Does Health Spending Affect the Economic Growth of Lower-Middle-Income Economies? CS-ARDL Approach

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Abstract

Spending on healthcare may lead to improved health outcomes, which can stimulate human capital growth, increase productivity, and boost the economy. Accordingly, this paper aims to assess whether health spending influences the growth of lower-middle-income countries between 2000 and 2019 in both short- and long-term. Since government and private health expenditures account for the vast majority of healthcare expenditures, the study employs two models to examine whether health expenditures affect economic growth. The first model examines private health spending's influence on economic growth, whereas the second model analyzes general government health spending's influence on economic growth. The study uses "cross-sectional autoregressive distributed lag (CS-ARDL)" method, along with extra diagnostic and specification tests. The findings of the two models for the overall sample reveal that health spending had no significant influence on GDP per capita due to the insignificant health spending in these countries. Moreover, the study divides the main data set into two groups based on the average current health expenditure as a percentage of GDP from 2000 to 2019. The first subgroup includes the countries with an average health expenditure lower than 5%, and the second subgroup includes the countries with an average equal to or greater than 5%, and the study conducts the CS-ARDL technique on both models for these subgroups. The findings reveal that all variables are insignificant in both models for the first subgroup. For the second subgroup, all variables are insignificant in both models except government health expenditure which is significant in the long term with economic growth, indicating that increasing health government spending may affect economic growth in the long term. Therefore, lower-middle-income countries have to prioritize public health spending and develop alternative funding sources, while also supporting growth-oriented policies and collaborating with private health sector.

Keywords: Health expenditure, Lower-middle-income, CS-ARDL, Economic growth, Private health spending, General government health spending

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هل الإنفاق الصحي يؤثر على النمو الاقتصادي للاقتصادات ذات الدخل المتوسط المنخفض؟ نهج CS–ARDL

ملخص

قد يؤدي الإنفاق على الرعاية الصحية إلى تحسين النتائج الصحية، والتي يمكن أن تحفز نمو رأس المال البشري، وزيادة الإنتاجية، وتعزيز الاقتصاد. وفقًا لذلك، تهدف هذه الدراسة إلى تقييم ما إذا كان الإنفاق الصحي يؤثر على نمو الاقتصادات ذات الدخل المتوسط المنخفض من عام 2000 إلى عام 2019 على المدى القصير والطويل. نظرًا لأن الإنفاق الصحي الحكومي والإنفاق الصحي الخاص يمثلان الغالبية العظمى من نفقات الرعاية الصحية، تستخدم الدراسة نموذجين للتحقق في تأثير النفقات الصحية على النمو الاقتصادي. يبحث النموذج الأول تأثير الإنفاق الصحي الخاص على النمو الاقتصادي، بينما يحلل النموذج الثاني تأثير الإنفاق الصحي الحكومي العام على النمو الاقتصادي. تستخدم الدراسة نهج CS–ARDL، إلى جانب اختبارات التشخيص والمواصفات الإضافية. تكشف نتائج النموذجين للعينة الإجمالية أن الإنفاق الصحي لم يكن له تأثير على النمو الاقتصادي في تلك الدول والراجع إلى الإنفاق الصحي الضئيل. علاوة على ذلك، تقسم الدراسة مجموعة البيانات الرئيسية إلى مجموعتين بناءً على متوسط الإنفاق الصحي كنسبة مئوية من الناتج المحلي الإجمالي من عام 2000 إلى عام 2019، تشمل المجموعة الفرعية الأولى الدول التي يقل متوسط الإنفاق الصحي فيها عن 5٪، وتشمل المجموعة الفرعية الثانية الدول التي يبلغ متوسطها 5٪ أو أكثر، وأجرت الدراسة تقنية CS–ARDL على كلا النموذجين لهذه المجموعات الفرعية. تبرز النتائج أن جميع المتغيرات غير مفسرة في كلا النموذجين للمجموعة الفرعية الأولى. بالنسبة للمجموعة الفرعية الثانية، فإن جميع المتغيرات غير مفسرة في كلا النموذجين باستثناء الإنفاق الصحي الحكومي على المدى الطويل مع النمو الاقتصادي، مما يشير إلى أن زيادة الإنفاق الحكومي الصحي قد تؤثر على النمو الاقتصادي على المدى الطويل. لذلك، يتعين على البلدان ذات الدخل المتوسط الأدنى إعطاء الأولوية للإنفاق على الصحة العامة وتطوير مصادر تمويل بديلة، مع دعم السياسات الموجهة نحو النمو والتعاون مع القطاع الصحي الخاص.

الكلمات المفتاحية: الإنفاق الصحي، الدخل المتوسط المنخفض، CS–ARDL، النمو الاقتصادي، الإنفاق الصحي الخاص، الإنفاق الصحي الحكومي العام.

1. Introduction

As a fundamental goal, all societies strive for good health, since health enhancements have a considerable impact on living standards. Although many factors influence health, one of the most influential factors in population health is health spending (Cylus et al., 2018). This explains the growing interest in the association between economic growth and health spending. (Akingba, Kaliappan, & Hamzah, 2018). Since the healthcare sector has a substantial impact on human capital quality, boosting healthcare expenditure enhances human output, consequently supporting economic growth. In other words, spending on healthcare may lead to improved health outcomes, which can foster the growth of human capital, increase productivity, and improve the economy's state (Raghupathi, & Raghupathi, 2020).

Health spending includes government expenditures, personal payments, and sources such as employer-provided health programs, and non-governmental organizations, in which governments fund 51% of each country's health expenses on average, alongside private spending accounting for more than 35% of global health spending (WHO, 2019), which comprises the majority of healthcare spending. People will take the necessary actions anytime investing in their health depending on their resources or borrowing the necessary sums. Due to that, some individuals will invest, while others won't be able to meet the expense of the investment and will rely on government spending in this area (Beraldo, Montolio & Turati, 2009).

Lower-middle-income countries' healthcare systems suffer structural challenges. A significant source of concern is the absence of health spending for individuals in need of medical care on both levels of government spending as well as private spending due to the limitation of income in these countries, which limits service consumption and drains household resources (Mills, 2014). Government health spending per person has increased in middle-income nations since 2000, as it reached an average of US270 per person in upper-middle-income nations, compared to US60 at most in lower-middle-income nations (WHO, 2019), which highlights the insignificant government health spending in these countries.

Several research findings have led to contradicting conclusions, notably in developing countries, along with the studies' shortages that count for the cross-section in lower-middle-income countries. As a result, this study seeks to

address the disparity shown by the paucity of correlation studies between spending on health and economic growth in lower-middle-income nations. The purpose of this investigation is to explore the short- and long-term influences of such associations between 2000 and 2019. Considering health expenditure is almost composed of government along with private spending, the spending on public and private health may have dissimilar influences on economic growth, which represents an area that needs exploration in lower-middle-income countries. Consequently, the study uses two models to inspect the impact of general government health spending on the growth of these nations as well as the impact of private health spending on economic growth using the cross-sectional autoregressive distributed lag (CS-ARDL). Moreover, the study divides the main data set into two subgroups based on the health expenditure average as a percentage of GDP from 2000 to 2019. The first subgroup includes the countries with an average health expenditure lower than 5%, and the second subgroup includes the countries with an average equal to or greater than 5%, and the study conducts the CS-ARDL technique on both models for these subgroups.

The study's further sections are organized as follows: Theoretical framework and literature review are highlighted in the second section. Health spending in lower-middle-income countries is the focus of the third section compared with other income-level countries. The data description is shown in section four. The research technique is the focus of the fifth section. The model's empirical results are the subject of the sixth part, which is followed by the conclusion.

2. Theoretical Framework and Literature Review

When a lack of skilled labor or adequate infrastructure becomes a severe hindrance to increasing output, sufficient public investment may be beneficial in stimulating economic growth. As a result, government spending's influence on the growth of the economy may be the sole appropriate indicator for measuring government spending performance; nevertheless, government spending is not the major driver of economic growth (Chu et al., 1995). However, does this apply to health care spending? The "Increasing Public Expenditure Law" in addition to the "Theory of Displacement Effect" are two widely recognized theories of public expenditure. In 1893, Wagner discovered a long-term association between expenditure of the government and GDP. Government expenditure has always outpaced economic growth. Peacock and Wiseman

investigated Wagner's Law and discovered that Wagner had neglected leaps and shocks. According to their theory, social upheavals such as war cause a long-lasting upward shift, the level predicted when normal times restart is different from what it was before the upheaval. The phrase “displacement effect hypothesis” is used to characterize this upward movement (Demirbas, 1998). Many empirical investigations, particularly those that use a time-series paradigm, have revealed substantial confirmation supportive of the Wagner Law. These findings, according to Henrekson (1993), are likely erroneous since they were reached using non-stationary and non-cointegrated data.

The association between health expenditures and health effects is questioned by the difficulty in separating the role of health input as a driver of health status. Prior scholars employed two basic techniques. The first strategy is based on Grossman's research on human capital theory at the individual level, which treats health as a commodity that an individual will want to maximize given his or her financial constraints, as well as several endogenous and exogenous variables or characteristics that affect an individual's health. In this model, education and income are significant explanatory variables. The second method considers health to be a product that can be assessed using aggregate or macro-level data. This strategy is based on the fundamental idea that health may be thought of as an "output" of a health system, impacted by the system's "inputs." The relationship between medical care resources as system inputs and health outcomes as system outputs is of particular relevance to users of this method. However, because many of the variables employed in both processes are the same, there is a large overlap and a hazy boundary between them (Nixon & Ulmann, 2006).

Recently, a considerable investigation has been carried out on the association between health spending and economic growth. Kleiman (1974) investigated the allocation of private and government health spending per capita. The findings supported the notion that families should modify their expected health expenditure level in light of their health status in addition to their income before making modifications to adapt the supply of health services provided by the government. It also contends that the government operates similarly, altering health spending to account for household income received privately. Newhouse (1977) investigated the link between a country's revenue and health spending. This association affects both resource allocation in institutional contexts in addition the relationship between medical care and well-being.

Some studies explored the impact of different health indicators (such as life expectancy) on labor productivity since the healthcare industry has a large influence on human capital productivity and hence promotes economic growth. Bloom, Canning & Sevilla, (2004) conclude that wholesomeness, using the life expectancy variable, has a positive substantial influence on the productivity of labor. Other studies examined the health spending effect on health status, such as the study of Anyanwu & Erhijakpor (2009) that suggested that overall health expenses are unquestionably significant drivers of health outcomes (under-five and infant mortality) using two-stage least squares in Africa from 1999 to 2004. Anton & Onofrei (2012) examined the relationship between the effectiveness of the healthcare system; using the mortality rate for children under the age of five and GDP, and total health spending for Central and Eastern European nations, which showed that the effectiveness of the healthcare system is still insufficient. Results from regression analysis indicate that GDP per capita in addition to total health spending are the main contributors to the disparities in health status between these nations. To determine the association between overall health spending and preventable fatalities between 1996 and 2006, Heijink, Koolman & Westert (2013) looked at with in-country variance and growth rates in 14 western nations using descriptive analysis and multiple regression models. A substantial correlation between concurrent and lag health spending and preventable fatalities was demonstrated by the regression models. Bein (2020) determined that spending on public health had a stronger connection with lower death rates. Arora (2001) looked at how health spending throughout the last century has affected the growth of eleven industrialized nations, where their growth was accelerated by health improvements by a maximum of 40%.

There has been a point of interest in economic studies that examine association between health spending and economic growth using the production function at the country level. Bakare & Olubokun, (2011) confirmed this significant and positive association using the ordinary least squares approach through the production function and variables such as GDP, health expenditure, gross capital creation, and labor force. Oni (2014) determined that human capital, particularly its influence on labor productivity has a direct impact on growth in Nigeria. From 1981 to 2013, Alhowaish (2014) investigated the same relationship in Saudi Arabia. According to the result of the Granger causality test, health spending does not affect economic growth. Raghupathi, & Raghupathi (2020) proved an affirmative correlation between health spending

and GDP and productivity in the US from 2003 to 2014. On the other hand, the ARDL approach was used by Fendoğlu & Gökçe, (2021) to assess Turkey's economic progress and expenditure on health and education from 2006 to 2021, and based on the empirical findings, there was no long-term correlation throughout the period studied.

On the other hand, some panel studies scrutinized the association amid health spending and economic growth. Using datasets from 1961 to 2007, Pradhan (2011) explored this connection in 11 countries from OECD and supported the presence of a long-term and short-term bi-directional association between health spending and economic growth. Halc-Tülüce et al., (2016) analyzed high-income in addition, low-income economies from 1995 to 2009 using the GMM technique and concluded that private health expenditure has a negative impact on economic growth. Ozyilmaz et al., (2022) examined the same association in the 27 European Union countries from 2000 to 2019, using the "Random Forest Method" for each nation individually after using it for the panel and concluded that health spending contributed to economic expansion, however, the magnitude differed by nation. Odhiambo (2021) used ARDL analysis in Sub-Saharan African nations from 2008 to 2017 and found no link between health spending and economic growth in middle-income nations, on the other hand, a definite unidirectional association was found in low-income nations. The study of Çetin & Ecevit (2010) used data from 15 OECD countries, the percentage of public health spending to entire health spending was included in the study along with additional descriptive variables using the panel OLS method, and the study's findings showed no indication of a statistically significant association between health spending and economic growth.

Consequently, it is possible to conclude that recent empirical contributions from both developed and developing nations have scrutinized the connection between health spending and economic growth. However, several study outcomes have yielded conflicting results, specifically in developing countries. Empirical research investigated this relationship employing a variety of panel estimation approaches. To avoid the cross-section problem, this study investigates the relationship in lower-middle-income economies from 2000 to 2019 using the CS-ARDL model.

3. Health expenditure in lower-middle-income economies

Health spending reflects both the government and private's ability and intention to spend on health care. Health spending is perceived as a human capital investment, which may clarify the association between health spending and economic performance. Investing in human capital leads to improved production. As a result, there is a significant connection between rising GDP and growing health spending. Raising health expenses would also encourage individuals to seek medical treatment regularly, improving GDP and productivity. But so far, health spending in low- and middle-income nations remains challenging (Raghupathi, & Raghupathi, 2020). In contrast to high-income nations, middle- and low-income nations frequently spend less on health, receive less public support, and account for a great proportion of total expenditures through spending by households. As countries develop and get wealthier, they allocate more public resources to health and spend substantially more per person (Hopkins, 2010). As previously stated, the Domestic general government health expenditure in proportion to GDP in high-income countries climbed from 5.6% in 2000 to 7.7 % in 2019, whereas it increased in upper-middle-income countries from 2.3% to 3.2% during the same period. In lower-middle-income nations, this percentage improved slightly from 1.2% to 1.4%, although in low-income countries, it declined from 1.3% to 1.1% within the same time frame. Consequently, as evidenced by figure (1), domestic general government health spending (%GDP) in high-income countries is significantly greater than in the rest of the world; however, the gap between upper and lower-middle-income is not considerable, plus almost no differential exists between lower-middle and low-income nations.

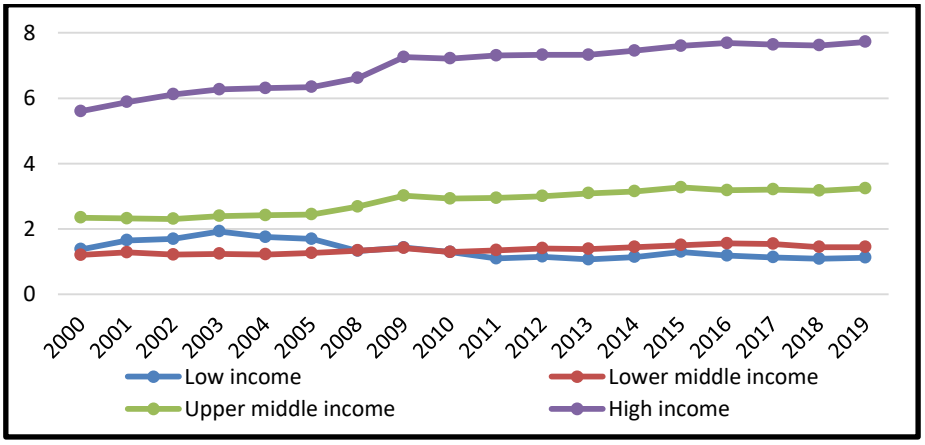

Figure (1): Domestic general government health expenditure (% of GDP)

Source: WHO Global Health Expenditure database.

On the other hand, domestic private health spending compared to overall health spending percentages in high-income countries accounts for around 40% of current health spending, owing to significant government health spending in these countries. Owing to rises in government health spending, private health spending in upper-middle-income has decreased from 57% in 2000 to around 44% in 2019. In the lower-middle, it declined from 65% to 57%, while in low-income countries, it fell from 57% to 48% attributable to increases in poverty and costs. Thus, many individuals in these countries cannot afford private medical services.

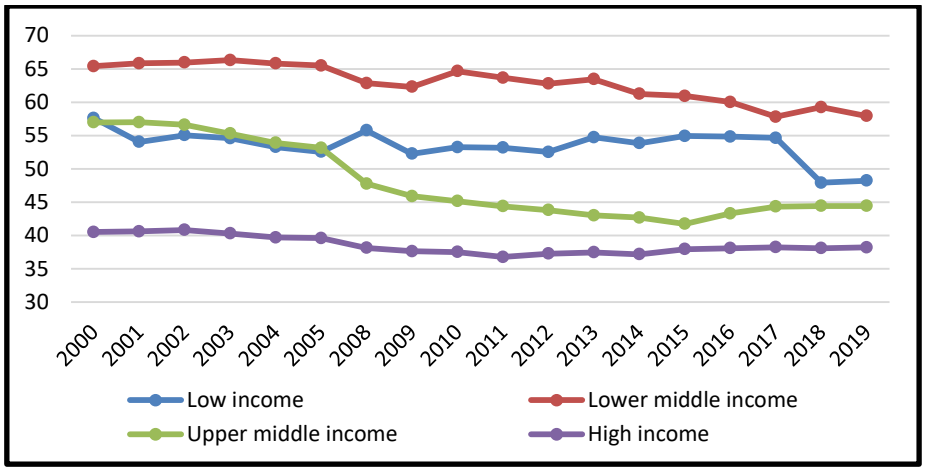

Figure (2): Domestic private health expenditure (% of current health expenditure)
Source of Data: WHO Global Health Expenditure database

4. Data Description

This empirical investigation inspects the effects of health spending on economic growth in short- and long-run periods using the data of 37 lower-middle-income economies from 2000 to 2019, including "Angola, Benin, Bangladesh, Bhutan, Cambodia, Cabo Verde, Cameroon, Cote d'Ivoire, Comoros, Egypt, Eswatini, El Salvador, Ghana, Indonesia, India, Iran, Kenya, Kiribati, Kyrgyz Republic, Lao PDR, Lebanon, Lesotho, Mauritania, Mongolia, Nepal, Nicaragua, Pakistan, Philippines, Senegal, Solomon Islands, Sri Lanka, Tajikistan, Tanzania, Timor-Leste, Tunisia, Ukraine, and Vanuatu". The selection of nations was influenced by lower-middle-income countries, however, other countries in the same classification were excluded due to the lack of data availability for one or more of the variables used in the models. This classification provides a comprehensive assessment of the consequences of health spending on economic growth. Furthermore, it provides governments with more exact information on the influence of general government health spending over and above private health spending on economic growth so that

appropriate economic policies may be implemented. The research spans the years 2000 through 2019.

The countries were chosen based on the classification of lower-middle-income nations by the World Bank in 2022 using GNI per capita with income ranging from 1086 to 4255 (USD).

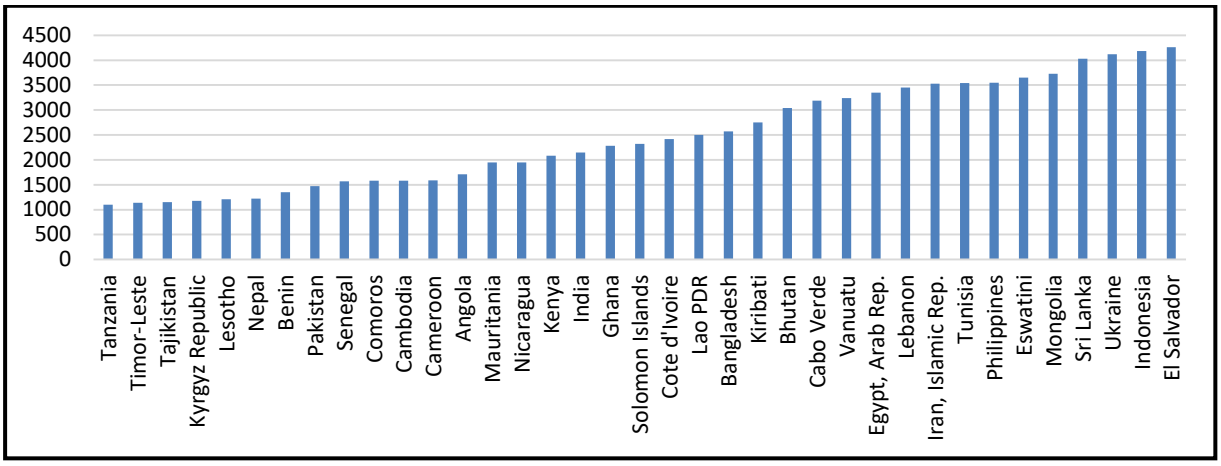

Figure (3): Selected Lower-middle-income countries classified using GNI per capita
Source of Data: World Bank Database

Given their level of income, the average health spending (% of GDP) for the selected countries during the previous 20 years has ranged between 2.5 % and 8%, except for Kiribati. The study uses this average to split the main data set into two groups: countries with an average health expenditure lower than 5% and countries with equal or more than 5%, and conducts the CS-ARDL technique on the whole dataset in addition to the two subgroups.

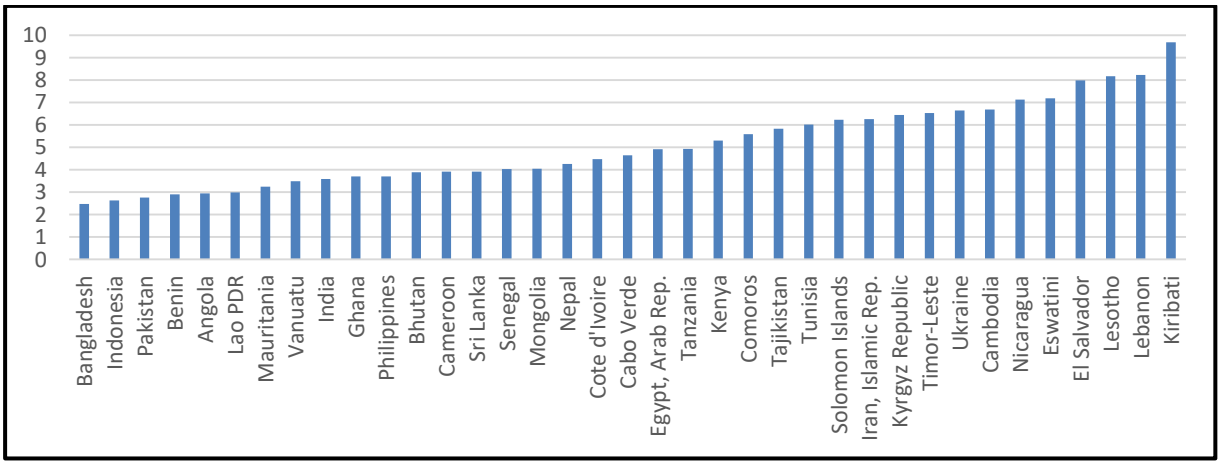

Figure (4): Average of Current health expenditure (% of GDP) for lower-middle-income countries from 2000 to 2019
Source of Data: Calculated by the author using WHO Global Health Expenditure database

The "World Development Database", "The World Health Organization database" as well as "UNESCO Institute for Statistics" were used to collect all of the data. Table (1) illustrates the variables employed in the two models.

Table (1): Variables Description

Variable name	Description	Abbreviation & Source of Data
"GDP per capita growth (annual %)"	"The GDP is divided by the midyear population based on constant local currency. Gross value added by all resident producers is added to any applicable product taxes, less any subsidies not reflected in the cost of the goods, to calculate GDP at buyer's prices."	GDPPC (WB)
"Domestic private health expenditure (% of current health expenditure)"	"The portion of current domestic health spending that is covered by businesses, nonprofits, and individuals. These costs may be covered by the healthcare providers or volunteer health insurance may be paid in advance. These statistics show how much of healthcare spending comes from the private sector."	DPHE (WHO)
"Domestic general government health expenditure (% of GDP)"	"The percentage of the GDP that the government has set aside to cover healthcare expenses. Payments for social health insurance, internal grants, and transfers, subsidies for people who prefer to purchase health insurance, business financing initiatives, and transfers are examples of public sources. They all represent the total amount the government spends on healthcare and are resources for public health."	DGH (WHO)
"Gross fixed capital formation (% of GDP)"	"Includes the construction of workplaces, hospitals, private residences, commercial and industrial buildings, as well as land improvements, the purchase of machinery, equipment, and plant, and the building of roads and railways.	GFC (WB)
"Government expenditure on education, total (% of government expenditure)"	"Total general government spending (current, capital, and transfers) on education as a share of overall general government spending"	GEE (UNESCO)

Source: Collected by Author

5. Empirical methodology

"GDP per capita growth" represents the dependent variable in both models, with "domestic private health expenditure" as an explanatory variable in the first model, and "domestic general government health expenditure" as an explanatory variable in the second model. Domestic government health expenditure as

percentage of GDP reflects the importance given to health in public expenditures, and private health expenditure as percentage of current health expenditure reflects the structure of health spending. The two models include other explanatory variables such as "gross fixed capital formation", based on Akingba, et al., (2018) and Zuven (2014), and "government education expenditure", based on Akingba, et al., (2018) and Gaies (2022). According to the endogenous growth hypothesis, human and physical capital may increase output levels (Gaies, 2022), therefore, the study uses physical capital, measured by gross fixed capital formation, and human capital, measured by government education expenditure. The two models can be represented as follows:

$$GDPPC = \beta_0 + \beta_1 DPHE + \beta_2 GFC + \beta_3 GEE$$

Model (1)

$$GDPPC = \beta_0 + \beta_1 DGH + \beta_2 GFC + \beta_3 GEE$$

Model (2)

Panel models are probable to reveal strong error cross-sectional dependence when there is a correlation among each unit in the same cross-section. This is related to the effect of certain unnoticed mutual traits that are shared by all units and can have distinct effects on each of them (De Hoyos & Sarafidis, 2006; Henningsen & Henningsen, 2019). Cross-section error independence cannot be assured by relying on cross-section unit-specific variables, and neglecting such dependencies may result in skewed estimates and flawed reasoning (Chudik, Pesaran & Tosetti, 2011). As a result, Pesaran and Smith (1995) initially proposed the cross-sectional modeling technique. They determined that when the coefficients in the dynamic model vary between groups, pooling generates inconsistent and occasionally misleading coefficient estimates, whereas the cross-section is able to yield reliable estimates of the long-run effects. Later, Chudik and Pesaran (2015) improved the cross-section model by taking into account the ARDL panel data model estimation, in which the cross-section unit's dependent variable is clarified by its lagged, weakly exogenous regressors' existing and lagged values, common factors that unnoticed but were possibly serially correlated, and an idiosyncratic error that was serially uncorrelated. Additionally, they imply the presence of a variety of extra variables that are impacted by a similar set of unnoticed common causes (Yones, 2023). The cross-sectional dependency test is used in the study due to the panel data features. After conducting cross-sectional dependence test, this study obligatorily applies the second-generation unit root test since it permits cross-

sectional associations, and Pesaran's cointegration test (2015). All of these required tests were taken into consideration in the use of the "CS-ARDL modeling technique". Long-term and short-term valuations are carried out in this study. This technique seems to be completely unaffected by difficulties like mixed-order integration, non-stationarity, endogeneity, and cross-section dependency (Zeqiraj, Sohag, & Soytas, 2020). This is since having imprecisely estimated outcomes is significantly correlated with disregarding unnoticed shared components (Voumik & Sultana, 2022). Endogeneity, serial correlation, and misspecification issues do not affect the robustness of CS-ARDL (Yu, et al., 2022).

Using a panel dataset with times t = 1, 2,..., T, and country groups i = 1, 2,..., N, the CS-ARDL is illustrated by the following equation :

$$\mathbf{\Delta Y_{it}} = \boldsymbol{\mu_i} + \boldsymbol{\varphi_i}(\boldsymbol{y_{it-1}} - \boldsymbol{\beta_i X_{it-1}} - \boldsymbol{\phi_{1i}}\bar{\boldsymbol{Y}}_{\boldsymbol{t-1}} - \boldsymbol{\phi_{2i}}\bar{\boldsymbol{X}}_{\boldsymbol{t-1}}) + \sum_{J=1}^{P-1} \boldsymbol{\mathcal{V}_{ij}}\, \mathbf{\Delta Y_{it-j}} + \sum_{J=0}^{q-1} \boldsymbol{\mathcal{K}_{ij}}\, \boldsymbol{X_{it-j}} + \boldsymbol{\mu_{1i}}\boldsymbol{\Delta}\bar{\boldsymbol{Y}}_{\boldsymbol{t}} + \boldsymbol{\mu_{2i}}\boldsymbol{\Delta}\bar{\boldsymbol{X}}_{\boldsymbol{t}} + \boldsymbol{\varepsilon_{it}}$$ (Esmaeili, et al., 2022).

Consequently, the following equation will be applied to the two models of this study:

$$\mathbf{LGDPPC_{it}} = \boldsymbol{\mu_i} + \boldsymbol{\varphi_i}(\mathbf{LGDPPC_{it-1}} - \boldsymbol{\beta_i X_{it-1}} - \boldsymbol{\phi_{1i}}\overline{\mathbf{LGDPPC}}_{\boldsymbol{t-1}} - \boldsymbol{\phi_{2i}}\bar{\boldsymbol{X}}_{\boldsymbol{t-1}}) + \sum_{J=1}^{P-1} \boldsymbol{\mathcal{V}_{ij}}\, \mathbf{\Delta Y_{it-j}} + \sum_{J=0}^{q-1} \boldsymbol{\mathcal{K}_{ij}}\, \boldsymbol{X_{it-j}} + \boldsymbol{\mu_{1i}}\boldsymbol{\Delta}\overline{\mathbf{LGDPPC}}_{\boldsymbol{t}} + \boldsymbol{\mu_{2i}}\boldsymbol{\Delta}\bar{\boldsymbol{X}}_{\boldsymbol{t}} + \boldsymbol{\varepsilon_{it}}$$

Where:

- X_{it} represents the regressor vectors (DPHE, GFC, GEE in model 1) and (DGH, GFC, GEE in model 2).
- The independent and dependent variables are performed by X_{it-j} and Y_{it-j} in the short run.
- The short-run coefficients of dependent and independent variables are represented by $\mathcal{V}_{ij}$ and $\mathcal{K}_{ij}$, respectively.
- The short-run mean of the dependent variable is depicted in μ_{1i} and the short-run independent variable's means are depicted in μ_{2i}.

Before proceeding with the cointegration analysis, unit root tests should be performed. "Pesaran's cross-sectional augmented modified Dick-Fuller (CADF) unit-root test" is employed to validate it. The long-run cointegration between these variables comes once the panel unit root has been identified. Panel

cointegration experiments, such as Westerlund's, can be used. “Cross-sectional dependence” as well as “slope heterogeneity” are important diagnostics to consider when conducting a panel data analysis (Tugcu, 2018). In this case, the Pesaran (2004) cross-sectional test was employed along with Pesaran & Yamagata (2008) slope heterogeneity test.

6. Empirical results

6.1 Descriptive Analysis

Table (2) depicts the descriptive analysis of the study variables. These nations have an average GDP per capita of 2.7, with a standard deviation of 3.6. In 2000, the Solomon Islands had the lowest value, while Timor-Leste had the highest in 2010. The average value of domestic private health spending is 48% of total health spending, with a minimum of 2% in the Solomon Islands in 2010 and a maximum of 88 percent in the Comoros in 2009. The health expenditure of domestic general government as a percentage of GDP averages 2%, with a low of 0.12% in Cameroon in 2019 and a high of 12% in Kiribati in 2004. The Gross fixed capital formation average value is 24, with a minimum and maximum of -5.98848% and 70.105%, respectively in the Solomon Islands in 2002 and Timor-Leste in 2011. The average value of government expenditure on education is 16% of the total government expenditure, with a minimum of 5% and a maximum of 44% in Vanuatu 2018 and Vanuatu 2003, respectively.

Table (2): Descriptive Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
GDPPC	740	2.709015	3.59758	-16.5772	17.2114
DPHE	740	48.44814	21.42068	2.10269	87.9384
DGH	740	2.189723	1.729219	0.120615	12.0627
GFC	740	24.42048	9.482733	5.98848	70.105
GEE	740	16.39628	5.725246	4.9	44.8018

6.2 Correlation analysis

Correlation is employed to aid with variable selection. When the correlation is between 0.7 and 0.9, multicollinearity is a concern (Leiby & Ahner, 2023). Despite the fact that the study used private expenditure as a percentage of health

expenditure and general government expenditure as a percentage of GDP in variable selection to avoid multicollinearity, the two variables that measure health spending have a significant correlation (-0.7174), therefore two models are used to elucidate their influence on growth.

Table (3): Correlation Matrix

	GDPPC	DPHE	DGH	GFC	GEE
GDPPC	1				
DPHE	0.0694	1			
DGH	-0.1791	-0.7174	1		
GFC	0.2689	-0.2181	-0.0314	1	
GEE	-0.0722	-0.1885	0.0588	-0.1246	1

Table (4) demonstrates that domestic private health expenditure is positively related to GDP per capita as well as gross fixed formation, while domestic government health spending is negatively related to GDP per capita.

Table (4): Correlation Matrix

	GDPPC	DPHE	GFC	GEE		GDPPC	DGH	GFC	GEE
GDPPC	1				**GDPPC**	1			
DPHE	0.0694	1			DGH	-0.1791	1		
GFC	0.2689	-0.2181	1		**GFC**	0.2689	-0.0314	1	
GEE	-0.0722	-0.1885	-0.1246	1	**GEE**	-0.0722	0.0588	-0.1246	1

6.3 Slope Heterogeneity and Cross-Section Dependence Tests:

Panel data has two major issues, slope heterogeneity, in addition to cross-section dependency. Series must satisfy the cross-section dependency in addition to slope heterogeneity tests to choose the accurate unit root test, which is first- or second-generation (Esmaeili, et al., 2022). The results of slope heterogeneity in Table (5) show that there is slope heterogeneity in the two models since the delta, as well as adjusted delta values, are statistically significant.

The Pesaran test investigates cross-sectional dependence in more depth. The test outcomes are shown in the lower half of Table (5). Therefore, the null

hypothesis for all variables that cross-sectional dependence does not exist is disproven.

Table (5): Slope Heterogeneity & Cross Section Dependence Tests

Main Sample				**First Subgroup**			**Second Subgroup**	
	Model 1	Model 2		Model 1	Model 2		Model 1	Model 2
Delta	6.445 ***	5.139 ***	Delta	2.300**	2.902***	Delta	5.921***	5.076***
Adj. Delta	7.442 ***	5.987 ***	Adj. Delta	2.656***	3.351***	Adj. Delta	6.837***	5.862 ***
CD	10.905***	11.286***	CD	6.123 ***	5.842***	CD	6.718***	7.178***

***Significant at 1%, ** Significant at 5%

As a result, whenever one of the variables in one country changes, the effects are felt in the others involved in the research. As a result, these nations are linked. Since the cross-sectional augmented modified Dick-Fuller (CADF) second-generation unit root test takes into account slope and cross-sectional dependence variability, the CADF tests offer more reliable findings.

6.4 Unit root test

It is critical to analyze the unit root before applying the CS-ARDL technique to guarantee that all the variables aren't stationary at I(2) but rather at I(1), I(0), or a grouping of I (1) and I(0). Table (6) displays the results of the CADF panel unit root test, which indicates that variables' stationarity is a combination of I (1) and I(0). As a result, we are allowed to use the panel CS-ARDL model.

The "CADF" results reveal that "Domestic private health expenditure", "Domestic general government health expenditure" and "Government expenditure on education," have unit roots at the level, in addition, these variables have no unit roots at the first difference. "Gross domestic product per capita" and "Gross fixed capital formation" are stationary in level I(0).

Table (6): Cross-sectional augmented modified Dick-Fuller (CADF)

Variable	**Level**	**Z[t-bar]**	**P-value**	**First difference**
GDPPC	0	-2.465	0.007	
DPHE	1	-0.160	0.436	0.000
DGH	1	1.077	0.859	0.000
GFC	0	-1.692	0.045	
GEE	1	0.367	0.643	0.000

6.5 Cointegration investigation:

In panel data, it is crucial to analyze the cointegration connection. It is critical to emphasize that cointegration increases the model's output dependability. In the existence of Cross section dependence, Westerlund's cointegration test (2007) result is more precise and instructive (Esmaeili, et al., 2022).

Table (7) Westerlund Cointegration test

Main Sample							
Model 1				**Model 2**			
Statistic	**Value**	**Z-value**	**P-value**	**Statistic**	**Value**	**Z-value**	**P-value**
Gt	-3.143	-5.947	0.000	**Gt**	-3.363	-7.39	0.000
Ga	-12.192	-1.073	0.142	**Ga**	-12.771	-1.581	0.057
Pt	-17.384	-5.247	0.000	**Pt**	-18.123	-5.946	0.000
Pa	-11.125	-3.446	0.000	**Pa**	-12.652	-4.881	0.000
First Subgroup: Countries with an average health expenditure lower than 5%							
Model 1				**Model 2**			
Statistic	**Value**	**Z-value**	**P-value**	**Statistic**	**Value**	**Z-value**	**P-value**
Gt	-3.007	-3.483	0.000	**Gt**	-2.892	-2.966	0.002
Ga	-11.571	-0.364	0.358	**Ga**	-11.672	-0.425	0.335
Pt	-12.77	-4.373	0.000	**Pt**	-11.631	-3.295	0.001
Pa	-12.402	-3.198	0.001	**Pa**	-11.384	-2.539	**0.006**
Second Subgroup: Countries with an average health expenditure more than 5%							
Model 1				**Model 2**			
Gt	-3.844	-7.45	0.000	**Statistic**	**Value**	**Z-value**	**P-value**
Ga	-14.196	-2.001	0.023	**Gt**	-3.582	-6.236	0.000
Pt	-12.792	-4.183	0.000	**Ga**	-13.014	-1.269	0.102
Pa	-13.106	-3.753	0.000	**Pt**	-12.732	-4.126	0.000
Gt	-3.844	-7.45	0.000	**Pa**	-11.211	-2.493	0.006

Table (7) shows the panel cointegration testing results for the whole sample and for the subgroups. The outcomes indicate that no cointegration null hypothesis is disproved, indicating that study variables are cointegrated in lower-middle-income countries.

6.6 Estimate the model

The short-run and long-run common coefficients for the CS-ARDL approach are shown in Table (8). In both models, the error correction term has a negative coefficient and is statistically significant at the 1% level. When error correction term's coefficient is between -1 and -2, the equilibrium path's GDP per capita varies slightly. The delayed error correction component in the first model has a coefficient of negative 1.2 in the short-run model and a coefficient of negative 1 in the second model, indicating that the process swings about the long-run value diminishing rather than gradually reaching the equilibrium path over time. However, once this process is completed, the path to equilibrium swiftly converges (Loayza & Ranciere, 2006; Narayan & Smyth, 2006).

Table (8) CS- ARDL Long-run and Short-run results

Model (1)	Coef.	P. Value	Model (2)	Coef.	P. Value
Short Run					
L.GDPPC	-0.21612	0.025**	**L.GDPPC**	-0.0063	0.96
DPHE	0.18368	0.333	**DGH**	0.860814	0.611
GFC	0.177472	0.424	**GFC**	0.214949	0.365
GEE	-0.25086	0.234	**GEE**	0.008053	0.971
L.DPHE	-0.14438	0.429	**L.DGH**	-0.23367	0.928
L.GFC	-0.2581	0.087*	**L.GFC**	-0.30378	0.08*
L.GEE	0.066926	0.759	**L.GEE**	0.311693	0.299
Adjust. Term					
lr_GDPPC	-1.21612	0.000***	**lr_GDPPC**	-1.00632	0.000***
Long Run					
lr_DPHE	-0.41978	0.424	**lr_DGH**	0.336385	0.959
lr_GEE	-0.34475	0.222	**lr_GEE**	1.247917	0.023**
lr_GFC	0.255924	0.608	**lr_GFC**	0.229636	0.414

***Significant at 1%, ** Significant at 5%,*Significant at 10%,

In the short term, all variables are insignificant in the first model except the lag of GDP per capita and gross fixed capital formation at 10%, and in the second model, all variables are insignificant except gross fixed capital formation at 10%. In the long term, only the government expenditure on education is significant. In both models, in the short and long term, the health expenditure is not significant with economic growth, which corresponds to Odhiambo (2021); Çetin & Ecevit (2010).

Tables (9) and (10) reflect the results after dividing dataset into two groups: 18 countries with average health expenditure as a percentage of GDP of less than 5% from 2000 to 2019, and 19 countries with average health expenditure of more than 5%, as shown in figure (4). Table (9) displays the short-run and long-run common coefficients for the CS-ARDL approach for first subgroup.

Table (9) CS- ARDL (Countries Average Health Expenditure less than 5%)

Model (1)	Coef.	P. Value	Model (2)	Coef.	P. Value
Short Run					
L.GDPPC	-0.05893	0.675	**L.GDPPC**	-0.0546	0.627
DPHE	0.191362	0.245	**DGH**	-0.30632	0.912
GFC	-0.22215	0.484	**GFC**	-0.01383	0.968
GEE	0.350903	0.252	**GEE**	0.073748	0.723
L.DPHE	-0.13125	0.398	**L.DGH**	0.265939	0.915
L.GFC	0.101668	0.805	**L.GFC**	0.038804	0.894
L.GEE	-0.38197	0.114	**L.GEE**	-0.03716	0.826
Adjust. Term					
lr_GDPPC	-1.00892	0.000***	**lr_GDPPC**	-1.00546	0.000***
Long Run					
lr_DPHE	0.058345	0.865	**lr_DGH**	-45.4713	0.316
lr_GEE	-4.18607	0.283	**lr_GEE**	-4.75054	0.333
lr_GFC	-4.39065	0.293	**lr_GFC**	-44.0021	0.324

***Significant at 1%, ** Significant at 5%,* Significant at 10%,

All variables are insignificant in both models for the first subgroup, which confirms the overall sample result, and clarifies that health spending is not

significant with economic growth within countries that spend less than an average of 5% of GDP on health care.

Table (10): CS- ARDL (Countries Average Health Expenditure more than 5%)

Model (1)	Coef.	P. Value	Model (2)	Coef.	P. Value
Short Run Est.					
L.GDPPC	0.029193	0.821	**L.GDPPC**	-0.05399	0.67
DPHE	0.506174	0.153	**DGH**	1.761934	0.226
GFC	0.513879	0.137	**GFC**	0.063792	0.855
GEE	0.106651	0.797	**GEE**	0.439125	0.271
L.DPHE	-0.7698	0.323	**L.DGH**	1.708508	0.173
L.GFC	-0.68267	0.025	**L.GFC**	-0.42927	0.067
L.GEE	-0.81426	0.089	**L.GEE**	0.688796	0.203
Adjust. Term					
lr_GDPPC	-0.97081	0.000***	**lr_GDPPC**	-1.00539	0.000***
Long Run Est.					
lr_DPHE	0.293223	0.703	**lr_DGH**	3.198202	0.059*
lr_GEE	-1.37358	0.197	**lr_GEE**	1.0905	0.123
lr_GFC	0.18583	0.739	**lr_GFC**	-0.14059	0.805

***Significant at 1%, ** Significant at 5%,*Significant at 10%,

The result of the CS-ARDL for the second subgroup demonstrates that all variables are insignificant in both models with the exception of gross fixed capital formation in the short run, which is significant at 5% in the first model and 10% in the second model, and government expenditure on education in the short run, which is significant in the first model. In the second model, government health expenditure is significant at 10% level in the long term with economic growth, demonstrating that government spending on health care can affect economic growth in the long term, and indicating that spending more than an average of 5% of GDP on health care is significant in these nations with economic growth in the long term.

7. Conclusion

The relationship between health spending and economic growth has been deliberated in studies from different aspects however, the researchers have not

focused on lower-middle-income countries. This study aims to investigate the influence of private and government spending on gross domestic product per capita using the CS-ARDL approach on annual data from 2000 to 2019. "Cross-sectional dependence" and "slope heterogeneity" have been assessed using the "Pesaran (2004) cross-sectional test" as well as " Pesaran & Yamagata (2008) slope heterogeneity test". The results confirmed cross-section dependence. Therefore, to determine stationarity, the "Pesaran's cross-sectional augmented modified Dick-Fuller (CADF) unit-root test" is performed, which indicates that the variables are I(0) and I(1). The cointegration test according to the "Westerlund Cointegration Test" confirms that cointegration exists, indicating that study variables are cointegrated.

According to the findings of the main sample, “Domestic private health expenditure” as well as “Domestic general government health expenditure” are not correlated with economic growth in the lower- middle-income countries in both short and long term, which corresponds to Odhiambo (2021); Çetin & Ecevit (2010). This result can be interpreted due to the insignificant spending of these nations on the health sector, given the noteworthy strong indication that spending in health systems improves health outcomes and raises GDP in developed countries. In contrast, developing nations, particularly those with low and lower middle incomes, have relatively small health spending, which has an insignificant influence on GDP. Although private health spending in these countries is substantial in comparison to overall health spending, it is insufficient to affect GDP per capita since income per capita in these countries is comparatively low.

Moreover, the study used the average of current health expenditure as percentage of GDP from 2000 to 2019 to split the main data set into two groups: the first group with a health expenditure average lower than 5%, and the second group with an average equal to or greater than 5%. All variables are insignificant in both models for the first subgroup. For the second subgroup, all variables are insignificant in both models, except government health expenditure, which is significant in the long term with economic growth, indicating that increasing the percentage of health spending can affect economic growth in the long term.

It's feasible to conclude that the crucial struggle opposing health sector in low- and lower-middle-income countries is the substantial shortage of funding.

Consequently, private expenditures on health have been taking place to reduce the rising expenditures of the publicly sponsored health system, inflicting an unjust burden on communities while having no effect on economic growth in these countries. Therefore, lower-middle-income countries have to support growth-oriented policies and collaborate with private health sector, while also prioritizing public health spending and developing alternative funding sources, as increasing health government spending will be problematic due to shortage of financing in these countries. Moreover, if public health spending is insufficient, the governments should focus on spending efficiency (Garcia-Escribano, Juarros & Mogues, 2022) by reducing corruption, reducing economic disparity, and implementing health initiatives that improve population access to essential healthcare services in these nations, and eliminating unnecessary spending should be a top concern.

Consequently, further studies on healthcare spending on the micro level should be conducted along with health investment health spending, and spending efficiency, and further studies are needed to conclude the minimum government and private health spending required that can affect economic growth.

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