development Goals (SDGs, #3) on healthy lives and promoting the well-being of all at all ages for African economic success. Importantly, 15% of the total government budget had to be committed to the health docket to accomplish the SDGs, with only Togo, Rwanda, Botswana, Zambia, Madagascar, Swaziland, Ethiopia, Lesotho, Malawi, Liberia, and Mozambique meeting the objective in 2011 (WHO, 2014). In Kenya, public healthcare expenditure rose slightly to 2.2% from 1.9% as a portion of GDP between the 2012/2013–2019/2020 financial years. As a proportion of total public spending, the health docket

budget allocation rose to 9.5% from 7.8% in the same period (The Republic of Kenya, 2020). New disbursements for restrictive grants to level-5 hospitals and further funding for Universal Health Care initiatives aided the rise (The Republic of Kenya, 2020). Despite these significant gains in health sector budget allocations, the present trend nevertheless misses the mark of the government's committed goal of allocating 15% of overall public spending to the health docket, per the 2001 Abuja Declaration (African Union, 2001). The gains in health docket budget allocations also fall short of the government's pledge of devoting 12% of its expenditure to healthcare spending (Jubilee Party, 2017).

In Kenya, the government has made significant strides to improve health outcomes regarding the provision of healthcare services (Murunga et al., 2019). These efforts have been evidenced through declining child mortalities and the burden of serially communicable diseases. The under-5 mortalities have declined from 99 per 1,000 live births in the year 2000 to 42 per 1,000 live births in 2020. The country has also witnessed an improvement in infant mortality from 60 to 31 per 1,000 live births between 2000 and 2020 (World Development Indicator [WDI], 2020). With the implementation of improved health measures, the HIV/AIDS prevalence rate among the adult population has decreased significantly to 4.2% in 2020 (WDI, 2020). However, non-communicable diseases account for a larger portion of deaths in Kenya, with approximately 50% of patient deaths being due to non-communicable diseases (Murunga et al., 2019). According to the United Nations Population Division (2020), life expectancy in Kenya is 67 years on average. A major setback in the improvement of life expectancy in Kenya is the high prevalence of under-5 mortality and HIV/AIDS. Compared with other East African nations, life expectancy is higher: in Uganda, Tanzania, and Burundi it is 64, 66, and 62 years, respectively (World Bank, 2020b).

Kenya's GDP growth rate dropped from 5.3658% to −0.3075% between 2019–2020 (World Bank, 2020a), because of the economic downturns of the COVID-19 outbreak. Donor funding shrunk as the economy deteriorated, and the repayment of external debt relative to gross domestic product escalated to 3.6% as a proportion of total budget allocation (Kenya National Bureau of Statistics [KNBS], 2020). The COVID-19 outbreak struck at a time when Kenya's economy appeared to be on the rise. Kenya's economy was on pace to expand in the first half of 2020, with growth forecast to go to 7% from 5.4% between 2019 and the second quarter of 2020. The economy slowed in most sectors in the first quarter of 2020, compared with the same period in 2019. In the first quarter of 2019, real GDP increased by 4.9%, down from 5.5% in the previous quarter. The mystery shrouding the COVID-19 pandemic, as well as the related containment mechanisms adopted both locally and internationally, hindered economic activity in the third quarter (KNBS, 2020). Even though the global economic decline is unavoidable during shocks, countries are putting in place strategies to maintain economic prosperity (Fernandes, 2020). With COVID-19 still unfolding, it is informative to contribute to the literature by establishing the connection relating to government healthcare spending, life expectancy, and economic growth in Kenya.

Rono (2013) investigated the factors that influence healthcare spending in Kenya and revealed a substantial influence of GDP on government healthcare spending. Nyamwange (2012) discovered that health is a valuable asset in Kenya, with a GDP per capita elasticity of 0.024%. In a similar vein, Oloo (2013) investigated the relationship between social sector expenditure and economic growth. The study included healthcare expenditure and government spending on education as proxies for human capital advancement. In conclusion, the study found a substantial interconnection relating to human capital proxies and economic expansion in Kenya.

However, there is a knowledge void in Kenya regarding the linkage relating to healthcare spending, the life expectancy, and economic growth. In Kenya, no research has been done analyzing the medium- and long-term implications of health spending on economic prospects. Do public health spending and life expectancy have an impact on economic growth in both the short run and the long run? The study examined the following hypotheses to answer the research question:

$\mathbf{H_{O1}}$: In Kenya, public health spending has no substantial short- or long-term effect on economic growth.
$\mathbf{H_{O2}}$: Life expectancy does not influence economic growth in Kenya in both the short run and long run.

This paper is structured in five parts. Section 1 discusses the introduction and justification of the research topic. Section 2 carries out an empirical review of the literature and the theoretical foundation. Sections 3 and 4 summarize the methodological approach, the empirical findings, and discussions, respectively. Section 5 makes conclusions and discusses policy implications and opportunities for further research.

2 | LITERATURE REVIEW

In late 2019, a pneumonia-related case was reported in Wuhan, China, and later identified as a new coronavirus. The WHO named this virus COVID-19 (He et al., 2020). This spread rapidly, causing a global health crisis and an economic downturn. These economic repercussions of the COVID-19 epidemic have been called 'Coronanomics' (Eichengreen, 2020). The COVID-19 pandemic, according to Alfano and Ercolano (2020), resulted in lockdowns in numerous nations as a tactic to stop the virus from spreading. This resulted in a halt in economic activity as individuals remained at home, affecting aggregate demand and supply in the global economy. The shock waves of the COVID-19 epidemic, according to Baldwin and Tomiura (2020), include both demand- and supply-side consequences, with a reduction in aggregate trade flows and manufacturing disruptions, as well as a supply-side effect due to global supply chain alterations. This de-globalization process disrupted the global supply chain, momentarily impeding the regular movement of products and services across international borders. The pandemic wreaked havoc on the economic performance of many underdeveloped and developed countries. Therefore, how do countries revive their economies amidst the global pandemic?

According to Munro (2020), G7 member countries contribute 60% of worldwide aggregate demand and supply therefore, when they suffer macroeconomic setbacks, other countries across the globe get a cold. The cold, which is a macroeconomic flu, is a brief disruption in aggregate demand and supply followed by periods of recovery in leading economies (di Mauro, 2020). The economic recovery path of developed and developing countries from shocks to stability occurs only in the case of a normal 'macroeconomic sneeze,' not in the case of pandemics such as COVID-19, which seems to have caused huge economic distress (di Mauro, 2020). The global COVID-19 pandemic has resulted in a global health catastrophe with higher death rates as well as decreased output, consumption, and social welfare in economies around the world (Fernandes, 2020). Governments and policy analysts are putting in place economic recovery measures and stimulus incentives to mitigate the economic shocks of the COVID-19 pandemic to resuscitate the economy and gear up for economic development (Fernandes, 2020). The Keynesian theory, according to Romer (1986), proposes that higher government spending through expansionary fiscal policies stimulates economic growth during times of economic crisis. In this case, government expenditure through public healthcare spending and other health proxies that enhance labor productivity and output revives the economy in times of pandemics.

Kenya's first confirmed coronavirus incident was on March 12, 2020, and the number of infections increased exponentially (Ministry of Health, Kenya, 2020). From the onset of the first confirmed case, the government came up with containment mechanisms to limit the virus' transmission and save lives. To help Kenyans and business enterprises, the government implemented specific fiscal initiatives such as lowering the tax on monthly income from 30% to 25%, dropping the value-added tax to 14% from 16%, and cutting the turnover tax from 3% to 1%. Citizens earning under $240 per month were exempted from remitting tax to the government. Moreover, the government increased transfer payments to the most vulnerable members of society, notably the emerging urban vulnerable people (Government of Kenya, 2020).

These were precautionary measures, not economic solutions to COVID-19 shocks. According to the Government of Kenya (2020), the government took further monetary policy steps to improve private sectors' loan access. The Central Bank lending rate was deliberately lowered to 7.0% from 8.25%, and the cash reserve ratio was slashed from 5.25% to 4.25%, putting an extra Ksh 35 billion Kenyan shillings (KES) into the money market. Commercial banks were also given some leeway in terms of classification and provisioning requirements for loan

accessibility during this period. The government adopted the comprehensive Kenya Economic Stimulus Program (ESP) that focuses on all sectors of the economy to boost economic activity in the country (Government of Kenya, 2020). Despite these initiatives, there is still much that needs to be done in the long run to resuscitate the economy amidst the pandemic, which can be achieved through a healthy labor force.

2.1 | Theoretical review

Buchanan (1965) proposed a growth theory that stated that the government should raise public healthcare spending regardless of demand. This hypothesis sparked disagreement among economists, who claimed that if the government made healthcare available to the general population, it would result in excess demand, which would lead to excessive government healthcare spending. This means that political decisions regarding public healthcare spending should be decided independently of healthcare demand, rather than in response to inefficiencies in the healthcare system (Buchanan, 1965). This idea accurately explains the healthcare situation in Kenya, where inefficiencies are caused not by a lack of finances to dedicate to the public health docket, but by the poor quality of the country's healthcare system (Nyamwange, 2012). The problem with this hypothesis is that it will result in a better healthcare system emerging from the private sector, rendering the public healthcare system inequitable.

Nyamwange (2012) stated that decisions regarding healthcare spending are inevitably influenced by politicians rather than market forces. As a result, political decisions about healthcare spending should be based on empirical forecasts from GDP estimates (Jowett, 1999). Kenya's nominal GDP was ranked 61st by the World Bank in 2020, implying that public healthcare spending remains low. As a result, a country like Kenya would choose to cut public health spending even though it is not a reasonable move. In Kenya, doctors demand greater remunerations through industrial action, expanding recurrent expenditure, which, in turn, inhibits improvement in healthcare outcomes in the country and instead displaces healthcare resources (Nyamwange, 2012). Crucially, if GDP per capita had a major impact on public healthcare spending, developing economies like Kenya would benefit from healthcare policies that reflect their wealth. As a result, a well-defined financial blueprint that reflects the nation's riches would make the public healthcare system efficient, rather than promote a perpetual rise in resource allocation (Buchanan, 1965).

The endogenous models emphasize the significance of developing human capital as a stimulus for economic expansion. Barro (2013) investigated the interconnection relating to health and the nation's stock of wealth by incorporating human capital into the endogenous growth model. He found that while improved health implies long-term economic growth, the latter boosts health capital accumulation. Barro's (2013) model considers the explicit influence of health on labor efficiency, stating that improvements in health, such as fixed hours worked, accumulation of physical capital, educational attainment, and individual experience, increase employees' production. Furthermore, increased health reduces mortality rates and the burden of sickness, lowering the rate of human capital depreciation and, as a result, increasing demand for human capital, which has an indirect beneficial influence on productivity (Barro, 2013). Ssozi and Asongu (2016) note that the underpinnings of Barros' original endogenous growth theory are still important in today's empirical literature on human capital enhancement in Africa. Moreover, Mankiw et al. (1992) added to the Solow (1956) growth model, emphasizing the relevance of improving the stock of human capital for economic expansion in the medium term and the long term.

2.2 | Empirical literature review

The nexus relating to health and economic growth is explained by the endogenous growth models when an economy strives to attain a steady state-level of growth (Nyamweya, 2017). Economic growth is a function of human capital, which becomes more effective because of better education, better health, and technological innovation (Barro, 2013; Grossman, 1976). Many researchers utilize various variables as health proxies in their empirical work, such as life expectancy, infant death, healthcare spending, and adult mortality (Nyamweya, 2017).

The COVID-19 outbreak has posited both economic and health disruptions across the globe. In the recent past, much of the research has been focused on examining on how government expenditure significantly impacts economic growth, but few studies have investigated whether the government can establish sustainable economic development and growth in times of a health crisis like the COVID-19 pandemic, such as in developing countries through health expenditure. Piabuo and Tieguhong (2017) used econometric methodologies to investigate a study in the Central African Economic and Monetary Community (CEMAC) sub-region as well as in nine African nations that carried out the Millennium Development Goals of 2013. The study concluded that those countries that implemented 15% of public expenditure on health recorded a 0.38 unit rise in growth of GDP per capita. This implied that a rise in government spending on healthcare significantly influences the per capita GDP of a country. Similarly, Ibikunle (2019) obtained similar results and concluded that increased government spending on the health sector should be prioritized to realize the sustainable development goal of economic growth. The study employed the use of the ordinary least square (OLS) and the Granger causality post-estimation approach to examine the influence of healthcare expenditure on the growth of GDP.

In Nigeria, Ogundipe and Lawal (2011) adopted the ordinary least square approach and revealed that healthcare spending inversely influences the growth of the gross domestic product. This result contradicts those by Bakare and Olubokun (2011), while Oni (2014), with help of multivariate OLS regression techniques, concluded that life expectancy inversely enhances the growth of GDP. Olisakwe (2019) used the classical linear regression method over a period of 36 years and observed that increased government budgetary spending on the health sector inversely impacts economic growth in Nigeria. In the same line, Nwani and Kelikume (2019) also found similar findings as those by Olisakwe (2019). The study by Nwani and Kelikume (2019) employed the use of the Toda–Yamamoto analytic method to establish the causal connection between healthcare spending, health status, and GDP growth from 1981 to 2018. They confirmed the existence of an inverse non-interdependent nexus relating to public healthcare spending and economic expansion.

In the years 1960–2005, Beheshti and Sojoudi (2008) explored the interrelation between public healthcare spending and GDP growth in Iran. The findings from the Johansson cointegration test and the bounds testing confirmed the long-run interrelation between government healthcare spending and the gross national income. Causality results revealed the presence of a one-way causality emerging from gross national income to public healthcare spending. Similarly, using panel data over 13 years for emerging economies, Ngangue and Manfred (2015) concluded that increased life expectancy positively enhances gross national income. Mahyar (2016) investigated the influence of economic development on the longevity of life in Iran over 47 years using the Vector Error Correction Model (VECM) approach. The findings demonstrated that economic development has a strong direct impact on life expectancy. Similarly, Mehrara and Musai (2011) confirmed the same results using the Gregory and Hansen (1996) cointegration technique.

In Cameroon, Mandiefe and Tieguhong (2015) investigated the nexus between public healthcare investments and GDP growth using VECM analytical techniques over 25 years. The results established the presence of a long-run equilibrium between healthcare spending and GDP progress. Through optimal resource allocation, public healthcare spending enhances GDP growth in the long term. As a result, the government should devote 10–15% of its total expenditure to health in line with the WHO and the 2001 Abuja Declaration, respectively.

During the 1990–2009 period, Elmi and Sadeghi (2012) inspected the causation and cointegration links between growth in the economy and public healthcare spending in emerging economies. The data demonstrated that GDP and government health expenditure have a medium-term causal relationship. Additionally, the outcomes suggested that, in the long run, income is an important component in the level and amount of healthcare spending in developing nations. The study recommended further research be conducted in a specific developing country by using different analytical techniques. Using ARDL analytical technique, Ahmad and Hasan (2016) examined the influence of government healthcare spending, healthcare outcomes, and governance in Malaysia from 1984 to 2009. The output from the analysis confirmed a long-term linkage relating to healthcare spending, healthcare outcomes, and governance. Likewise, Erçelik (2018) applied an ARDL cointegration model to examine the influence of Turkey's health output on

economic growth from 1980 to 2015 and obtained the same results. From the above studies, it can be concluded that healthcare spending significantly influences economic progress in the long term. Aurangzeb (2003) confirmed evidence of the medium-term and long-term linkage relating to healthcare spending and GDP growth in Pakistan over 30 years.

Using the OLS regression technique and a sample of countries from Africa, Europe, America, and Asia over 20 years, Aguayo-Rico et al. (2005), analyzed the correlation between health as an asset and the growth of GDP. The findings showed that health capital significantly enhances GDP growth. Kim and Lane (2013) used a mixed-effect approach among 17 Organisation for Economic Co-operation and Development (OECD) countries and critically examined the interrelation between health outcomes and healthcare policy in the United States. Study findings reported both inverse and direct results; no link existed between government spending on health and child mortality, while a direct association exists between healthcare expenditure and life expectancy. Similarly, Dogan, Tülüce, and Dogan et al. (2014) used the ARDL technique among OECD nations to evaluate healthcare spending and health outcomes from 1995 to 2011. The results were consistent with those of Kim and Lane (2013). Also, Heshmati (2001) extended the Solow growth model to analyze the association between healthcare expenditure and GDP growth amongs OECD nations from 1970 to 1992. The results provided evidence of a significant correlation between the variables. In Turkey, Kar and Taban (2003) and Yumuşak and Yıldırım (2009) obtained an inverse link between healthcare expenditure and GDP using the cointegration technique.

Researchers are still unable to reach a consensus regarding the causality problem despite the large volume of studies. Çetin and Ecevit (2010) observed neutral causality, while Elmi and Sadeghi (2012) reported bidirectional causality. There is also a disparity in the findings between advanced and emerging economies. All these divergent viewpoints are compelling grounds for investigating the nexus related to healthcare spending, life expectancy, and GDP increase in Kenya.

3 | METHODOLOGY

3.1 | Definition of variables

Owing to inconsistencies in data for health indicators in Kenya, this study relied on health expenditure and life expectancy as health proxies. According to WHO (2020), health expenditure is explained as the level of monetary resources directed to the healthcare sector relative to the country's stock of wealth. Therefore, healthcare spending data were extracted from World Bank Open data and measured as a percent of GDP in this study. United Nations Population Division (2017) defines life expectancy as the sum of years a toddler is expected to live if the current tendencies in death rate during their birth remained unchanged. The data on life expectancy were extracted from the World Development Indicator website and measured as the number of total years an infant is expected to live if current tendencies in mortality remained the same. According to OECD (2022), terms of trade are explained as the proportion of the index of export value relative to the index of import value. If net exports surpass net imports, a nation's balance of payment terms of trade is favorable, suggesting that for the same amount of net exports, the country may obtain more imports. The data on terms of trade were obtained from the World Bank database. COVID-19 disrupted the global supply chain and resulted in stringent restrictions on international trade. These economic shocks greatly affected the balance of payments (BOP) across the globe, especially in developing economies such as Kenya. Economic growth is defined as the value of all final products and services generated within the domestic economy over time, as measured by yearly GDP growth, by the International Monetary Fund (IMF, 2012). It is generally evaluated as a percentage rise in real GDP per capita, but we use annual GDP growth data extracted from the World Bank database in this study because we analyze the overall economic performance in the medium and long run. The study used yearly time series data for all variables from 2000 to 2020.

3.2 | Autoregressive distributed lag (ARDL) modelling

The ARDL model established by Pesaran et al. (2001) was examined to determine the medium-term and long-run effects of healthcare spending and life expectancy on GDP growth in Kenya. The ARDL model is appropriate when factors are integrated at I(0) or order I(I). According to Duasa (2007), the model is fit for comparing medium-term and long-run elasticities for small samples on the basis of the assumptions of OLS to analyze the presence of cointegration between elements of interest. The ARDL is adequate for explanatory factors that are integrated of order I(0), I(1), or jointly cointegrated, according to Frimpong and Oteng-Abayie (2006); however, the model is constrained when explanatory factors are integrated of order I(2). The ARDL model developed below was applied to examine the connection between GDP and explanatory variables, health proxies, and terms of trade in Kenya.

$$\mathrm{GDP}_t = \beta_0 + \beta_1 \mathrm{HE} + \beta_2 \mathrm{LE} + \beta_3 \mathrm{TOT} + \beta_4 \mathrm{Di} + \epsilon i_t$$

When evaluating time series data, a condition called log transformation is used to account for the series' variations' stability (Luetkepohl & Xu, 2009). The study variables should be log-linearized for model predictability, economic analysis, and forecasting reasons. The use of logarithms, on the other hand, reduces model prediction accuracy if the model's stability of variance is not established (Luetkepohl & Xu, 2009). As a result of adding logarithms to Eq (i), the model becomes:

$$\Delta \mathrm{LogGDP}_t = \beta_0 + \beta_1 \Delta \mathrm{LogHE} + \beta_2 \Delta \mathrm{LogLE} + \beta_3 \Delta \mathrm{LogTOT} + \beta_4 \mathrm{D} + \epsilon i_t$$

where ΔLog GDP_t represents the logarithm of the GDP in time *t* from 2000 to 2021, ΔLog HE indicates the logarithm of government healthcare spending in time *t*, ΔLog LE logarithm of life expectancy in time *t*, and ΔLog TOT logarithm of terms of trade in time *t*. β_0 represents the constant term in the estimation while β_1, β_2, β_3, and β_4 are coefficient parameter estimates. *D* captured the structural breaks (dummy = 0, no shock and dummy = 1, shock in the economy) while representing the disturbance term in time *t*.

To evaluate the short-term and long-term equilibrium, Equation (ii) was transformed into ARDL model Equation (iii) below:

$$\begin{aligned}\Delta \mathrm{LnGDP}_t = {} & \beta_0 + \sum_{k=1}^{n} \beta_1 \Delta \ln \mathrm{GDP}_{t-k} + \sum_{k=1}^{n} \beta_2 \Delta \ln \mathrm{HE}_{t-k} + \sum_{k=1}^{n} \beta_3 \Delta \ln \mathrm{LE}_{t-k} + \sum_{k=1}^{n} \beta_4 \Delta \ln \mathrm{TOT}_{t-k} \\ & + \sum_{k=1}^{n} \beta_5 \Delta \mathrm{D}_{t-k} + \lambda_1 \ln \mathrm{GDP}_{t-1} + \lambda_2 \ln \mathrm{HE}_{t-1} + \lambda_3 \ln \mathrm{LE}_{t-1} + \lambda_4 \ln \mathrm{TOT}_{t-1} + \lambda_5 \mathrm{D}_{t-1} + \epsilon_t\end{aligned}$$

The drift element in the model is captured by β_0 in Equation (iii), the first differencing of the time series data is shown by Δ, and the random term ϵ_t captures the white noise effect.

Following the establishment of the long-term equilibrium nexus between health proxies, terms of trade, and GDP growth in Kenya in Equation (iii), the study used error correction model (ECM) methodology to ascertain the short-run association in the model. This helps to determine the speed of adjustment in the long-run equilibrium owing to a disturbance in the medium-term. The following is how the ECM equation (iv) is obtained from the ARDL equation (iii):

$$\begin{aligned}\Delta \mathrm{LnGDP}_t = {} & \beta_0 + \sum_{k=1}^{n} \beta_1 \Delta \ln \mathrm{GDP}_{t-k} + \sum_{k=1}^{n} \beta_2 \Delta \ln \mathrm{HE}_{t-k} + \sum_{k=1}^{n} \beta_3 \Delta \ln \mathrm{LE}_{t-k} + \sum_{k=1}^{n} \beta_4 \Delta \ln \mathrm{TOT}_{t-k} \\ & + \sum_{k=1}^{n} \beta_5 \Delta \mathrm{D}_{t-k} + \varpi \mathrm{ECM}_{t-k} + \epsilon_t\end{aligned}$$

4 | FINDINGS AND DISCUSSIONS

4.1 | Descriptive statistics

The average, median, maximum, minimum, and standard deviation values are depicted in Table 1. The total number of observations is estimated to be 21. GDP increased by 4.4679 on average over the study period, with the highest value of 8.4057, a low of −0.3075, and a standard deviation of 2.4116. The average value of healthcare spending as a percent of annual growth of GDP was 5.7602, with the highest, lowest, and standard deviation values of 9.20, 4.6392, and 1.1492, respectively. According to the findings, Kenya's average life expectancy is 59.4743 years, with the highest and lowest values of 66.6960 and 51.6900 years, respectively. In absolute terms, the terms of trade averaged 4.5881, implying that Kenya has been in a BOP disequilibrium, relying heavily on imports during the period of study. The biggest trade deficit was (9.0355*-1) (the raw data for terms of trade were negative for the entire period. To change the data to logarithimic form, we multiplied (*) the raw data by (-1). The results for terms of trade are then multiplied (*) by (-1) in the interpretation) and the lowest was (0.7069*-1). In absolute terms, the variation of the data from the average value represented by standard deviation was 3.1114.

TABLE 1 Descriptive statistics

	GDP	HE	LE	TOT
Mean	4.4679	5.7602	59.4743	4.5881
Median	5.3571	5.4593	60.2620	4.3902
Maximum	8.4057	9.2000	66.6960	9.0355
Minimum	−0.3075	4.6393	51.6900	0.7069
Standard deviation	2.4116	1.1492	5.4802	3.1114
Observations	21	21	21	21

Notes: HE, health expenditure; LE, life expectancy; TOT, terms of trade; GDP, gross domestic product.

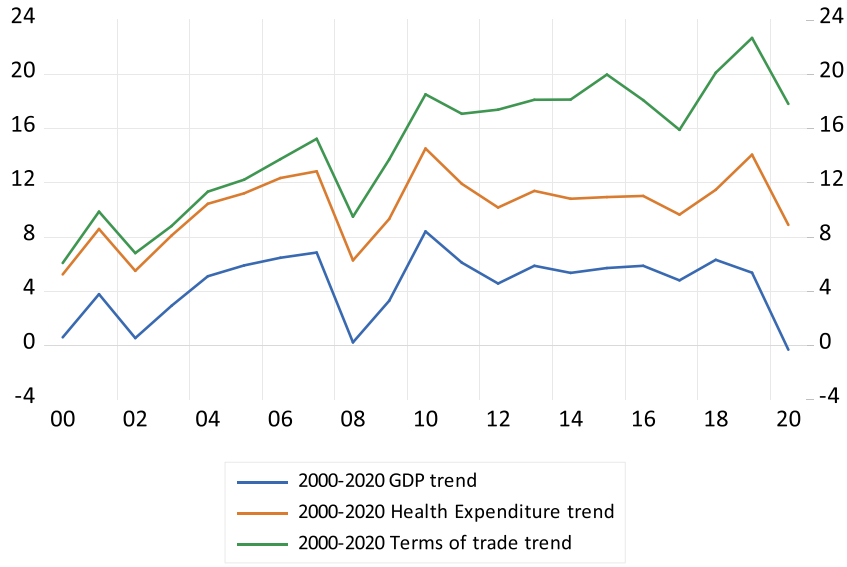


FIGURE 1 Trends of GDP, health expenditure, and terms of trade

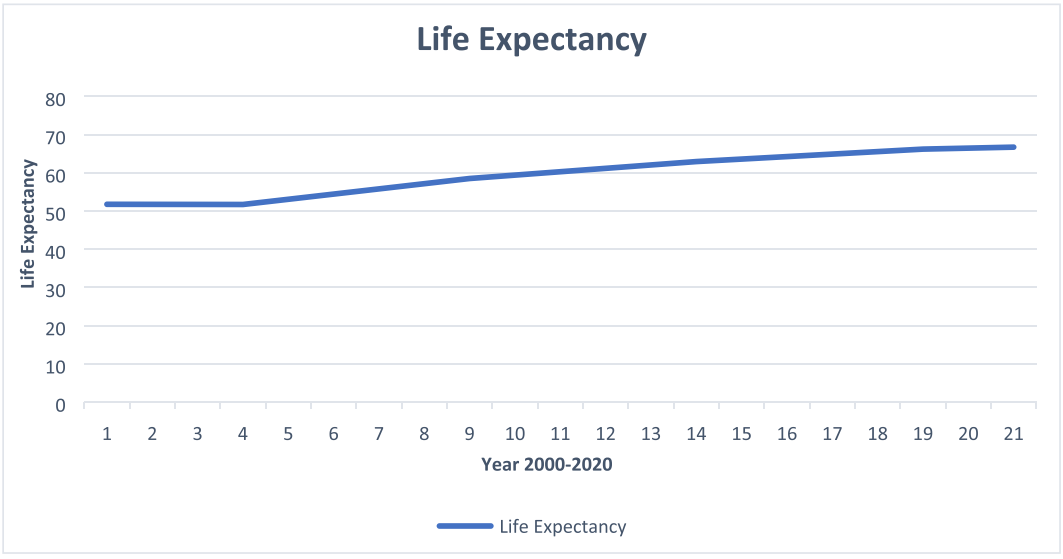


FIGURE 2 Trends in life expectancy

4.1.1 | Trends in GDP growth

Figure 1 illustrates graphical depictions of the trends in variables over the sample period to aid understanding of the study variables. GDP is the most volatile indicator, followed by terms of trade, although life expectancy in Figure 2 and health spending show a constant tendency over time. Since the year 2000, the Kenyan economy has shown diverse trends in terms of yearly GDP growth, as indicated by the peaks and troughs. Before the year 2000, the highest yearly GDP ever recorded was 26.83% in 1971, owing primarily to the coffee boom (GOK, 1994). Following the economic downturns of the 1990s and early 2000s, Kenya began an economic recovery route, with yearly GDP growth consistently positive, with the highest annual growth in 2007 of 6.85% (World Bank, 2020a). However, the negative repercussions of post-election violence in 2008 impeded this economic momentum, and the GDP contracted to 0.23% (World Bank, 2020a). Kenya's economic success has been increasing since the 2010 constitution and the flagship project Kenya Vision 2030 were implemented, with growth reaching 6.32% in 2018 (Republic of Kenya, 2020). Kenya's GDP dropped from 5.3658% to −0.3075% from 2019–2020 (World Bank, 2020c), because of the economic downturns of the COVID-19 outbreak. Donor funding shrunk as the economy deteriorated, and the repayment of external debt relative to gross domestic product escalated to 3.6% as a proportion of total budget allocation (Kenya National Bureau of Statistics, 2020). The COVID-19 outbreak struck at a time when Kenya's economy appeared to be on the rise. Kenya's economy was on pace to expand in the first half of 2020, with growth forecast to go to 7% from 5.4% between 2019 and the second quarter of 2020. The economy slowed in most sectors in the first quarter of 2020, compared with the same period in 2019. In the first quarter of 2019, real GDP increased by 4.9%, down from 5.5% in the previous quarter. The mystery shrouding the COVID-19 pandemic, as well as the related containment mechanisms adopted both locally and internationally, hindered economic activity in the third quarter (KNBS, 2020).

4.1.2 | Trends in healthcare expenditure

As depicted in Figure 1, there is evidence of fluctuations in the level of healthcare spending as a percent of annual GDP between 2000 and 2020, demonstrating sharp peaks and troughs. Despite the rise in the cost of living

standards, government budgetary spending on the social sector has not been substantial (Nyamwange, 2012). In Kenya, public healthcare expenditure rose slightly to 2.2% from 1.9% as a portion of GDP between the 2012/2013–2019/2020 financial years. As a proportion of total public spending, the health docket budget allocation rose to 9.5% from 7.8% in the same period (The Republic of Kenya, 2020). New disbursements for restrictive grants to level-5 hospitals and further funding for Universal Health Care initiatives aided the rise (The Republic of Kenya, 2020). Despite these significant gains in health sector budget allocations, the present trend nevertheless misses the mark of the government's committed goal of allocating 15% of the overall public spending to the healthcare docket per the 2001 Abuja Declaration (African Union, 2001).

4.2 | Correlation analysis

The findings in Table 2 illustrate that GDP, a measure of economic growth, was found to have a negative but significant association (Pearson correlation coefficient = −0.1531, *p*-value 0.0408 < 0.05) with health expenditure, which is inconsistent with the literature's theoretical constructs of a direct interrelation between healthcare spending and annual growth of the economy. GDP has a weak substantial positive association with terms of trade (correlation coefficient = 0.1787, *p*-value 0.0438 < 0.05) and life expectancy (correlation coefficient = 0.2722, *p*-value 0.0233 < 0.05), supporting the existing literature findings of a positive relationship in the variables.

TABLE 2 Correlation analysis

Correlation				
Probability	**GDP**	**HE**	**LE**	**TOT**
GDP	1 –			
HE	−0.1531(0.0408)	1 –		
LE	0.2722(0.0233)	0.4630(0.0345)	1 –	
TOT	0.1787(0.0438)	0.4335(0.0496)	0.9593(0.0000)	1 –

Notes: HE, health expenditure; LE, life expectancy; TOT, terms of trade; GDP, gross domestic product.
Significant values in brackets.

TABLE 3 First differencing unit root test

Variable	ADF-statistic	Critical value at 5%	p-value	Status
DGDP	−5.1793	−3.6908	0.0033	Stationary
DHE	−3.3222	−1.9602	0.0022	Stationary
DLE	−4.5105	−3.6908	0.0097	Stationary
DTOT	−3.9112	−3.6736	0.000	Stationary

Notes: HE-health expenditure, LE-life expectancy, TOT-terms of trade, GDP-gross domestic product.
**D-first difference, ADF-Augment Dickey-Fuller test*.

4.3 | Unit root test

If a time series dataset does not have a unit root or endogeneity attributes that contribute to erroneous output, it is deemed steady (Gujarati, 2003). A stationary dataset has a fixed mean and variance. The augmented Dickey–Fuller (ADF) test, proposed by Dickey and Fuller (1979), and the Phillips–Perron (PP) test, put forward by Phillips and Perron, are used to perform the unit root test (1988). The Phillips–Perron test is preferred because it has a stronger statistical power in distinguishing between real unit root and near unit process and is more resilient when homoscedasticity is assumed. The MacKinnon critical value of the standard Neyman–Pearson framework is compared with the ADF and PP test statistic as a rule of thumb. The series is stationary if the test statistic exceeds the critical value at a 5% level of significance. The series is not stationary in any other way (Table 3).

The ADF statistic was used to examine the data's stationarity to inspect if the data had unit root attributes or not across the sample period. For DGDP, DHE, DLE, and DTOT, the ADF statistics were −5.1793, −3.3222, −4.5105, and −3.9112, respectively. At a 5% level of significance, these computed ADF statistics were less than Mackinnon's critical values (ADF statistic < critical values). This meant that the data for the variables of interest had no unit root attributes at the first differencing, hence the null hypothesis of the presence of a unit root was collapsed and the conclusion that the data is stationary was drawn.

4.4 | Co-integration test

The next stage is to examine any evidence of long-run equilibrium among the factors after unit root testing. As a result, the bounds test was applied to inspect for cointegration to ascertain the existence of interrelationship. Results demonstrate that in most cases, the *F*-statistics exceeds the upper bounds at 10%, 5%, and 1% significance levels, indicating a path to long-run equilibrium and the existence of cointegration among the model factors (Table 4).

TABLE 4 Bound test

F-bounds test		Null hypothesis: No levels of relationship		
Test statistic	**Value**	**Significance**	**I(0)**	**I(1)**
F-statistic	13.0385	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

TABLE 5 Granger causality test

Null hypothesis:	Obs	*F*-statistic	Prob.
HE does not Granger cause GDP	21	3.2927	0.0473
GDP does not Granger cause HE		0.3384	0.7186
LE does not Granger cause GDPz	21	2.8176	0.0937
GDP does not Granger cause LE		0.6904	0.5177
TOT does not Granger cause GDP	21	0.1046	0.9014
GDP does not Granger cause TOT		2.2194	0.1455

Notes: LE, life expectancy; HE, health expenditure; TOT, terms of trade; GDP, gross domestic product.

4.5 | Granger causality test

The presence of cointegration in the model provides evidence for causation nexus, but the path of the causality could not be determined. A Granger causality test was performed to investigate whether a variable is a causative agent for the other. Granger causality, according to Granger (1980), establishes the causal–directional linkage between two factors using *F*-statistic. If and only if factor *X*'s time delays have stronger forecast power than factor *Y*'s time lags, then factor *X* causes factor *Y*. The null hypothesis, which states that factor *X* causes factor *Y*, is rejected as a decision rule. When the time lag of factor *X* is added to the time lag of values of *Y* itself, the conclusion is reached that *X* Granger causes *Y*, that is, the time lag of factor *X* has additional analytical power on *Y* (Table 5).

At the 5% level of significance, the findings revealed the presence of unidirectional causality moving from healthcare spending to the GDP (*p*-value 0.0473 < 0.05), while GDP does not cause healthcare spending (*p*-value 0.7186 > 0.05). These findings contradict the empirical studies of Dinçer and Yuksel (2019) and Mehrara and Musai (2011), which indicated one-way causality moving from GDP growth to healthcare expenditure for seven European nations and Iran, respectively. Also, contrary to Ecevits' (2013) findings, there is no causal linkage between life expectancy, terms of trade, and GDP at the 5% level of significance.

4.6 | ARDL model results

The long-run and short-run equilibrium was approximated because the ARDL bound test analysis revealed the presence of cointegration. From Table 6, the economic structural breaks, particularly the post-election violence in 2007/2008, economic sabotage in 2017, and the worldwide health crisis (COVID-19) were represented using a dummy variable. This dummy variable, designed to capture shocks, recorded a detrimental impact on GDP growth in Kenya. The economy declined by 4.1529 and 1.2359 units in the long-run and medium-term equilibria, respectively, ceteris paribus.

The adjusted *R*-square value for the model's goodness of fit is 0.928117. This means that in the short run, healthcare expenditure, life expectancy, and terms of trade determine 92.8117% of differences in GDP growth in Kenya. The cointegration error equation one-period lag shows that the speed of adjustment from medium-term to long-run equilibrium owing to post-elections, economic sabotage, and COVID-19 shocks in 2007/2008, 2017, and 2020, respectively is −2.2751, which is statistically significant (*p*-value 0.000 < 0.05). This specifies that the system is convergent, but that correcting the divergence between variables takes longer. In addition, the system has an oscillating adjustment procedure. Table 6 shows that healthcare spending has a statistically significant influence on GDP (*p*-value 0.0063 < 0.05) in the long run but insignificant in the medium term (*p*-value 0.0580 > 0.05). Health spending brings a negative but considerable contribution to a unit variation in GDP in both the long run and short run (−0.7976, −0.5883), respectively, according to the findings. This suggests that a unit rise in healthcare spending as a proportion of GDP led to a 0.797583 and a 0.588250 unit decrease in GDP in the long run and short run, respectively. The GDP growth is marginally more impacted by life expectancy than by health spending in absolute terms. The coefficient of life expectancy is 4.1 times bigger in the near term and 1.3 times bigger in the long term than health spending. This suggests that increased life expectancies, certeris paribus, ensure a steady supply of a healthy labor force to raise the country's output. However, high health spending (with a high recurrent-to-capital ratio), like in Kenya, causes both short- and long-term declines in the GDP of the nation. However, when the amount of health spending is raised to a level that would favorably boost GDP growth, both life expectancy and health expenditure serve as complements and are proxies for health. These findings are consistent with Olisakwe (2019), who found that higher government budgetary spending on health has an inverse influence on the expansion of the economy in Nigeria. Contrary to these findings, Piabuo and Tieguhong (2017) found that five African and CEMAC countries that spent 15% of GDP on health saw a 0.38 unit rise in per capita GDP, showing that public healthcare expenditure critically influences the per capita GDP of a nation.

TABLE 6 ARDL regression results

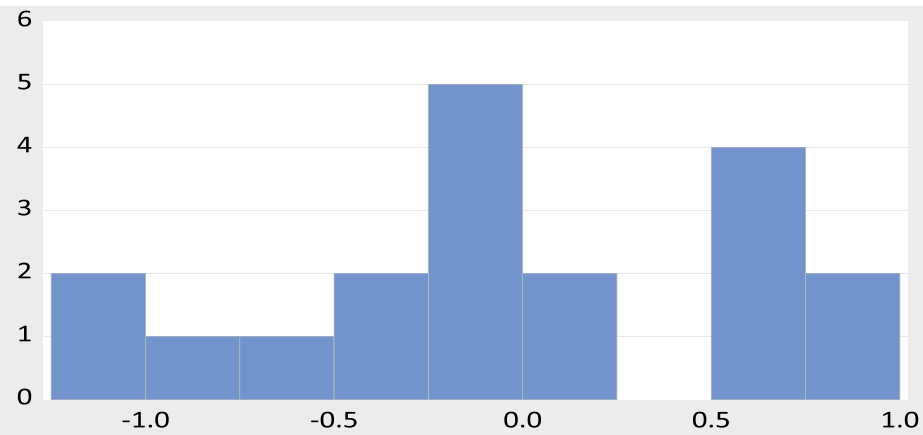
Long-run				
Variable	**Coefficient**	**Std. error**	***t*-statistic**	**Prob.**
HE	−0.7976	0.2071	−3.8510	0.0063
LE	1.0693	0.1361	7.8560	0.0001
TOT	−1.5624	0.2386	−6.5491	0.0003
DUMMY	−4.1529	0.7246	−5.7313	0.0007
C	−47.5270	6.4567	−7.3608	0.0002
Short-run				
(GDP[−1])	0.4320	0.0943	4.5793	0.0025
D (HE)	−0.5883	0.2599	−2.2638	0.0580
DLE	2.4328	0.3976	6.1188	0.0005
D (TOT)	−0.7004	0.1899	−3.6891	0.0078
D (TOT[−1])	1.6468	0.2592	6.3542	0.0004
D (DUMMY)	−1.2359	0.4591	−2.6918	0.0310
CointEq(−1)*	−2.2751	0.1965	−11.5806	0.0000
R^2	0.9521			
Adjusted R^2	0.9281			

Notes: HE, health expenditure; LE, life expectancy; TOT, terms of trade; GDP, gross domestic product.
D, first difference of the variable.
CointEq(−1)* – The cointegration error equation one-period lag shows the speed of adjustment from medium-term to long-run equilibrium owing to structural breaks.

The high recurrent-to-capital health expenditure ratio in Kenya is linked to the negative but significant influence of public healthcare spending on GDP growth. Despite the progressive growth in the health budget allocation since the commencement of devolution governance in 2013/14, the aggregate budget to the health docket is inadequate to meet the health sector's demands and obligations. Salaries, allowances, prescription supplies, and other routine costs account for 80% of the aggregate county government budget for health from 2017/18 to 2019/2020. Only 17.7% of total healthcare spending is spent on capital development to increase the quality of health facilities and infrastructure to boost the stock of people's health for human capital development. Kenya's healthcare financing is heavily reliant on donor support and out-of-pocket spending. The Kenyan government has a larger need to improve a better and more effective health insurance plan. If foreign financing is taken off, the prospect of a country's health system collapsing, and its population's health deteriorating, is unavoidable. As a result, the Kenyan government must provide stronger incentives to encourage savings through health insurance (National Hospital Insurance Fund [NHIF] plan) and take advantage of efficiencies to allocate more funds for capital health expenditure to fulfill the 2001 Abuja Declaration. Higher health insurance coverage leads to increased health service consumption, which improves the population's health stock, resulting in increased productivity and a longer life expectancy. Ghana and Rwanda have effectively implemented universal healthcare programs, and their populations are now healthier because of efficient health service consumption.

In both the long run and short run, however, life expectancy significantly influences the annual growth of the economy (*p*-values 0.0001, 0.0005 < 0.05). In the short run specifically, a unit upsurge in life expectancy led to a 2.432833 unit rise in GDP growth, while in the long term, a unit change in life expectancy led to the appreciation of GDP by 1.0693 units, ceteris paribus. As a result, higher life expectancy will supply the Kenyan economy with the essential healthy workforce to enhance the country's GDP productivity. This means that for Kenya to achieve long-term economic progress, it will be important to implement steps to increase citizen life expectancy, since this will act

TABLE 7 Histogram normality test



Series: Residuals	
Sample 2002 2020	
Observations 19	
Mean	-5.24e-15
Median	-0.103665
Maximum	0.991287
Minimum	-1.140873
Std. Dev.	0.624955
Skewness	-0.160656
Kurtosis	2.154177
Jarque-Bera	0.648104
Probability	0.723213

as a remedy for economic underdevelopment. This conclusion conforms Mahyar's (2016) findings for Iran and Ngangue and Manfred's (2015) findings for 141 emerging economies. In the long run, a rise in life expectancy increases a country's population, which lowers the capital-to-labor and land-to-labor ratios, thus lowering per capita income. As more individuals enter the workforce and more capital is amassed, this initial decrease is eventually balanced by higher output. If there are considerable productivity benefits from living longer, healthier lives, this compensation may potentially exceed the starting amount of income per capita. However, the compensation may be insufficient if the benefits of increased life expectancy are restricted and burdened by diseases such as HIV/AIDS, which has a prevalence of 4.9% in Kenya, as well as if some of the production components are inelastically supplied.

The computed coefficients for terms of trade as a control variable reveal a significant effect (p-value 0.0003, 0.0078 < 0.05) on GDP growth at a 5% level of significance in both the medium- and long-run equilibrium. Likewise, the findings demonstrate evidence of a positive influence on the growth of GDP in the long run (−1.5624*-1) (the raw data for terms of trade were negative for the entire period. To change the data to logarithimic form, we multiplied (*) the raw data by (-1). The results for terms of trade are then multiplied (*) by (-1) in the interpretation) while an inverse effect in the short run (1.6468*-1). This suggests that a unit change in terms of trade, in the long run, leads to an appreciation of GDP by 1.5624 units and a decrease of −1.6468 in the short run, ceteris paribus. The effect of terms of trade on the Kenyan economy in the medium term, on the other hand, tends to be inverse owing to the country's overwhelming reliance on importation during shocks. The findings contradict those of a study conducted in Pakistan by Jebran et al. (2018).

4.7 | Diagnostic tests

Validity inspection of the predicted model relied on diagnostic checks. Histogram normality test, Breusch–Pagan heteroscedasticity test, the Breusch–Godfrey serial correlation Lagrange multiplier (LM) test, Ramsey Regression Equation Specification Error Test (RESET) test for functional misspecification, and stability test using cumulative sum (CUSUM) and cumulative sum of square stability (CUSUMSQ) charts were applied.

The stochastic term must be uniformly spread with constant variance and zero average values, according to the normality assumptions of classical ordinary least squares. The p-value of the Jarque–Bera statistic (0.723213) is greater than 0.05 at the 95% confidence interval, as shown in Table 7. This proves that the residuals follow a normal distribution.

For the model specification test, Ramsey RESET was applied. The test confirms whether a non-linear combination of regressors predicts the regressed factor. If the explanatory factors predict the dependent factor, the model is misspecified. The results in Table 8 reveal that, at a 5% significance level, the F-statistic of the Ramsey RESET test was found to be significant (p-value 0.2094 > 0.05). This means that the ARDL model's explanatory variables are

TABLE 8 Ramsey RESET test

	Value	Df	Probability
t-statistic	1.4059	6	0.2094
F-statistic	1.9764	(1, 6)	0.2094
Likelihood ratio	5.4098	1	0.0200

TABLE 9 Breusch–Godfrey serial correlation LM test

Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.4897	Prob. F(2,5)	0.6394
Obs*R^2	3.1122	Prob. chi-squared(2)	0.2110

linearly related to the predicted factor, implying that the functional form of the equation is suitably defined. The linearity assumption of Ordinary Least Square estimation approaches is verified.

The ordinary least square (OLS) estimators are unbiased, yet inefficient in the presence of autocorrelation. For inspection of serial autocorrelation of the random term, the Breusch–Godfrey serial correlation LM test was utilized. From Table 9, the probability values of the *F*-statistic (0.6394) and Observed*R^2 (0.2110) at lag length 2 were

TABLE 10 Breusch–Pagan heteroscedasticity test

Null hypothesis: Presence of homoskedasticity			
F-statistic	1.7370	Prob. F (11,7)	0.2376
Obs*R^2	13.9057	Prob. chi-squared (11)	0.2383
Scaled explained SS	1.0892	Prob. chi-squared (11)	0.9999

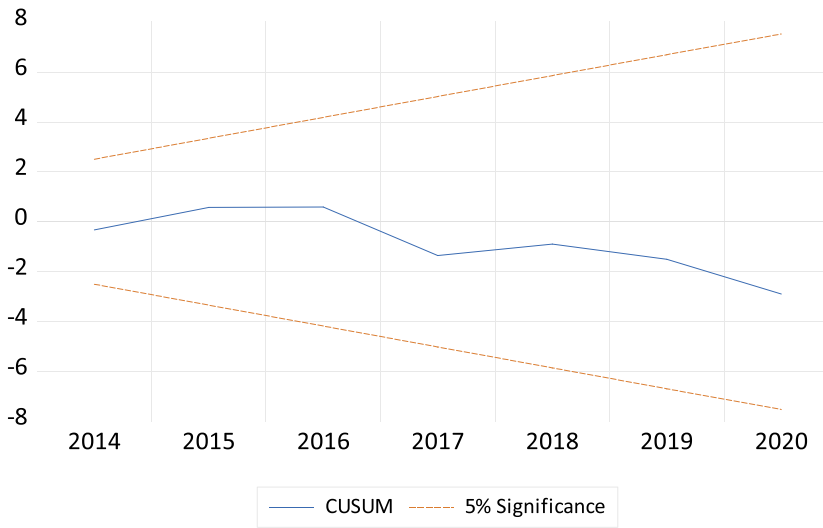


FIGURE 3 CUSUM stability test

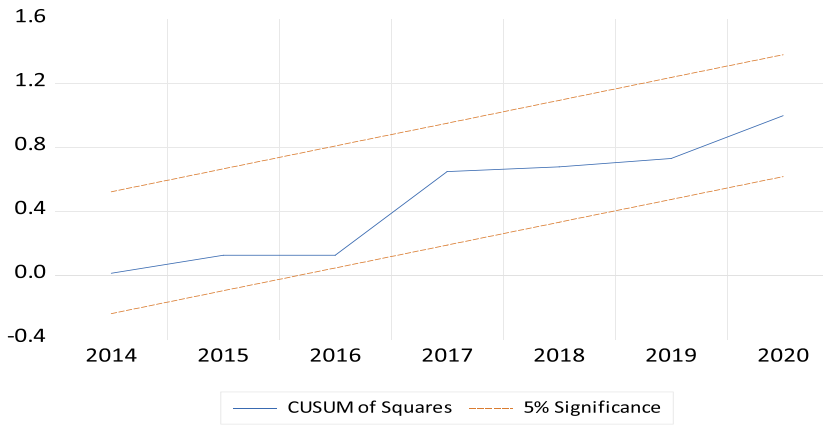


FIGURE 4 CUSUM of square stability test

significant (p-value 0.6394 > 0.05) at the 5% significance level. Therefore, the null hypothesis of no serial correlation of residuals in distinct periods in the model was accepted (Table 9).

If there are variations in the variance of the stochastic element, heteroscedasticity is present. This could be attributed to an error in measurement or discrepancies in subpopulations. The Breusch–Pagan–Godfrey test was used to determine the econometric problem. The p-value of F-statistic and Observed*R^2 (0.2383) are both substantial (p-value 0.2376 > 0.05). The homoscedasticity assumption's null hypothesis was thus accepted (Table 10).

According to Pesaran and Pesaran (1997), CUSUM and CUSUMSQ examine the parameter stability of the model. Specifically, CUSUM verifies systematic deviations in the parameter estimates whereas CUSUMSQ inspects rapid variation in model stability. Figures 3 and 4 depict the stability of parameter estimates because the plots lie within the accepted region at 95% confidence. As a result, it is possible to make unbiased statistical inferences, interpretations, and policy suggestions.

5 | CONCLUSION AND POLICY RECOMMENDATIONS

This study established the impact of life expectancy, terms of trade, and public healthcare spending on Kenya's GDP growth amidst the COVID-19 pandemic using the ARDL model. The findings show that health spending has an indirect influence on GDP growth. This is because of the low public healthcare expenditure, 15% below the 2001 Abuja Declaration. In the long run, the influence is substantial, but in the short run, it is insignificant. Granger causality results reveal evidence of a unidirectional causal association between public healthcare spending and GDP growth. The findings suggest that healthcare spending is a critical component of the economic framework for Kenya and that if addressed well, it enhances Kenya's economic growth and development. It suggests that if more resources are put into upgrading Kenya's healthcare system, the country will benefit from the flexibility of its workforce.

This paper emphasizes the significance of reaching the 2001 Abuja Declaration and goes on to expand on the literature concerning the potential direct influence of increased healthcare spending on GDP. Kenya should strive to fulfill and exceed the 2001 Abuja Declaration's target. More importantly, because it is evident that Kenya's health sector is under resourced and least developed, the study recommends an increase in government budgetary spending on the health docket to meet the 2001 Abuja Declaration of 15% of total government expenditure on health spending, with such investments directed toward infrastructure spending in the healthcare system and combating life-threatening diseases that tend to shorten the country's life expectancy.

The empirical analysis shows evidence that life expectancy directly influences the annual growth of GDP, in the medium and the long run. Although the results of the Granger causality test demonstrated evidence of neutral causality, the ARDL model depicts that healthy life expectancy has an impact on the progress of the Kenyan economy. The Kenyan government should emphasize investments in the enhancement of human capital through the provision of better medical care infrastructure, personnel training, and ensuring access to healthcare services and facilities. Taking such steps increases the country's productive capacity and economic growth, as well as the provision of a high-quality workforce. With an emphasis on the delivery of Universal Health Coverage (UHC) by 2030, Africa's shifting healthcare sector continues to leave an everlasting mark. Kenya is developing a Health Financing Strategy to help accelerate the country's progress toward universal healthcare. Kenya established a Universal Healthcare (UHC) pilot program in the regions of Isiolo, Kisumu, Machakos, and Nyeri in 2018 to provide Kenyans with quality healthcare without financial burden (The Ministry of Health, 2018a, 2018b). The program should be thoroughly implemented across the country to enhance human capital to promote labor productivity. Furthermore, given the importance of healthcare in Kenya, public policy analysts can advocate for a health package, included as a mandatory premium for public servants entitled to pay as you earn (PAYE) income, as a separate entity from the NHIF scheme.

The COVID-19-related economic downturn in developing nations is significant enough to put pressure on the budgetary space for health spending, which is already frequently limited and insufficient for universal healthcare, as in Kenya. Though the lessons learned from prior crises give hope that future supplementary budgetary allocations

will protect health, even maintaining current levels of allocation will not be sufficient to meet the rising health needs brought on by COVID-19. It is likely to be troublesome when it comes to the amount and destination of development aid for health, especially for lower- to middle-income economies. Therefore, developing countries should recognize COVID-19 primarily as a health problem that can only be resolved in the short run by a spike in health spending financed by the reallocation of currently available resources. Developing countries should maintain, and if possible, boost budgetary quotas for health while quickening investments in more effective and adaptable health spending. They should also conduct and regularly update budgetary space for health evaluations as part of a medium-term expenditure plan to reduce uncertainty, perhaps under the auspices of a worldwide partnership that seeks to make it easier to include such assessments in policy decisions.

Governments should boost the manufacturing sector for industrial growth to rectify the country's BOP imbalance. This will result in the manufacturing of final goods for export. Manufacturing is a significant pillar in the National Government's Big Four economic program (enhance food and nutrition security, achieve universal healthcare, provide affordable housing, and support growth of manufacturing sector for job creation). Manufacturing is considered the key to achieving the other development objectives. The idea is that manufacturing will provide many high-quality jobs, raising workers' living standards and enabling them to seek good healthcare. As a result, the research recommends that the government emphasize policies that expand the number of Export Processing Zones (EPZ) in incentivizing more companies to invest in Kenya for promoting exports, positioning Kenya as a manufacturing hub.

5.1 | Limitations and suggestions for further research

Technology in medical infrastructure, nutrition, and family welfare spending determine a substantial portion of aggregate healthcare spending and significantly help in improving the stock of health and human capital. Estimating such variables in Kenya is difficult owing to a scarcity of data. Furthermore, while a long and healthy life expectancy is important for productivity, our study was limited by a lack of data on public health spending on chronic diseases. Future research should look into obtaining this type of data for empirical analysis and policy recommendations.

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Resumen. Este estudio exploró el análisis del efecto causal del gasto sanitario y la esperanza de vida sobre el crecimiento anual del producto interior bruto (PIB) en Kenia utilizando series temporales de datos de 2000 a 2020. Se aplicaron modelos de retardo autorregresivo distribuido (ARDL, por sus siglas en inglés) y de corrección de errores (ECM, por sus siglas en inglés) para examinar el equilibrio a corto y largo plazo y la velocidad de ajuste al equilibrio a largo plazo debido a una perturbación a corto plazo, respectivamente. El análisis de comprobación de límites confirmó la existencia de una relación a largo plazo entre los factores. La velocidad de ajuste de los equilibrios a medio y largo plazo debida a rupturas estructurales es estadísticamente significativa. Esto indica que el sistema es convergente, pero tarda más en rectificar la divergencia. El gasto sanitario influye significativamente en el crecimiento del PIB a largo plazo, con un efecto desestimable a medio plazo. La esperanza de vida influye de manera sustancial y directa en el crecimiento del PIB tanto a medio como a largo plazo, mientras que la relación de intercambio, un factor de control, influye de manera significativa pero indirecta en el crecimiento del PIB. La prueba de causalidad de Granger revela la existencia de una causalidad unidireccional entre el gasto sanitario y el crecimiento económico, aunque no aporta pruebas empíricas de que el gasto sanitario impulse el crecimiento económico a largo plazo. Así pues, los resultados concluyen que el gasto sanitario y la esperanza de vida mejoraron fundamentalmente el crecimiento del PIB en Kenia durante el periodo considerado.

抄録: 本稿では、2000~2020年までの時系列データを使用して、ケニアの年間の国内総生産(GDP)の成長に対する医療支出と平均寿命の因果効果分析を実施する。自己回帰分布ラグモデルと誤差修正モデルを用いて、短期均衡と長期均衡、及び短期的攪乱による長期均衡への調整の速度を調査した。バウンド検定による解析により、因子間に長期的な関連性があることが確認された。構造変化による中期均衡から長期均衡への調整の速度は統計的に有意である。これは、システムは収束しているが、分散を修正するのに時間がかかることを示している。医療費は、長期的にはGDPの成長に有意に影響するが、中期的にはほとんど影響しない。平均寿命は、中長期的にGDP成長率に実質的かつ直接的に影響を与えるが、制御因子である交易条件は、GDP成長率に有意ではあるが間接的に影響を与える。グレンジャー因果関係検定から、医療支出が長期的な経済成長を促進するという実証的な裏付けはないものの、医療支出の経済成長に対する一方向の因果関係の存在が明らかになった。以上の知見から、医療支出と寿命が、検討された期間においてケニアのGDPの成長を促進する基礎となっているという結論に至る。