Perspective Article

Public Health Expenditure, Fiscal Space, and Economic Growth: A Cross-Country Panel Analysis

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Abstract

The relationship between public health expenditure and economic growth remains contested, particularly in the post-pandemic context of mounting fiscal pressures. While the human-capital framework predicts a positive growth dividend from health investment, recent evidence points to heterogeneous, conditional effects. This study examines whether the growth impact of domestic general government health expenditure (DGGHE) is moderated by fiscal space—proxied by public debt and the primary balance—across income levels. Using a strongly balanced panel of 161 countries over 2000–2023 from the WHO Global Health Expenditure Database, the Kose et al. cross-country fiscal space database, and the World Bank World Development Indicators, we combine within-country fixed effects, Driscoll–Kraay standard errors, and two-step System GMM with orthogonal deviations. A one-percentage-point increase in DGGHE/GDP is associated with a 0.47-percentage-point decline in annual GDP growth ($p<0.01$). The DGGHE × Debt/GDP interaction is negative and significant once human capital is controlled, whereas the DGGHE × Primary balance interaction is positive and significant ($\beta=0.021$, $p<0.05$), indicating that stronger fiscal positions mitigate the negative association. The effect is concentrated in high- and upper-middle-income economies (net effects of −0.72 and −1.12), with statistically null effects in lower-middle- and low-income countries. System GMM diagnostics confirm instrument validity (AR(2) $p=0.253$; Hansen J $p=0.721$). These findings suggest that the growth impact of public health spending depends jointly on development level and fiscal space, underscoring the need for expenditure-efficiency and fiscal-management reforms rather than higher spending alone.

Keywords: public health expenditure; fiscal space; economic growth; cross-country panel; System GMM; Driscoll–Kraay standard errors

JEL Classification: E62, H51, I15, O47

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1. Introduction

The relationship between public health expenditure and economic growth has emerged as a central question at the intersection of health economics, public finance, and development policy. Health spending now accounts for nearly 10 percent of global GDP, and the World Health Organization projects continued real growth in health budgets through 2030, particularly in low- and middle-income economies (Jakovljevic & Getzen, 2016). Yet the empirical literature has not converged on whether higher public health spending consistently raises growth, attenuates it, or generates effects that vary systematically across countries and macroeconomic contexts (Bloom et al., 2018; Hu & Wang, 2024).

The theoretical case for a positive growth effect is well established. In the Grossman (1972a, 1972b) framework, health is treated as a durable form of human capital that augments productive time and labor productivity. Building on this microfoundation, Barro (1996) identifies two distinct channels through which improved population health stimulates aggregate output: direct gains in labor productivity, and indirect gains through higher survival probabilities that lengthen the effective planning horizon for human-capital investment. Subsequent contributions by Bloom, Canning, and Sevilla (2004) and Bhargava et al. (2001) provide cross-country evidence consistent with these predictions.

Against this benchmark, however, a growing body of evidence documents non-linear, threshold, or even negative associations between public health spending and growth. Wang, Tao, and Xiong (2022) and Hu and Wang (2024) find that the relationship between government health expenditure and growth in OECD economies is highly non-linear, with the marginal contribution diminishing—and turning negative—above certain consumption and capital-investment thresholds. Gaies (2022) reassesses this nexus in the context of the global sanitary crisis and reports heterogeneous effects across developing countries. These findings echo a much older debate on the composition of public expenditure originating in Aschauer (1989), Barro (1990), and Devarajan, Swaroop, and Zou (1996), which emphasizes that current expenditures—of which health spending is a substantial component—may exhibit non-monotonic or crowding-out effects on growth depending on initial conditions and the productivity of complementary inputs.

A second strand of literature has focused on the macro-fiscal environment within which health spending decisions are made. The concept of *fiscal space*—formally introduced by Heller (2005) and extended to the health sector in Heller (2006)—captures the budgetary room available to governments to finance desired expenditures without compromising fiscal sustainability. Tandon and Cashin (2010) and Barroy et al. (2021) refine this framework, emphasizing that fiscal space for health depends on overall fiscal capacity, prioritization, and public financial management. Kose, Kurlat, Ohnsorge, and Sugawara (2022) operationalize fiscal space through a multi-dimensional cross-country database covering debt sustainability, balance-sheet vulnerability, and market access indicators.

Despite the theoretical importance of fiscal space, empirical work that explicitly tests whether it conditions the growth impact of public health expenditure remains limited. Existing studies typically examine either the unconditional growth effect of health spending (Beylik et al., 2022; Boachie et al., 2018) or, separately, the unconditional effect of fiscal indicators such as public debt on growth (Reinhart & Rogoff, 2010; Eberhardt & Presbitero, 2015; Égert, 2015). The interaction between the two—whether the productive returns to health spending depend on the country's debt position, primary balance, or income level—has received comparatively little attention in a unified cross-country panel framework.

In short, three gaps remain. First, the unconditional spending–growth literature rarely models fiscal space as a moderator rather than a control. Second, studies linking fiscal indicators (debt, primary balance) to growth seldom interact them with public expenditure composition. Third, income-group heterogeneity in the growth productivity of health spending has not been tested jointly with fiscal-space moderation in a long, broad panel. This paper addresses all three within a single interaction-based specification on 161 countries over 2000–2023.

This paper addresses that gap. Using a strongly balanced panel of 161 countries over 2000–2023, we estimate the impact of domestic general government health expenditure (DGGHE) on GDP growth, allowing the slope to vary with two fiscal space indicators—government debt and the primary balance—and with the country's income classification. We exploit complementary identification strategies: within-country fixed effects with cluster-robust standard errors, Driscoll–Kraay (1998) standard errors to accommodate cross-sectional dependence, and two-step

System GMM (Blundell & Bond, 1998) with orthogonal deviations and Windmeijer-corrected standard errors to address the potential endogeneity of health spending.

Our analysis yields four main findings. First, a one-percentage-point increase in DGGHE/GDP is associated with a 0.47 pp decline in annual GDP growth in the baseline specification, a magnitude robust to alternative estimators. Second, the DGGHE × Debt/GDP interaction is negative and statistically significant once human capital is controlled for, while the DGGHE × Primary balance/GDP interaction is positive and significant, indicating that fiscal space materially conditions the growth–health relationship. Third, the negative association is concentrated in high- and upper-middle-income economies, while it is statistically indistinguishable from zero for lower-middle-income countries—consistent with the stronger marginal productivity of health investment at intermediate development levels. Fourth, System GMM diagnostics (AR(2) p=0.253; Hansen J p=0.721) support the substantive interpretation under plausible identification assumptions.

The contribution of this paper is threefold. Methodologically, we provide what is, to our knowledge, the first systematic empirical examination of the interaction between public health expenditure and fiscal space in a long, broad cross-country panel, leveraging novel data on fiscal space (Kose et al., 2022) and modern panel estimators robust to cross-sectional dependence and endogeneity. Substantively, we reconcile apparently divergent findings in the recent literature—positive effects in OECD samples (Beylik et al., 2022), threshold effects in narrower panels (Hu & Wang, 2024), and conditional effects in developing-country contexts (Gaies, 2022; Iheoma, 2024)—by showing that the growth impact of public health spending depends jointly on the level of development and the macro-fiscal environment. From a policy perspective, our findings imply that scaling up public health spending without complementary attention to fiscal space and expenditure efficiency may not deliver the growth dividends predicted by the canonical framework, with direct implications for universal health coverage strategies in fiscally constrained settings (Barroy et al., 2021; Kurowski et al., 2023).

The remainder of the paper is organized as follows. Section 2 reviews the theoretical framework and develops testable hypotheses. Section 3 describes the data and empirical strategy. Section 4 presents the main results, marginal effects, income-group heterogeneity, and robustness checks. Section 5 discusses the findings in relation to the literature and outlines limitations. Section 6 concludes with policy implications.

2. Literature Review and Theoretical Framework

2.1 Health, human capital, and economic growth

The canonical theoretical lens through which health spending is linked to growth is the human-capital framework articulated by Grossman (1972a, 1972b). In this framework, health is conceptualized as a durable capital stock that depreciates with age and can be augmented through investment in medical care, time, and complementary inputs. Health enters individual utility both as a consumption good and as a productive input, generating healthy time available for market work and home production. The aggregation of these microeconomic mechanisms underpins the prediction that improvements in population health raise labor productivity, lengthen working lives, and stimulate human-capital accumulation more broadly.

Barro (1996) and Barro and Sala-i-Martin (1995) formalize this insight in cross-country growth regressions, identifying two distinct channels. The first is a direct productivity effect: healthier workers are more productive and supply more effective labor hours. The second is an indirect effect through demographic and behavioral channels—higher life expectancy raises returns to schooling and induces greater savings and physical capital accumulation. Bloom, Canning, and Sevilla (2004) augment the standard Solow-type production function with a measure of population health and find that health stock makes an independent, statistically significant contribution to per-capita output. Bhargava et al. (2001) use adult survival rates and document that the elasticity of growth with respect to health is heterogeneous across income levels, with stronger effects in low- and middle-income economies where health stocks are further from the production frontier.

More recent contributions have refined the framework along three dimensions. Bloom, Kuhn, and Prettner (2018) survey the theoretical and empirical literature and emphasize multiple transmission channels, including productivity, education, savings, demographic dividends, and inequality. Sharma (2018), using dynamic panel data spanning 143 years, finds that the long-run health–growth relationship is robust to a wide range of specifications but exhibits substantial heterogeneity over time and across regions. For OECD countries specifically, Hartwig (2010) reports panel Granger-causality evidence suggesting that health capital formation contributes to long-term growth, though the magnitude is smaller than in earlier studies—consistent with diminishing marginal returns at high health-stock levels.

2.2 Public health expenditure, productivity, and crowding-out

The transition from population health to public health expenditure as a driver of growth is not automatic. While health spending is an essential input into health capital, the marginal contribution of an additional dollar of public health spending to growth depends on multiple intervening factors: the efficiency of health systems, the composition of spending, and the opportunity cost of public funds (Grigoli & Kapsoli, 2018). A classical strand of public-finance literature, beginning with Aschauer (1989) and Barro (1990), distinguishes between productive and unproductive components of public expenditure, with the former entering the aggregate production function directly and the latter financed by distortionary taxes that may crowd out private investment.

Devarajan, Swaroop, and Zou (1996) provide an influential empirical test of these ideas in a panel of 43 developing countries, showing that an excessive share of current expenditure—of which health is a major component—can be associated with lower growth, particularly when complementary investments in physical infrastructure are constrained. Baldacci, Clements, Gupta, and Cui (2008) extend this framework to a panel of 118 developing countries from 1971 to 2000 and find that both education and health spending have positive direct effects on human capital and growth, but that the magnitude of these effects depends critically on governance quality, inflation control, and the size of fiscal deficits. Their central insight—that higher spending alone is insufficient and must be complemented by efficiency-enhancing reforms—is echoed in more recent contributions.

Empirical evidence specifically on public health expenditure and growth has produced mixed results. Beylik et al. (2022) examine 21 OECD countries using Driscoll–Kraay standard errors and find a positive association between health expenditure indicators and economic growth. Wang, Tao, and Xiong (2022) employ a non-parametric additive model on Chinese provincial data and document a non-linear relationship with significant regional heterogeneity. Hu and Wang (2024) apply a dynamic panel threshold model to 33 OECD countries from 2001 to 2017 and find that the growth effect of public health expenditure is positive below certain thresholds of consumption, wages, and capital but turns negative above them. Dritsaki and Dritsaki (2023) examine the G7 in a heterogeneous panel data framework and confirm long-run positive effects of health expenditure on per-capita output.

In developing-country contexts, the evidence is more nuanced. Boachie, Ramu, and Põlajeva (2018) document positive associations between health expenditure and outcomes in Ghana, while Faruk et al. (2022) find that the health expenditure–growth nexus in MENA countries is moderated by institutional quality. Ikpe, Agu, and Okwor (2025) report that the effect of health expenditure on growth in Sub-Saharan Africa depends materially on governance quality, providing further evidence of conditionality. Gaies (2022) explicitly reassesses these relationships in light of the post-2020 health crisis and finds that the growth impact of health expenditure has changed substantially in many developing economies, reflecting both fiscal strain and pandemic-induced productivity shocks.

A parallel literature situates health spending within the income–expenditure nexus and the demographic transition. Baltagi, Lagravinese, Moscone, and Tosetti (2017), using a global sample and spatial-econometric methods, show that health-care expenditure is income-elastic but that the elasticity falls below unity once cross-country dependence is accounted for, implying that health care behaves closer to a necessity than a luxury at the global level. Complementing this, Lopreite, Misuraca, and Puliga (2023) apply word-embedding and bibliometric techniques to map the thematic evolution of the ageing–health-expenditure literature, identifying e-health and the fiscal sustainability of health systems under population ageing as emergent policy priorities. These contributions reinforce our motivation: because the level of health spending is tightly bound to income and demographic structure, isolating the conditional growth effect of public health expenditure net of fiscal capacity is essential.

2.3 Fiscal space and its measurement

The concept of fiscal space was formalized by Heller (2005) as "the availability of budgetary room that allows a government to provide resources for a desired purpose without any prejudice to the sustainability of a government's financial position." The notion gained prominence in the context of scaling up public expenditure to meet the Millennium Development Goals, particularly in low-income countries facing tight budget constraints. Heller (2006) subsequently extended the framework to the health sector, identifying five potential sources of expansion: raising domestic revenue, reprioritizing existing expenditure, borrowing, seigniorage, and external grants.

Roy, Heuty, and Letouzé (2007) offered an alternative formulation that emphasized concrete policy actions for domestic resource mobilization, while Tandon and Cashin (2010) developed the most influential operational framework, identifying five pillars of fiscal space for health: economic growth, budget reprioritization, earmarked revenues, efficiency gains, and external resources. Barroy et al. (2021) revisit Heller's framework fifteen years later and argue for a broader concept of "budgetary space for health" that integrates public financial management considerations. The IMF's subsequent reassessment (IMF, 2018) further refined the operational definition by combining indicators of debt sustainability, balance-sheet risk, and market access.

Kose, Kurlat, Ohnsorge, and Sugawara (2022) provide the most comprehensive cross-country database of fiscal space indicators, covering 202 countries over 1990–2022 with 28 to 30 indicators grouped into four categories: government debt sustainability, balance-sheet composition, external and private-sector debt, and market perception. Their analysis documents a weakening of fiscal space across emerging and developing economies since the global financial crisis—a trend exacerbated by the COVID-19 pandemic, as confirmed by Kurowski et al. (2023). This dataset, in its Spring 2026 update, provides the fiscal-space indicators used in the present study.

2.4 Public debt, primary balance, and growth

A separate but related literature examines the impact of fiscal indicators—particularly public debt and the primary balance—on economic growth. The seminal contribution of Reinhart and Rogoff (2010) suggested a threshold relationship in which debt-to-GDP ratios exceeding 90 percent are associated with materially lower growth, though their findings have been the subject of intense methodological debate. Eberhardt and Presbitero (2015) re-examine the debt–growth nexus in a large panel of countries using novel methods that allow for cross-country heterogeneity and find support for a negative average relationship without evidence of a common threshold. Égert (2015) provides a critical reassessment of nonlinear effects, while Chudik et al. (2017) use methods robust to cross-sectional dependence and report evidence of a debt threshold effect on output growth around 30 percent of GDP, lower than the Reinhart–Rogoff benchmark.

More recent contributions have refined this debate. Asteriou, Pilbeam, and Pratiwi (2021) document nonlinear effects in Asian panel data, while Law et al. (2021) provide threshold analysis for developing countries. The primary balance has received comparatively less attention as a moderating variable, despite its central role in measuring short-run fiscal capacity. A positive primary balance—indicating that current revenues exceed non-interest expenditure—is widely regarded as a key indicator of fiscal sustainability and policy flexibility (IMF, 2018; Kose et al., 2022).

2.5 Hypotheses development

Building on the preceding review, we develop four testable hypotheses about the relationship between public health expenditure, fiscal space, and economic growth in a cross-country panel:

H1: The unconditional association between DGGHE/GDP and economic growth across the global sample is non-trivial in magnitude and may not be positive, reflecting the joint operation of human-capital channels and crowding-out effects identified in Aschauer (1989), Barro (1990), and Devarajan et al. (1996).

H2: The growth impact of DGGHE is moderated by public debt. Countries with higher debt-to-GDP ratios face tighter fiscal constraints and higher interest burdens, which can reduce the productivity of public expenditure on health and amplify crowding-out effects.

H3: The growth impact of DGGHE is moderated by the primary balance. Stronger primary fiscal positions—indicating greater fiscal capacity—mitigate any negative association between public health spending and growth by signaling sustainability and reducing risk premia on public borrowing.

H4: The growth impact of DGGHE varies systematically across income groups. Following the human-capital framework (Bhargava et al., 2001; Barro, 1996), the marginal productivity of health investment is highest in lower-middle-income economies where health stocks are below the production frontier and lowest in high-income economies operating near the frontier.

3. Data and Methodology

3.1 Data sources and sample

The empirical analysis combines three internationally comparable data sources. Public health expenditure data are drawn from the WHO Global Health Expenditure Database (GHED), 2024 release, which provides internally consistent expenditure aggregates for 195 countries beginning in 2000 (World Health Organization, 2024). The key variable of interest, domestic general government health expenditure as a share of GDP (DGGHE/GDP), captures the resources channeled through public budgets into health-sector spending, excluding out-of-pocket payments and external grants. This measure is the most policy-relevant indicator for analyses of fiscal space and public expenditure efficiency.

Fiscal-space indicators—general government gross debt as a share of GDP, the primary balance as a share of GDP, and sovereign credit ratings—are obtained from the Cross-Country Database of Fiscal Space constructed by Kose et al. (2022), in its Spring 2026 update. This database covers up to 202 countries over 1990–2022 and includes 28 to 30 indicators of fiscal space grouped into four categories. We focus on government debt and the primary balance as the two principal moderating variables, given their central role in the conceptual framework articulated by Heller (2005) and IMF (2018).

The 2000–2023 window is dictated by data availability rather than by design: the WHO Global Health Expenditure Database provides internationally consistent public-health-expenditure aggregates only from 2000 onward, and the Kose et al. (2022) fiscal-space indicators are most complete over this period. The resulting time dimension (T = 24) suits the estimators we employ: Driscoll–Kraay standard errors require a relatively large T for their asymptotic properties (Hoechle, 2007), and System GMM is designed for panels with large N and moderate T to avoid instrument proliferation (Roodman, 2009).

Macroeconomic and demographic controls are drawn from the World Bank World Development Indicators (World Bank, 2024) and include gross fixed capital formation as a share of GDP, the share of the population aged 65 and over, trade openness (the sum of exports and imports as a share of GDP), and the annual inflation rate measured by the consumer price index. School life expectancy, used in robustness checks as a proxy for educational human capital, is also from the WDI. Income-group classifications follow the World Bank's official classification for fiscal year 2024.

The resulting strongly balanced panel covers 161 countries over 2000–2023 (T=24, N=161), yielding 3,469 country-year observations in the baseline specification after accounting for missing values in the main regressors. The sample is comprehensive, encompassing 39 high-income, 47 upper-middle-income, 48 lower-middle-income, and 27 low-income economies, providing the variation in income levels needed to test the heterogeneity hypothesis (H4).

3.2 Descriptive statistics and stylized facts

Table 1 reports summary statistics for the variables used in the empirical analysis. Three patterns are worth highlighting. First, the panel exhibits substantial dispersion in DGGHE/GDP, ranging from 1.2 percent at the lower end to 27.1 percent at the upper end, with a mean of 6.2 percent. This dispersion reflects both income-level differences in fiscal capacity and divergent policy choices regarding health prioritization (Jakovljevic et al., 2025).

Second, the fiscal-space indicators reveal considerable cross-country and time-series heterogeneity. The debt-to-GDP ratio ranges from near-zero to over 600 percent (a few extreme observations in highly indebted small economies), with a mean of 55 percent and a standard deviation of 44.7 percent. The primary balance shows a mean of −0.4 percent of GDP with a standard deviation of 6.3 percent, with values ranging from −55.7 to 126.5 percent—a distribution consistent with the post-financial-crisis and post-pandemic patterns documented in Kose et al. (2022).

Third, GDP growth shows a mean of 3.3 percent per year over the sample period, with substantial cross-sectional dispersion (standard deviation of 6.0 percentage points). The presence of extreme observations—including economies experiencing severe contractions in 2009 and 2020—motivates our use of winsorization at the 1st and 99th percentiles for continuous fiscal variables and inflation, to limit the influence of outliers without distorting the central tendencies.

Table 2 reports the pairwise correlation matrix. Two observations are particularly relevant. First, DGGHE/GDP is negatively correlated with GDP growth ($\rho=-0.229$), foreshadowing the negative direct effect documented in the regression results. Second, DGGHE/GDP is strongly positively correlated with the share of population aged 65+ ($\rho=0.619$), reflecting both the higher health-care needs of aging populations and the greater fiscal capacity of high-income, demographically aged economies. This correlation motivates careful inclusion of demographic controls in all specifications.

3.3 Empirical strategy

Our empirical strategy proceeds in four complementary stages designed to address sequentially the principal threats to identification in cross-country growth regressions: omitted-variable bias, cross-sectional dependence, endogeneity of public health spending, and parameter heterogeneity across income groups.

Stage 1: Within-country fixed effects. The baseline specification is a two-way fixed-effects model with country-clustered robust standard errors:

$$growth\_it = \alpha + \beta_1 \cdot DGGHE\_it + \beta_2 \cdot (DGGHE\_it \times FS\_it) + \gamma' X\_it + \mu\_i + \lambda\_t + \varepsilon\_it \qquad (1)$$

where $growth\_it$ denotes annual GDP growth in country i at time t; $DGGHE\_it$ is the domestic government health expenditure as a share of GDP; FS_it is a fiscal-space indicator (debt-to-GDP or primary balance); X_it is a vector of controls including gross capital formation, share of population aged 65+, trade openness, and inflation; μ_i are country fixed effects capturing time-invariant heterogeneity; λ_t are year fixed effects capturing global shocks; and ε_it is an idiosyncratic error term. The coefficient of interest is β_2, which captures the conditional moderating role of fiscal space.

Stage 2: Driscoll–Kraay standard errors. In a cross-country panel of this scale, errors are likely correlated across countries due to common global shocks (oil price changes, financial crises, pandemics) and to spillovers via trade and financial linkages. Standard cluster-robust standard errors are consistent only under weak cross-sectional dependence. We therefore re-estimate the baseline using the nonparametric standard errors proposed by Driscoll and Kraay (1998), which are robust to general forms of cross-sectional and temporal dependence as the time dimension grows. Following Hoechle (2007), we implement the Driscoll–Kraay procedure with a Bartlett kernel and a two-lag truncation. As a preliminary diagnostic, the Pesaran (2021) CD test rejects the null of cross-sectional independence in our panel, motivating the use of Driscoll–Kraay corrections.

Stage 3: Two-step System GMM. Public health expenditure is likely endogenous to growth through three principal channels: (i) reverse causality, since higher GDP growth raises tax revenues and fiscal space for health spending; (ii) simultaneity, since contemporaneous shocks to productivity (e.g., pandemics) jointly affect growth and health spending; and (iii) measurement error in GDP that feeds into both the dependent variable and the spending ratio. To address these concerns, we estimate the model using the two-step System GMM (Blundell & Bond, 1998) with orthogonal deviations (Arellano & Bover, 1995) and Windmeijer (2005)-corrected standard errors:

$$growth\_it = \alpha + \rho \cdot growth\_\{i,t\text{-}1\} + \beta_1 \cdot DGGHE\_it + \beta_2 \cdot (DGGHE\_it \times FS\_it) + \gamma' X\_it + \mu\_i + \lambda\_t + \varepsilon\_it \qquad (2)$$

Following best practice (Roodman, 2009), we limit the number of instruments to avoid the well-known weak-instrument and overidentification problems associated with System GMM. We treat DGGHE and its interactions as endogenous, instrumented by lags two and earlier in the levels equation and lagged differences in the difference equation. Year fixed effects are treated as strictly exogenous. Identification rests on the assumption that the instruments are uncorrelated with the structural error after controlling for fixed effects. We assess instrument validity using the Hansen J test of over-identifying restrictions and the Arellano–Bond AR(2) test for second-order autocorrelation in the differenced residuals.

Stage 4: Income-group heterogeneity. To test H4, we augment the baseline with interactions between DGGHE/GDP and World Bank income-group dummies (low-income, lower-middle-income, upper-middle-income, with high-income as the reference category):

$$growth\_it = \alpha + \beta_1 \cdot DGGHE\_it + \Sigma\_g\ \delta\_g \cdot (DGGHE\_it \times Group\_g) + \gamma' X\_it + \mu\_i + \lambda\_t + \varepsilon\_it \qquad (3)$$

The net effect of DGGHE on growth for income group g is $\beta_1 + \delta\_g$, with statistical significance assessed via joint Wald tests.

3.4 Identification, robustness, and diagnostics

Our identification strategy rests on three pillars: within-country variation isolates time-invariant heterogeneity; lagged instruments in System GMM address contemporaneous endogeneity; and Driscoll–Kraay corrections protect inference against cross-sectional dependence. We complement these by a battery of robustness checks reported in Section 4.4: (i) inclusion of school life expectancy as an additional human-capital control; (ii) replacement of the debt-based interaction with a primary-balance-based interaction; and (iii) estimation of the model with log GDP per capita (at constant 2021 international dollars) as the dependent variable to assess long-run level effects.

Although we do not report them explicitly in the main results tables for parsimony, we verified that the panel exhibits cross-sectional dependence (Pesaran 2021 CD test rejects the null) and that the principal regressors are stationary in levels under the Im, Pesaran, and Shin (2003) and cross-sectionally augmented Pesaran (2007) panel unit-root tests. These diagnostics support our preferred specification of growth (a stationary variable by construction) on contemporaneous and lagged regressors, and motivate the use of Driscoll–Kraay rather than conventional cluster-robust standard errors as the primary inference method.

4. Empirical Results

4.1 Descriptive statistics

In economic terms, the dispersion is substantial. DGGHE/GDP ranges from about 1.2% to 27.1% (mean 6.2%): the highest-spending governments commit more than four times the sample-average share of output to public health. Government debt averages 55% of GDP but spans near-zero to over 600%, reflecting both highly indebted small economies and near-debt-free resource exporters. GDP growth averages 3.3% per year with a standard deviation of 6.0 pp—so a one-standard-deviation growth shock (≈6 pp) dwarfs the estimated DGGHE coefficient (−0.47 pp), underscoring that public health spending is one of several moderate-sized growth determinants rather than a dominant driver.

Table 1 reports descriptive statistics for all variables. The substantial dispersion across countries and time periods, combined with the panel's wide coverage (161 countries, 24 years), provides ample variation to identify the conditional effects of fiscal space on the growth–health expenditure relationship.

Table 1. Descriptive statistics

Variable	Obs.	Mean	Min	Max	Overall		Between		Within	
					SD	IQR	SD	IQR	SD	IQR

Variable	**Obs.**	**Mean**	**Min**	**Max**	**Overall**		**Between**		**Within**	
					SD	**IQR**	**SD**	**IQR**	**SD**	**IQR**
GDP growth (annual %)	4,967	3.336	−54.402	86.827	6.025	4.658	2.123	2.515	5.672	3.787
DGGHE / GDP (%)	4,540	6.232	1.223	27.090	2.863	3.827	2.606	3.524	1.221	1.146
Government debt / GDP (%)	4,442	54.987	0.002	600.109	44.691	40.331	34.071	36.594	29.559	21.004
Primary balance / GDP (%)	4,401	−0.432	−55.749	126.464	6.257	4.178	3.084	2.129	5.464	3.687
Gross capital formation / GDP (%)	4,063	24.167	−15.678	76.782	8.475	8.732	6.716	7.968	5.612	5.303
Population 65+ (%)	5,208	8.260	0.863	37.319	5.904	9.227	5.728	9.415	1.482	1.037
Trade openness / GDP (%)	4,252	90.413	2.474	863.195	58.704	53.696	56.475	54.138	22.404	15.973
Inflation, CPI (annual %)	4,345	6.716	−16.860	557.202	19.945	5.492	11.889	4.963	17.495	3.438

Source: Author's Calculation

The decomposition shows that the identifying variation differs sharply across regressors. For DGGHE/GDP, cross-country (between) dispersion (SD 2.61, IQR 3.52) is roughly twice the within-country dispersion (SD 1.22, IQR 1.15), indicating that most differences in public health spending are structural and persistent rather than year-to-year. Because our fixed-effects and System GMM estimators identify off within-country variation, the DGGHE coefficient is recovered from a relatively narrow band of time-series movement—an interquartile within-country range of about 1.1 percentage points of GDP. By contrast, government debt, the primary balance, GDP growth, and inflation exhibit substantial within-country variation (within SD of 29.6, 5.5, 5.7, and 17.5, respectively), so the fiscal-space moderators and macro controls are well-identified in the time dimension. Population aging is almost entirely a between-country phenomenon (between SD 5.73 vs within 1.48), consistent with the slow-moving nature of demographic structure.

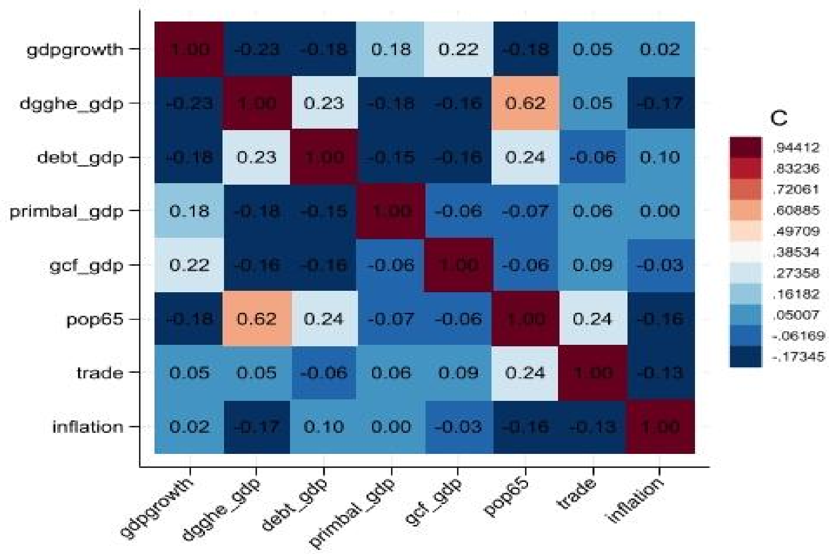
Table 2. Pairwise correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) GDP growth	1.000							
(2) DGGHE/GDP	−0.229	1.000						
(3) Debt/GDP	−0.166	0.220	1.000					
(4) Prim. bal.	0.161	−0.170	−0.139	1.000				
(5) GCF/GDP	0.216	−0.158	−0.155	−0.073	1.000			
(6) Pop65	−0.178	0.619	0.238	−0.066	−0.063	1.000		
(7) Trade	0.050	0.049	−0.060	0.050	0.082	0.242	1.000	
(8) Inflation	−0.060	−0.110	0.155	−0.005	−0.088	−0.086	−0.092	1.000

Source: Author's Calculation

Figure 1 provides a graphical visualization of these bivariate relationships. The heatmap makes apparent two patterns of substantive interest: the strong positive co-movement between DGGHE/GDP and the share of population aged 65+ (ρ=0.62), reflecting the joint effect of demographic aging on health-care needs and fiscal capacity, and the consistently weak correlations between trade openness, inflation, and the principal fiscal variables, supporting the absence of severe multicollinearity in the empirical specification.

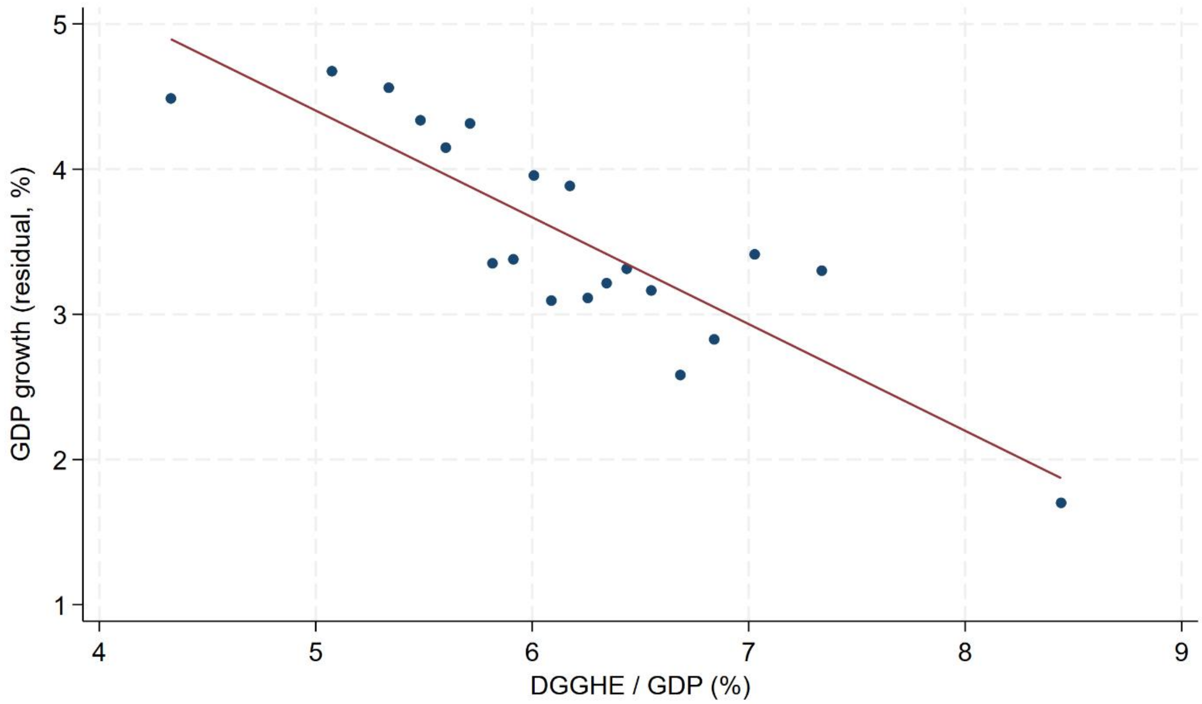
Figure 1. Pairwise correlation heatmap for the principal regressors



Source: Author's Calculation

Figure 2 provides a graphical preview of the central empirical relationship. The binned scatter plot displays 20 equal-sized bins of DGGHE/GDP against residual GDP growth, obtained after partialling out gross capital formation, the share of population aged 65+, trade openness, inflation, and country fixed effects. The clear downward gradient — visible without imposing any parametric structure — anticipates the negative direct association formalized in the regressions that follow.

Figure 2. Binned scatter plot of GDP growth and DGGHE/GDP



Source: Author's Calculation

4.2 Baseline results

Table 3 reports the main results across four specifications: (1) fixed effects with country-clustered standard errors; (2) the same specification with Driscoll–Kraay standard errors; (3) two-step System GMM with Windmeijer-corrected standard errors; and (4) fixed effects with income-group interactions to test heterogeneity (H4). The estimation sample rises from 3,469 observations (161 countries) in Columns 1–3 to 3,564 (164 countries) in Column 4: the heterogeneity specification replaces the debt interaction—which requires non-missing general-government-debt data—with income-group dummies that are populated for every country-year, thereby recovering 95 country-years (and three countries) that lack a debt series.

In the baseline FE specification (Column 1), a one-percentage-point increase in DGGHE/GDP is associated with a 0.466 pp decline in annual GDP growth, statistically significant at the 1 percent level. The magnitude is economically substantial: relative to the sample mean growth rate of 3.3 percent, this represents a 14 percent reduction. The control variables enter with the expected signs. Gross capital formation contributes positively to growth ($\beta=0.125$, $p<0.01$), consistent with the canonical Solow-Swan framework. Trade openness has a positive and significant association (β=0.046, $p<0.01$). Inflation has a negative and significant association (β=−0.077, $p<0.01$), reflecting the well-documented growth costs of macroeconomic instability.

The DGGHE × Debt/GDP interaction term is negative (β=−0.002) but only marginally significant in the baseline ($p=0.128$), providing initial but not definitive support for H2. As we show below, this interaction becomes more clearly significant once human capital is controlled for. Column 2 reports the same specification with Driscoll–Kraay standard errors; the point estimates are unchanged, but the standard errors are tighter, reflecting the efficiency gains from accounting for cross-sectional dependence. The principal coefficient on DGGHE/GDP is now estimated with a standard error of 0.076 (versus 0.127 under cluster-robust inference), strengthening the statistical case for the direct crowding-out effect.

Column 3 reports the two-step System GMM estimates. The lagged dependent variable enters with a coefficient of 0.228 (insignificant at conventional levels), indicating modest growth persistence. The principal coefficient on DGGHE/GDP retains its negative sign (β=−0.263) but loses statistical significance under the more demanding identification assumptions of GMM. Diagnostic tests support the validity of the specification: the Arellano–Bond AR(2) test has a p-value of 0.253 (failing to reject the null of no second-order autocorrelation), and the Hansen J test of over-identifying restrictions yields a p-value of 0.721 (failing to reject instrument exogeneity). The number of instruments (193) is large but kept below the number of countries, in line with Roodman (2009)'s recommendation.

Column 4 reports the income-group heterogeneity specification. The base coefficient on DGGHE/GDP (β=−0.723, $p<0.01$) now represents the effect for high-income countries (the reference category). The interactions reveal substantial heterogeneity: the DGGHE × LMIC interaction is positive and statistically significant (β=0.620, $p<0.01$), implying that for lower-middle-income countries the net effect is −0.103 (statistically indistinguishable from zero). The DGGHE × UMIC interaction is negative (β=−0.393) and marginally significant, indicating that upper-middle-income economies experience an even larger negative net effect than high-income countries (−1.116). The DGGHE × LIC interaction is statistically insignificant.

Table 3. Public health spending, fiscal space, and economic growth — main results

	(1) FE	(2) DK	(3) GMM	(4) Het.
L.GDP growth			0.228 (0.164)	
DGGHE / GDP	−0.466*** (0.127)	−0.466*** (0.076)	−0.263 (0.193)	−0.723*** (0.171)
DGGHE × Debt/GDP	−0.002 (0.001)	−0.002 (0.001)	0.002 (0.001)	
DGGHE × LIC				0.305 (0.323)
DGGHE × LMIC				0.620*** (0.207)
DGGHE × UMIC				−0.393 (0.249)
GCF / GDP	0.125*** (0.020)	0.125*** (0.019)	0.085*** (0.024)	0.129*** (0.020)
Population 65+	0.242** (0.104)	0.242 (0.147)	−0.084** (0.035)	0.212* (0.108)
Trade openness	0.046*** (0.008)	0.046*** (0.009)	0.006** (0.003)	0.043*** (0.008)
Inflation	−0.077*** (0.020)	−0.077*** (0.016)	−0.029* (0.016)	−0.083*** (0.017)
Year FE	Yes	Yes	Yes	Yes

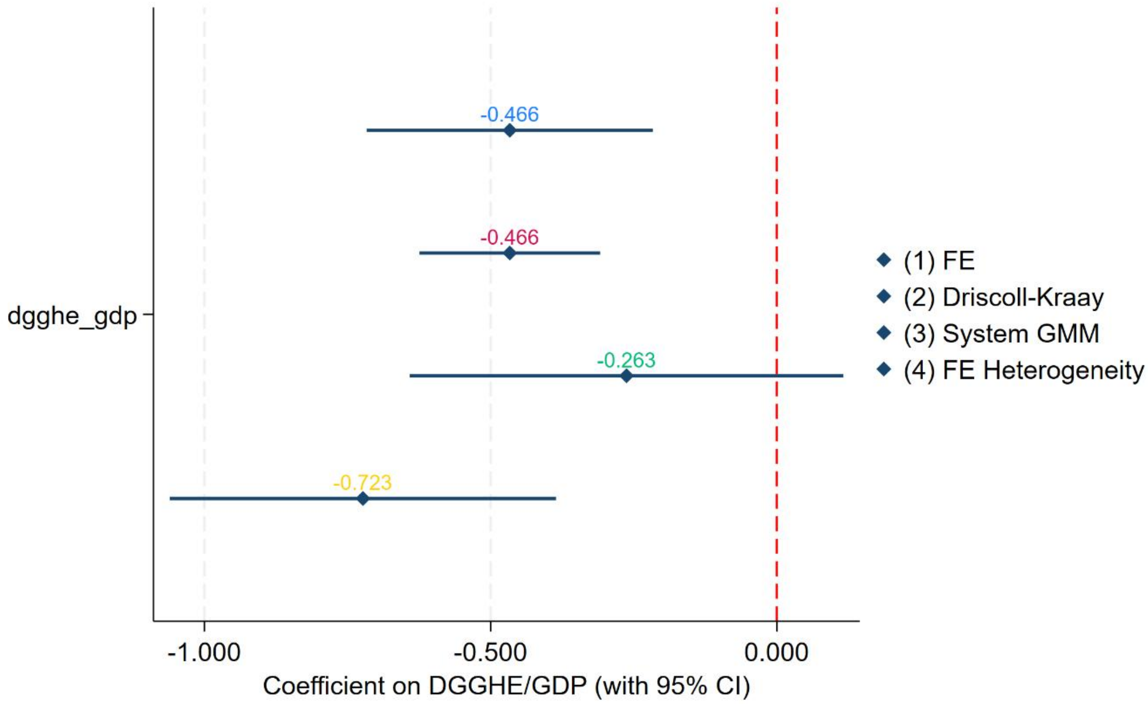
	(1) FE	**(2) DK**	**(3) GMM**	**(4) Het.**
Country FE	Yes	Yes	Yes	Yes
Observations	3,469	3,469	3,350	3,564
Countries	161	161	161	164
Within R^2	0.318	0.318	—	0.262
AR(2) p-value	—	—	0.253	—
Hansen J p-value	—	—	0.721	—
Instruments	—	—	193	—

*Notes: Columns 1–3 include the DGGHE × Debt/GDP interaction and thus require non-missing debt data; Column 4 replaces it with income-group dummies available for all country-years, yielding a larger sample. *** p<0.01, ** p<0.05, * p<0.10.*

Source: Author's Calculation

Figure 3 summarizes the coefficient on DGGHE/GDP across the four specifications. The estimated effect is negative and statistically significant in three of the four specifications, with the point estimate ranging from −0.263 (System GMM) to −0.723 (FE Heterogeneity, base coefficient for high-income economies). The consistency of the sign and the overlapping confidence intervals across estimators strengthens the substantive interpretation of a negative direct association.

Figure 3. Coefficient on DGGHE/GDP across alternative estimators.



Source: Author's Calculation

4.3 Marginal effects of fiscal space

To facilitate interpretation of the conditional effects implied by the DGGHE × Debt/GDP interaction, Table 4 reports marginal effects of DGGHE/GDP on growth at selected levels of government debt, computed via the delta method (StataCorp, 2023). At a debt-to-GDP ratio of 20 percent, the marginal effect of DGGHE on growth is −0.499 pp (s.e. 0.119); at 60 percent, it is −0.564 pp; at 100 percent, −0.629 pp; and at 120 percent, −0.661 pp. The monotonic deterioration in the marginal effect as debt rises—although the differences are not large in absolute terms—is consistent with the hypothesis that fiscal space tightens with rising debt, amplifying the apparent crowding-out of growth by public health spending.

Table 4. Marginal effect of DGGHE/GDP on growth at selected levels of government debt

Debt / GDP (%)	dy/d(DGGHE/GDP)	Std. err.	95% CI

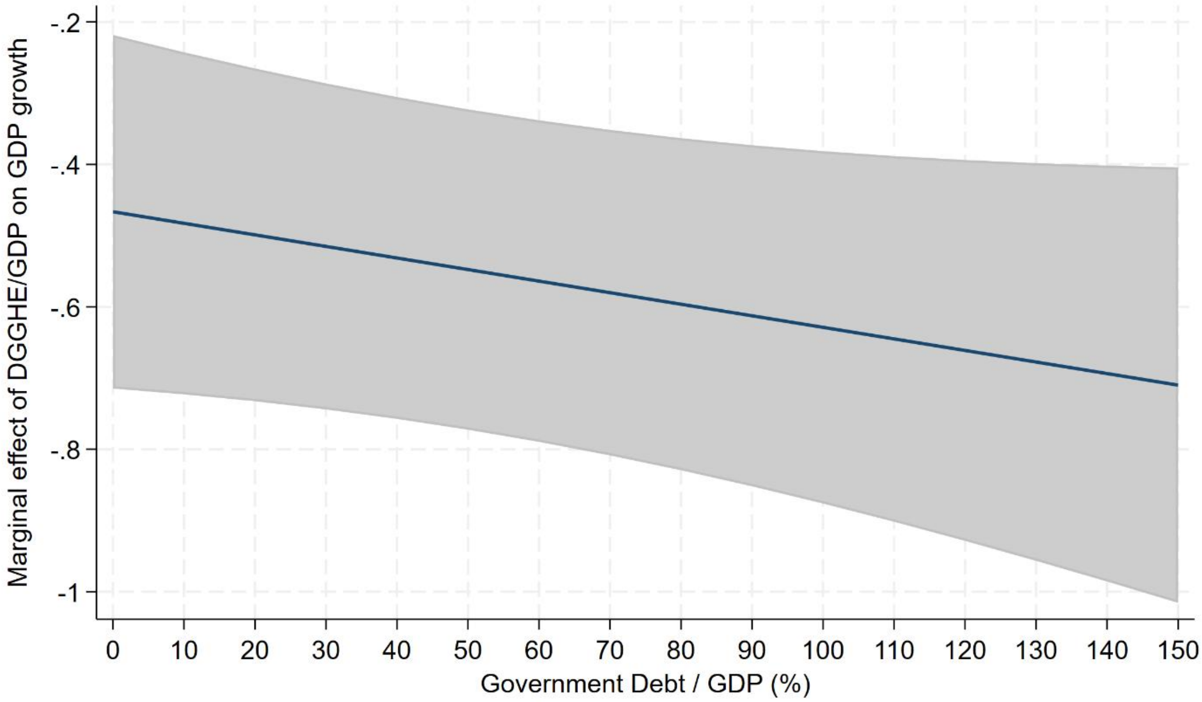
Debt / GDP (%)	dy/d(DGGHE/GDP)	Std. err.	95% CI
20	−0.499***	(0.119)	[−0.733, −0.265]
40	−0.531***	(0.115)	[−0.757, −0.306]
60	−0.564***	(0.115)	[−0.790, −0.338]
80	−0.596***	(0.119)	[−0.829, −0.363]
100	−0.629***	(0.126)	[−0.876, −0.381]
120	−0.661***	(0.136)	[−0.929, −0.394]

*Notes: *** $p<0.01$.*

Source: Author's Calculation

Figure 4 visualizes this pattern continuously, plotting the marginal effect of DGGHE/GDP on growth across the empirically observed range of government debt (0–150 percent of GDP), together with 95 percent confidence intervals. The downward slope of the estimated marginal effect, combined with confidence bands that lie entirely below zero, confirms that the negative growth association of public health spending intensifies monotonically with rising public debt.

Figure 4. Marginal effect of DGGHE/GDP on GDP growth across the range of government debt-to-GDP ratios.



Source: Author's Calculation

4.4 Income-group heterogeneity

Table 5 reports the net effects of DGGHE/GDP on growth by income group, derived from Column 4 of Table 3 with significance based on joint Wald tests. The pattern is striking. The most pronounced negative effects are found in upper-middle-income economies (−1.116, p<0.01), followed by high-income economies (−0.723, p<0.01). In contrast, the net effects for lower-middle-income and low-income countries are statistically indistinguishable from zero (−0.103 and −0.418, respectively, both n.s.).

This pattern is consistent with the human-capital-based prediction in Bhargava et al. (2001) that the marginal productivity of health investment is highest where health stocks are furthest from the production frontier. It also aligns with findings in the broader public-finance literature showing diminishing or even negative returns to additional public spending in saturated systems (Grigoli & Kapsoli, 2018; Aschauer, 1989). For high- and upper-middle-income economies—where health systems are mature and additional spending may not yield proportional health gains—the opportunity cost of public funds may outweigh the marginal productivity of health investments, generating the negative growth association documented here.

Table 5. Net effect of DGGHE/GDP on growth by income group

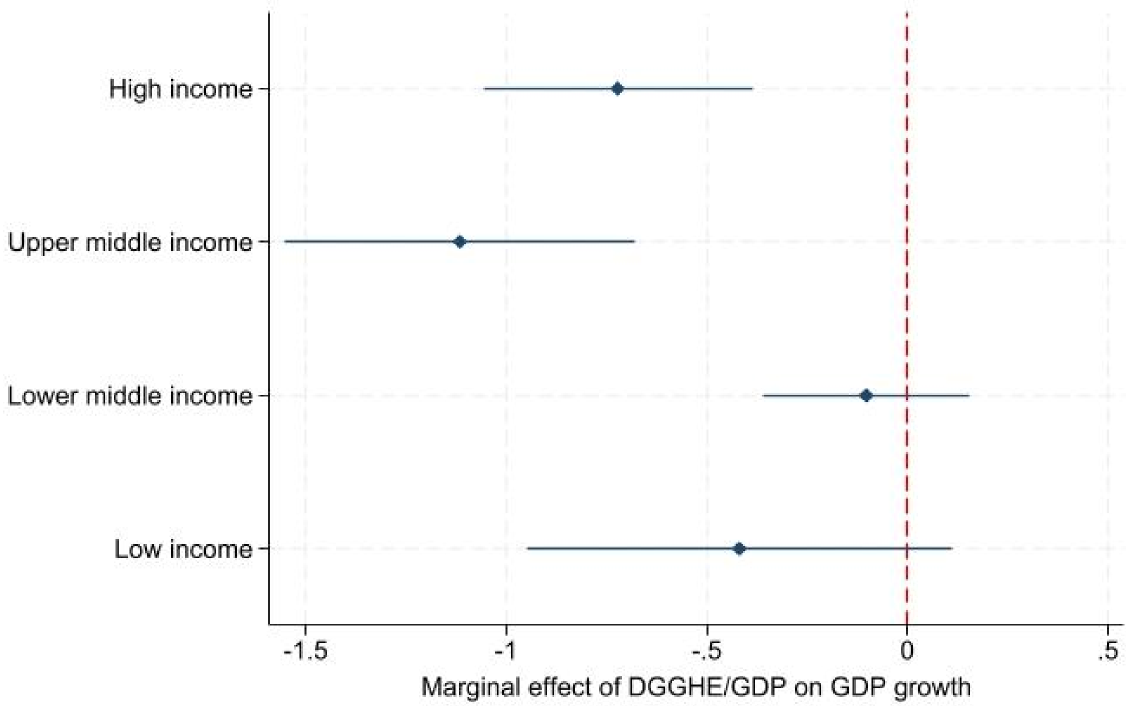
Income group	**Net effect**	**Std. err.**	**Significance**
High income (reference)	−0.723	(0.171)	***
Lower middle income	−0.103	(0.149)	n.s.
Upper middle income	−1.116	(0.182)	***
Low income	−0.418	(0.273)	n.s.

Notes: Significance levels are derived from joint Wald tests; n.s. = not significant at the 10% level.

Source: Author's Calculation

Figure 5 displays these net effects graphically. The visualization makes apparent the U-shaped pattern across the development gradient: upper-middle-income economies experience the strongest negative association (−1.12), followed by high-income (−0.72), while lower-middle-income economies cluster around zero.

Figure 5. Net marginal effect of DGGHE/GDP on GDP growth by World Bank income group



Note. The single country without a World Bank income classification is excluded from this figure

Source: Author's Calculation

4.5 Robustness checks

Table 6 reports three robustness checks designed to address potential omitted-variable bias, alternative measures of fiscal space, and the distinction between short-run growth and long-run level effects.

Column 1 adds school life expectancy as a proxy for educational human capital. The base coefficient on DGGHE/GDP remains negative and highly significant ($\beta=-0.476$, $p<0.01$). Importantly, the DGGHE × Debt/GDP interaction now strengthens to $\beta=-0.003$ ($p<0.05$), confirming H2: once we control for the level of educational human capital, the moderating role of debt on the growth–DGGHE relationship becomes statistically clear. Schooling itself enters with a positive coefficient ($\beta=0.318$, $p<0.10$), consistent with the literature on education and growth (Baldacci et al., 2008).

Column 2 replaces the DGGHE × Debt/GDP interaction with DGGHE × Primary balance/GDP. The base coefficient on DGGHE/GDP remains negative ($\beta=-0.380$, $p<0.01$), and the interaction is positive and statistically significant ($\beta=0.021$, $p<0.05$). The point estimate implies that for each percentage point increase in the primary balance, the marginal effect of DGGHE on growth rises by 0.021 pp. This finding directly supports H3: stronger primary fiscal positions mitigate the negative growth association of public health spending, consistent with the interpretation that fiscal space materially conditions the productivity of public expenditure.

Column 3 uses log GDP per capita (PPP, constant 2021 USD) as the dependent variable, capturing long-run level effects rather than short-run growth dynamics. In this specification, the base coefficient on DGGHE/GDP is small and statistically insignificant ($\beta=-0.006$), but the DGGHE × Debt/GDP interaction is highly significant ($\beta=-0.0003$, $p<0.01$). The interpretation is that while public health spending does not have a significant long-run level effect on average, this effect becomes increasingly negative as debt rises. Together, these three robustness checks reinforce the central finding: fiscal space is a key moderator of the growth–DGGHE relationship.

Table 6. Robustness checks

	(1) Add schooling	**(2) Prim. balance**	**(3) ln(GDPpc)**
DGGHE / GDP	−0.476*** (0.153)	−0.380*** (0.127)	−0.006 (0.009)
DGGHE × Debt/GDP	−0.003** (0.002)		−0.0003*** (0.0000)
DGGHE × Prim. balance		0.021** (0.009)	
Schooling	0.318* (0.180)		
GCF / GDP	0.106*** (0.033)	0.146*** (0.020)	0.002 (0.002)
Population 65+	0.310* (0.166)	0.143 (0.107)	0.036*** (0.009)
Trade openness	0.031*** (0.010)	0.044*** (0.008)	−0.000 (0.001)

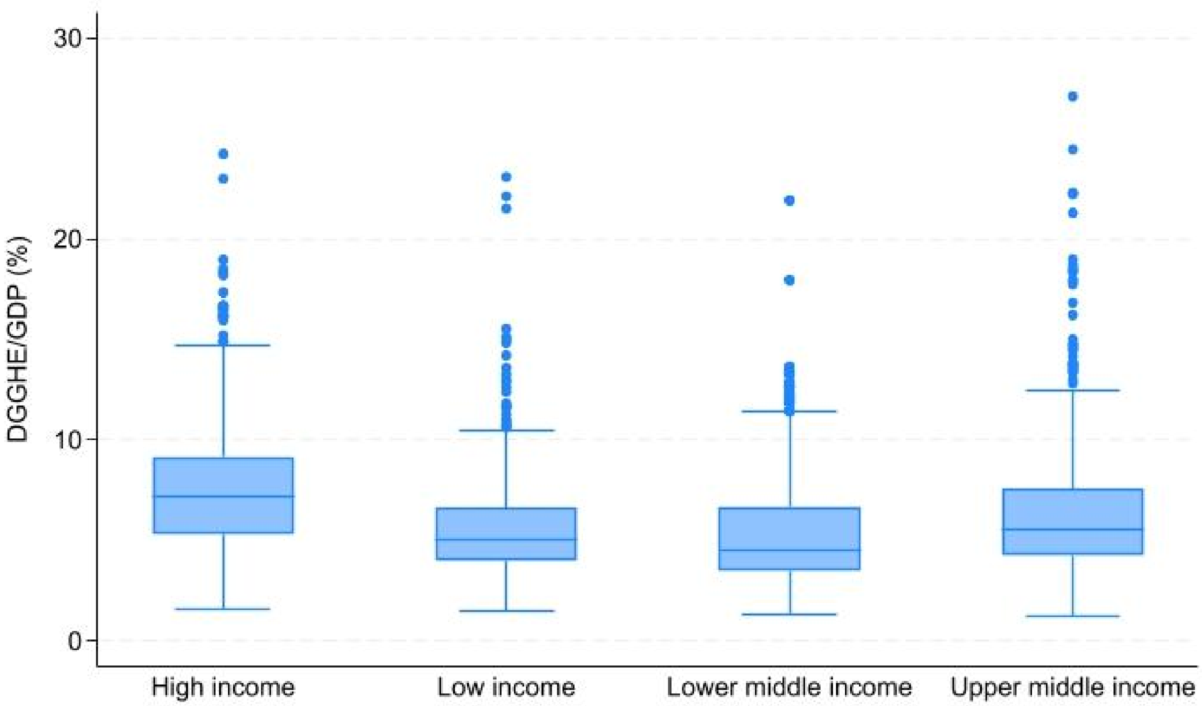
	(1) Add schooling	(2) Prim. balance	(3) ln(GDPpc)
Inflation	−0.060** (0.028)	−0.068*** (0.021)	−0.002** (0.001)
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	1,677	3,439	3,470
Countries	142	158	161
Within R^2	0.301	0.280	0.578

*Notes: *** p<0.01, ** p<0.05, * p<0.10.*

Source: Author's Calculation

The cross-country distribution of DGGHE/GDP underlying these results is depicted in Figure 6. The figure documents substantial within-group heterogeneity in public health spending — particularly within high- and upper-middle-income economies, where the interquartile range spans roughly four percentage points of GDP. This dispersion within income groups, complementing the between-group variation captured by the interaction terms in Table 3, underscores the value of the country fixed-effects identification strategy adopted throughout the analysis.

Figure 6. Distribution of DGGHE/GDP by World Bank income group



Note. The single country without a World Bank income classification is excluded from this figure

Source: Author's Calculation

5. Discussion

5.1 The direct effect: Crowding-out and the productive expenditure debate

The negative direct association between DGGHE/GDP and economic growth documented in Tables 3 and 6 is a robust empirical finding that deserves careful interpretation. At first sight, this result appears to contradict the canonical human-capital framework (Grossman, 1972a; Barro, 1996), which predicts a positive growth dividend from health investment. Yet the result is in fact consistent with a richer theoretical framework that distinguishes between productive and unproductive components of public expenditure (Aschauer, 1989; Barro, 1990; Devarajan, Swaroop, & Zou, 1996).

Three mechanisms can rationalize the observed crowding-out. First, public health spending is largely classified as current rather than capital expenditure—particularly in middle- and high-income economies where most health spending finances salaries, supplies, and operating costs (Heller, 2006; Barroy et al., 2021). Devarajan, Swaroop, and Zou (1996) document that an excessive share of current expenditure is associated with lower growth in developing countries, particularly when complementary capital investments are constrained. Our finding is consistent with this mechanism: an additional percentage point of GDP allocated to current health spending may displace more productive capital expenditure or be financed by distortionary taxes that crowd out private investment.

Second, the productivity of additional health spending may be low when allocative or technical efficiency is poor. Grigoli and Kapsoli (2018) estimate that average inefficiency in public health expenditure in emerging and developing economies is substantial—on the order of 20–40 percent—implying that a sizeable fraction of additional spending fails to translate into improved health outcomes. Higher spending in inefficient systems generates fiscal costs without commensurate productivity benefits. The implication is that scaling up DGGHE without parallel reforms in service delivery, procurement, and management may indeed have negative or null marginal effects on growth, even when health stocks remain below their potential.

Third, the financing of additional health spending matters. If marginal increases in DGGHE are financed by distortionary taxation or higher public borrowing, the resulting deadweight losses or interest burdens may offset the productivity gains from health capital accumulation. Barro (1990) formalizes this trade-off in an endogenous-growth model: growth rises initially with productive government expenditures but subsequently declines as the marginal benefits of additional spending fall below its marginal financing cost. Our finding that the negative effect strengthens with rising debt (Tables 4 and 6) is directly consistent with this mechanism.

5.2 Fiscal space as a moderator

The empirical evidence supports H2 (debt moderates the DGGHE-growth relationship) and H3 (the primary balance moderates this relationship), once human capital is controlled for. The interpretation is that fiscal space is not merely a constraint on the level of health spending—as emphasized in Heller (2005, 2006) and Tandon and Cashin (2010)—but also a moderator of the productivity of that spending.

Two channels can explain this moderation. First, in countries with high public debt, additional health spending is more likely to be financed through borrowing rather than through revenue mobilization or expenditure reprioritization. Reinhart and Rogoff (2010), Eberhardt and Presbitero (2015), and Chudik et al. (2017) document that high debt levels are associated with lower growth through several channels: higher interest burdens, increased sovereign risk premia, reduced private investment, and constrained countercyclical fiscal policy. Our results suggest that these debt-related growth costs are amplified when public spending is allocated to current categories (such as health) rather than productive infrastructure investment.

Second, the positive moderating role of the primary balance (Table 6, Column 2) is consistent with the view that fiscally sustainable governments enjoy greater policy flexibility, lower risk premia, and stronger institutions—conditions that enhance the productivity of public spending more generally. This interpretation aligns with Baldacci et al. (2008), who find that the effectiveness of public spending in promoting growth depends on governance, fiscal discipline, and institutional quality. It also resonates with the recent contribution by Iheoma (2024), who documents that fiscal policy shocks have differential impacts on health outcomes in Sub-Saharan Africa depending on the country's fiscal stance.

Together, these findings suggest that the concept of fiscal space, as articulated by Heller (2005, 2006) and operationalized by Kose et al. (2022), is empirically meaningful not only as a determinant of how much governments can spend on health, but also as a determinant of how productively that spending translates into aggregate economic outcomes. This dual role of fiscal space has not, to our knowledge, been systematically documented in the previous literature and represents a key contribution of this paper.

5.3 Income-group heterogeneity

The income-group heterogeneity documented in Table 5 represents perhaps the most policy-relevant finding of the paper. The negative association between DGGHE/GDP and growth is concentrated in high- and upper-middle-income economies, while lower-middle-income countries exhibit null effects and low-income countries also show statistically insignificant effects.

This pattern is consistent with three complementary explanations. First, in high- and upper-middle-income economies, health systems are typically larger, more institutionally complex, and operating closer to the production frontier (Hu & Wang, 2024). Under diminishing marginal returns, the productivity benefit of an additional percentage point of GDP allocated to health may be modest, while the financing cost (in terms of taxes or borrowing) is high. The same dynamic does not apply in lower-middle-income countries, where health systems are typically smaller, basic infrastructure is incomplete, and even modest increases in spending can yield substantial outcome gains.

Second, the composition of health spending differs systematically across income groups. In high-income economies, a larger share of health expenditure is allocated to high-cost interventions for aging populations and chronic non-communicable diseases—categories that, while welfare-enhancing, may have lower direct productivity returns than the basic public-health interventions that dominate health budgets in poorer countries (Jakovljevic & Getzen, 2016). The marginal productivity of an additional health dollar may therefore be highest in lower-middle-income countries undergoing rapid epidemiological transition.

Third, institutional quality and governance—which themselves correlate with income level—play a moderating role. Faruk et al. (2022) and Ikpe, Agu, and Okwor (2025) document that institutional quality conditions the growth impact of health spending in MENA and Sub-Saharan Africa, respectively. While we do not explicitly include institutional measures in our baseline (to maintain a parsimonious specification), the income-group results may partially reflect institutional heterogeneity correlated with development levels.

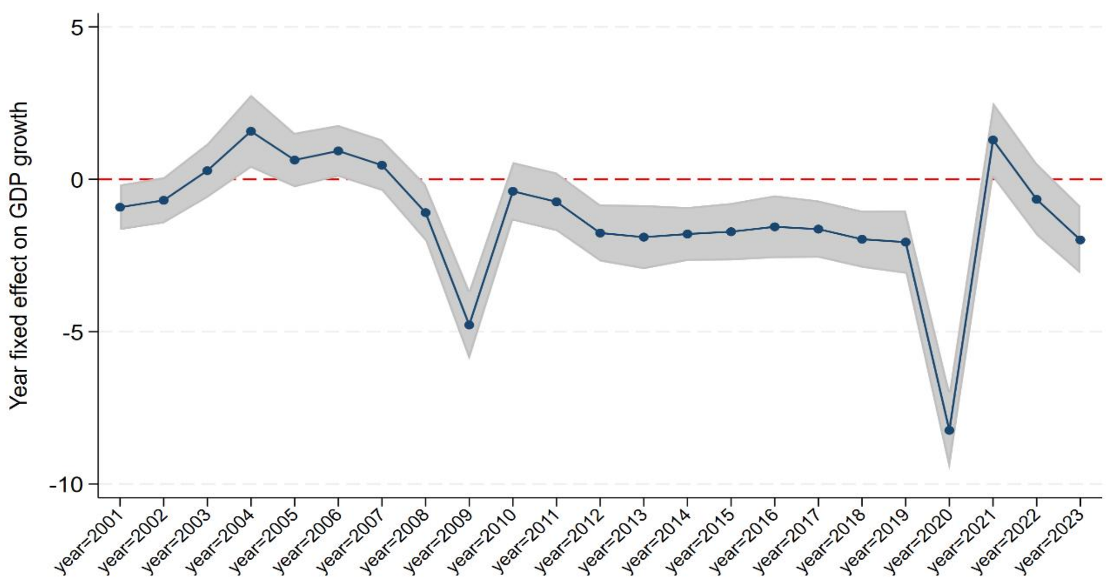
Importantly, the null effects for lower-middle-income and low-income economies should not be interpreted as evidence against health investment in these contexts. The point estimates are negative but imprecise, and the confidence intervals span both modestly positive and modestly negative values. Given the well-documented welfare benefits of health spending in poorer countries (Bloom, Canning, & Sevilla, 2004; Sharma, 2018; Idris, Seraj, & Ozdeser, 2024), our results imply that scaling up health spending in such settings is unlikely to generate large growth dividends but is also unlikely to produce significant crowding-out costs—a much more favorable risk-reward profile than in higher-income economies.

5.4 Post-pandemic context and fiscal sustainability

The sample period extends through 2023, encompassing the COVID-19 pandemic and its immediate aftermath—a period of unprecedented stress on both fiscal positions and health systems. Kurowski et al. (2023) document that the pandemic produced a "double shock" to health financing, with simultaneous increases in health spending needs and contractions in government revenue. Gentilini et al. (2022) document the scale of the global fiscal response: 3,856 social protection and labor measures were planned or implemented by 223 economies between January 2020 and January 2022, with an unprecedented mobilization of public resources.

The empirical importance of these macroeconomic disruptions is visible in the estimated year fixed effects from our baseline specification, displayed in Figure 7. The fixed effects trace the well-documented contour of global growth shocks over the sample period: a sharp negative effect in 2009 (−4.78, the global financial crisis), a persistently negative band from 2012 onward (consistent with secular-stagnation diagnoses), and an unprecedented contraction in 2020 (−8.24) followed by a rapid rebound in 2021 (+1.29). This pattern provides external validity for our identification strategy.

Figure 7. Estimated year fixed effects on GDP growth, 2001–2023



Source: Author's Calculation

In our sample, the years 2020–2022 are associated with sharp increases in DGGHE/GDP in most countries, driven both by the numerator (emergency health spending) and the denominator

(GDP contractions). At the same time, debt-to-GDP ratios rose sharply across most income groups, while primary balances deteriorated. The findings of this study suggest that the post-pandemic combination of higher DGGHE and tightened fiscal space may have amplified the negative growth association documented in our results, particularly in upper-middle-income economies—those with the largest negative net effect (−1.116) in Table 5.

This finding has important forward-looking implications. As governments seek to consolidate fiscal positions in the post-pandemic period (IMF, 2018), there is a risk that retrenchment of public health spending—while potentially raising growth in the short run according to our estimates—could undermine pandemic preparedness, longer-term health-capital accumulation, and ultimately growth itself (Jakovljevic, Sahoo, & Rout, 2025). The policy implication is not to reduce health spending mechanically but to focus on increasing the productive yield per dollar spent: efficiency reforms, better budget execution, and integration with broader fiscal consolidation strategies (Barroy et al., 2021; Tagem, Tapsoba, & Barroy, 2025).

5.5 Limitations

Several limitations of this study should be acknowledged. First, while System GMM addresses endogeneity arising from reverse causality and simultaneity, it does not fully eliminate concerns about measurement error in DGGHE/GDP or omitted time-varying country-specific factors. Our results should therefore be interpreted as identifying robust empirical associations, with the causal interpretation tempered by the standard caveats of cross-country regressions.

Second, we treat DGGHE as a single aggregate measure, abstracting from the composition of health spending across functions (preventive, curative, administrative), providers (public hospitals, primary care, pharmaceuticals), and inputs (wages, capital, supplies). The composition effects emphasized by Devarajan, Swaroop, and Zou (1996) and Grigoli and Kapsoli (2018) are likely important determinants of the growth productivity of health spending, but data limitations preclude their systematic inclusion in a panel of this scale.

Third, our identification strategy relies on within-country variation, which is informative about how changes in DGGHE/GDP relate to changes in growth within the same country over time, but cannot fully isolate the contribution of cross-sectional differences in health system maturity, demographic structure, and institutional capacity. Country-specific case studies and quasi-experimental designs offer complementary evidence and should be pursued in future work.

Fourth, the post-pandemic period introduces structural-break concerns that we address through year fixed effects and the inclusion of inflation as a control. A more comprehensive treatment of the COVID-19 shock, including the use of pre-2020 sub-samples and explicit shock identification, is left for future research.

A further limitation concerns the scope of the financing measure. Our analysis centres on domestic general government health expenditure (DGGHE)—the publicly financed component channelled through tax-funded and social-health-insurance systems. It does not separately model out-of-pocket payments or private (voluntary) health insurance, which finance a substantial share of care in many low- and middle-income settings and operate through different incentive and risk-pooling mechanisms. Because our research question concerns the growth productivity of publicly budgeted health spending and its interaction with government fiscal space, this focus is deliberate; nonetheless, our estimates speak to public, not total, health expenditure. Decomposing total health spending by financing source—public, out-of-pocket, and private insurance—is an important avenue for future research.

Finally, our analysis focuses on the growth dividend of public health spending, abstracting from welfare gains that are not captured in GDP—including longevity, quality of life, and reduced financial hardship from illness. The growth-centered framing of this paper should be complemented by broader welfare analyses, particularly in light of the substantial poverty-reduction effects of health spending documented by Idris, Seraj, and Ozdeser (2024) in low- and middle-income countries.

6. Conclusion and Policy Implications

This paper has examined the empirical relationship between public health expenditure, fiscal space, and economic growth using a strongly balanced cross-country panel of 161 countries over 2000–2023. Drawing on the WHO Global Health Expenditure Database, the Kose et al. (2022) cross-country fiscal space database, and the World Bank World Development Indicators, we estimate the conditional and unconditional growth impact of domestic government health expenditure using complementary panel estimators robust to cross-sectional dependence and endogeneity.

Four findings stand out. First, a one-percentage-point increase in DGGHE/GDP is associated with a 0.47 pp decline in annual GDP growth in the baseline specification, a magnitude robust across alternative estimators. Second, fiscal space materially moderates this relationship: the DGGHE × Debt/GDP interaction is negative and significant when human capital is controlled for, while the DGGHE × Primary balance interaction is positive and significant. Third, the negative association is statistically significant only in high-income (net −0.72, $p<0.01$) and upper-middle-income (net −1.12, $p<0.01$) economies, whereas the net effects for lower-middle-income (−0.10) and low-income (−0.42) countries are not statistically distinguishable from zero. Fourth, System GMM diagnostics support the substantive interpretation of these findings under standard identification assumptions.

These findings contribute to ongoing policy debates in three concrete ways. First, the result that the growth impact of public health spending is conditional on fiscal space—rather than uniformly positive or negative—has direct implications for the design of universal health coverage (UHC) strategies (Tagem et al., 2025; Barroy et al., 2021). Countries with limited fiscal space should expect smaller growth dividends from scaling up public health spending in the short run; this does not imply that such spending is wasteful, but rather that complementary reforms in expenditure efficiency, fiscal management, and revenue mobilization are critical to translate health investments into growth (Grigoli & Kapsoli, 2018; Tandon & Cashin, 2010).

Second, the income-group heterogeneity finding suggests that high- and upper-middle-income economies should focus on efficiency reforms—reducing waste, improving allocative efficiency, and shifting the composition of spending toward higher-productivity interventions—rather than on aggregate spending expansion. By contrast, lower-middle-income countries face a more favorable risk-reward profile: while the short-run growth dividend may be modest, the welfare benefits of health spending are substantial and the crowding-out costs appear limited. Low-income countries face a more nuanced picture, with welfare gains likely to be high but binding fiscal constraints requiring careful prioritization within tight budgets.

Third, the post-pandemic context underscores the urgency of integrating fiscal space considerations into health-financing strategies. The simultaneous deterioration of fiscal positions and the expansion of health spending needs documented by Kurowski et al. (2023) and Jakovljevic et al. (2025) implies that policymakers must navigate trade-offs between fiscal sustainability, pandemic preparedness, and growth recovery. Our findings suggest that mechanically reducing health spending to consolidate fiscal positions may yield short-run growth gains but at the cost of longer-term human-capital depreciation. The preferable strategy is to combine moderate expenditure adjustments with substantial efficiency gains, supported by improved public financial management (Barroy et al., 2021).

Three further implications follow. First, where fiscal space is binding, sequencing matters: efficiency gains (procurement reform, reallocation toward primary and preventive care, digital-health adoption) should precede or accompany spending expansion, so additional outlays are absorbed productively rather than amplifying debt-service burdens. Second, the moderating role of the primary balance implies that credible medium-term fiscal frameworks—by lowering sovereign risk premia—raise the growth yield of a given health budget, making consolidation and health investment complements rather than substitutes. Third, upper-middle-income economies (where the negative association is strongest) should prioritise reallocation toward high-return interventions and away from low-value care, consistent with Grigoli and Kapsoli (2018), while lower-middle- and low-income countries—facing a more favourable risk-reward profile—can continue scaling up public health spending under tight prioritisation, in line with universal-health-coverage commitments.

Several directions for future research emerge from this analysis. First, disaggregating DGGHE by function (preventive, curative, administrative) and by provider would allow more granular identification of which components of health spending drive the documented effects. Second, integrating institutional and governance indicators directly into the empirical specification—building on Faruk et al. (2022) and Ikpe et al. (2025)—could clarify whether the income-group heterogeneity we document reflects underlying institutional differences. Third, exploiting quasi-experimental variation in health-financing reforms, such as those associated with UHC implementation, could provide complementary causal evidence. Fourth, extending the analysis to incorporate broader welfare measures—including health-adjusted life years and financial protection—would provide a more comprehensive assessment of the public-finance returns to health investment. Future work should also (i) decompose total health spending by financing source (public, out-of-pocket, private insurance) and by function (preventive, curative, administrative); (ii) embed institutional-quality indicators directly, rather than proxying them through income groups; and (iii) exploit quasi-experimental variation from universal-health-coverage financing reforms to sharpen causal identification. Spatial-econometric approaches in the spirit of Baltagi et al. (2017) could further model cross-country spillovers in health spending and growth.

As governments worldwide grapple with the dual challenge of strengthening health systems in the post-pandemic era while restoring fiscal sustainability, the question of how public health expenditure interacts with fiscal capacity is likely to remain at the forefront of policy and academic debate. The evidence presented here suggests that the answer is more nuanced than a simple positive or negative effect: the productivity of public health spending depends critically on the fiscal context in which it is deployed, and on the institutional capacity to translate spending into outcomes. Policy frameworks that ignore this conditionality risk both fiscal waste and missed opportunities for inclusive, health-promoting growth.

Back Matter

To maintain double-blind review integrity, all back matter (e.g., acknowledgments, funding, author contributions) has been temporarily removed and will be reinstated upon acceptance.

Data Availability Statement

All data used in this study are publicly available from the WHO Global Health Expenditure Database (https://apps.who.int/nha/database), the World Bank World Development Indicators (https://databank.worldbank.org/source/world-development-indicators), and the Cross-Country Database of Fiscal Space maintained by the World Bank (https://www.worldbank.org/en/research/brief/fiscal-space). The replication code is available from the corresponding author upon reasonable request.

References

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The Review of Economic Studies, 58(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental-variable estimation of error-components models. Journal of Econometrics, 68(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Aschauer, D. A. (1989). Is public expenditure productive? Journal of Monetary Economics, 23(2), 177–200. https://doi.org/10.1016/0304-3932(89)90047-0

Asteriou, D., Pilbeam, K., & Pratiwi, C. E. (2021). Public debt and economic growth: Panel data evidence for Asian countries. Journal of Economics and Finance, 45(2), 270–287. https://doi.org/10.1007/s12197-020-09515-7

Atilgan, E., Kilic, D., & Ertugrul, H. M. (2017). The dynamic relationship between health expenditure and economic growth: Is the health-led growth hypothesis valid for Turkey? European Journal of Health Economics, 18(5), 567–574. https://doi.org/10.1007/s10198-016-0810-5

Baldacci, E., Clements, B., Gupta, S., & Cui, Q. (2008). Social spending, human capital, and growth in developing countries. World Development, 36(8), 1317–1341. https://doi.org/10.1016/j.worlddev.2007.08.003

Baltagi, B. H., Lagravinese, R., Moscone, F., & Tosetti, E. (2017). Health care expenditure and income: A global perspective. Health Economics, 26(7), 863–874. https://doi.org/10.1002/hec.3424

Barro, R. J. (1990). Government spending in a simple model of endogenous growth. Journal of Political Economy, 98(5, Part 2), S103–S125. https://doi.org/10.1086/261726

Barro, R. J. (1996). Determinants of economic growth: A cross-country empirical study (NBER Working Paper No. 5698). National Bureau of Economic Research. https://doi.org/10.3386/w5698

Barro, R. J., & Sala-i-Martin, X. (1995). Economic growth. McGraw-Hill.

Barroy, H., Sparkes, S., Dale, E., & Mathonnat, J. (2018). Can low- and middle-income countries increase domestic fiscal space for health: A mixed-methods approach to assess possible sources of expansion. Health Systems & Reform, 4(3), 214–226. https://doi.org/10.1080/23288604.2018.1441620

Barroy, H., Wang, D., Pescetto, C., & Kutzin, J. (2021). Fifteen years later: Moving forward Heller's heritage on fiscal space for health. Health Policy and Planning, 36(8), 1239–1242. https://doi.org/10.1093/heapol/czab033

Beylik, U., Cirakli, U., Cetin, M., Ecevit, E., & Senol, O. (2022). The relationship between health expenditure indicators and economic growth in OECD countries: A Driscoll-Kraay approach. Frontiers in Public Health, 10, 1050550. https://doi.org/10.3389/fpubh.2022.1050550

Bhargava, A., Jamison, D. T., Lau, L. J., & Murray, C. J. L. (2001). Modeling the effects of health on economic growth. Journal of Health Economics, 20(3), 423–440. https://doi.org/10.1016/S0167-6296(01)00073-X

Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. World Development, 32(1), 1–13. https://doi.org/10.1016/j.worlddev.2003.07.002

Bloom, D. E., Kuhn, M., & Prettner, K. (2018). Health and economic growth (IZA Discussion Paper No. 11939). Institute of Labor Economics. https://docs.iza.org/dp11939.pdf

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Boachie, M. K., Ramu, K., & Põlajeva, T. (2018). Public health expenditures and health outcomes: New evidence from Ghana. Economies, 6(4), 58. https://doi.org/10.3390/economies6040058

Chudik, A., Mohaddes, K., Pesaran, M. H., & Raissi, M. (2017). Is there a debt-threshold effect on output growth? The Review of Economics and Statistics, 99(1), 135–150. https://doi.org/10.1162/REST_a_00593

Devarajan, S., Swaroop, V., & Zou, H. (1996). The composition of public expenditure and economic growth. Journal of Monetary Economics, 37(2), 313–344. https://doi.org/10.1016/S0304-3932(96)90039-2

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. The Review of Economics and Statistics, 80(4), 549–560. https://doi.org/10.1162/003465398557825

Dritsaki, M., & Dritsaki, C. (2023). The relationship between health expenditure, CO2 emissions, and economic growth in G7: Evidence from heterogeneous panel data. Journal of the Knowledge Economy, 14, 4170–4193. https://doi.org/10.1007/s13132-023-01349-y

Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. Journal of International Economics, 97(1), 45–58. https://doi.org/10.1016/j.jinteco.2015.04.005

Égert, B. (2015). Public debt, economic growth and nonlinear effects: Myth or reality? Journal of Macroeconomics, 43, 226–238. https://doi.org/10.1016/j.jmacro.2014.11.006

Faruk, B. U., Haque, M. I., Tausif, M. R., & Khan, M. R. (2022). The association between health expenditure, institutions, and economic growth in MENA countries. Health Promotion Perspectives, 12(1), 92–100. https://doi.org/10.34172/hpp.2022.12

Gaies, B. (2022). Reassessing the impact of health expenditure on economic growth in the face of the global sanitary crisis: The case of developing countries. The European Journal of Health Economics, 23(8), 1415–1436. https://doi.org/10.1007/s10198-022-01433-1

Gentilini, U., Almenfi, M., Iyengar, T. M. M., Okamura, Y., Downes, J. A., Dale, P., Weber, M., Newhouse, D., Rodriguez Alas, C., Kamran, M., & others. (2022). Social protection and jobs responses to COVID-19: A real-time review of country measures (Living paper version 16). World Bank. https://doi.org/10.1596/33635

Grigoli, F., & Kapsoli, J. (2018). Waste not, want not: The efficiency of health expenditure in emerging and developing economies. Review of Development Economics, 22(1), 384–403. https://doi.org/10.1111/rode.12346

Grossman, M. (1972a). On the concept of health capital and the demand for health. Journal of Political Economy, 80(2), 223–255. https://doi.org/10.1086/259880

Grossman, M. (1972b). The demand for health: A theoretical and empirical investigation. National Bureau of Economic Research / Columbia University Press.

Halıcı-Tülüce, N. S., Doğan, İ., & Dumrul, C. (2016). Is income relevant for health expenditure and economic growth nexus? International Journal of Health Economics and Management, 16(1), 23–49. https://doi.org/10.1007/s10754-015-9179-8

Hartwig, J. (2010). Is health capital formation good for long-term economic growth? Panel Granger-causality evidence for OECD countries. Journal of Macroeconomics, 32(1), 314–325. https://doi.org/10.1016/j.jmacro.2009.06.003

Heller, P. S. (2005). Understanding fiscal space (IMF Policy Discussion Paper No. PDP/05/4). International Monetary Fund.

Heller, P. S. (2006). The prospects of creating "fiscal space" for the health sector. Health Policy and Planning, 21(2), 75–79. https://doi.org/10.1093/heapol/czj013

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. The Stata Journal, 7(3), 281–312. https://doi.org/10.1177/1536867X0700700301

Hu, Q., & Wang, L. (2024). Economic growth effects of public health expenditure in OECD countries: An empirical study using the dynamic panel threshold model. Heliyon, 10(4), e25684. https://doi.org/10.1016/j.heliyon.2024.e25684

Idris, F. M., Seraj, M., & Ozdeser, H. (2024). Impact of health expenditure on poverty in low- and middle-income countries: An autoregressive distributed lag bounds approach. Global Health Economics and Sustainability, 2(1), 2383. https://doi.org/10.36922/ghes.2383

Iheoma, C. G. (2024). Impact of fiscal policy shocks on health outcomes in Sub-Saharan Africa: A panel structural VAR approach. Global Health Economics and Sustainability, 2(4), 3454. https://doi.org/10.36922/ghes.3454

Ikpe, M., Agu, S. V., & Okwor, S. A. (2025). Health expenditure and economic growth in Sub-Saharan African countries: The role of governance quality. Review of Development Economics, 29(1), 145–168. https://doi.org/10.1111/rode.13158

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53–74. https://doi.org/10.1016/S0304-4076(03)00092-7

International Monetary Fund. (2018). Assessing fiscal space: An update and stocktaking (IMF Policy Paper). IMF.

Jakovljevic, M. (2015). BRIC's growing share of global health spending and their diverging pathways. Frontiers in Public Health, 3, 135. https://doi.org/10.3389/fpubh.2015.00135

Jakovljevic, M., & Getzen, T. E. (2016). Growth of global health spending share in low and middle income countries. Frontiers in Pharmacology, 7, 21. https://doi.org/10.3389/fphar.2016.00021

Jakovljevic, M., Sahoo, P. M., & Rout, H. S. (2025). Health expenditure and fiscal marksmanship before and during the coronavirus pandemic across the federal states of India. Global Health Economics and Sustainability, 3(3), 135–149. https://doi.org/10.36922/ghes.2920

Kose, M. A., Kurlat, S., Ohnsorge, F., & Sugawara, N. (2022). A cross-country database of fiscal space. Journal of International Money and Finance, 128, 102682. https://doi.org/10.1016/j.jimonfin.2022.102682

Kurowski, C., Evans, D. B., Tandon, A., Eozenou, P. H.-V., Schmidt, M., Irwin, A., Salcedo Cain, J., Pambudi, E. S., & Postolovska, I. (2023). From double shock to double recovery: Implications and options for health financing in the time of COVID-19 (HNP Knowledge Brief). World Bank.

Law, S. H., Ng, C. H., Kutan, A. M., & Law, Z. K. (2021). Public debt and economic growth in developing countries: Nonlinearity and threshold analysis. Economic Modelling, 98, 26–40. https://doi.org/10.1016/j.econmod.2021.02.004

Lopreite, M., Misuraca, M., & Puliga, M. (2023). An analysis of the thematic evolution of ageing and healthcare expenditure using word embedding: A scoping review of policy implications. Socio-Economic Planning Sciences, 87, 101600. https://doi.org/10.1016/j.seps.2023.101600

Pesaran, M. H. (2021). General diagnostic tests for cross-sectional dependence in panels. Empirical Economics, 60(1), 13–50. https://doi.org/10.1007/s00181-020-01875-7

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. Journal of Applied Econometrics, 22(2), 265–312. https://doi.org/10.1002/jae.951

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a time of debt. American Economic Review, 100(2), 573–578. https://doi.org/10.1257/aer.100.2.573

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. The Stata Journal, 9(1), 86–136. https://doi.org/10.1177/1536867X0900900106

Roy, R., Heuty, A., & Letouzé, E. (2007). Fiscal space for what? Analytical issues from a human development perspective. United Nations Development Programme.

Sharma, R. (2018). Health and economic growth: Evidence from dynamic panel data of 143 years. PLOS ONE, 13(10), e0204940. https://doi.org/10.1371/journal.pone.0204940

Tagem, A. M. E., Tapsoba, Y., & Barroy, H. (2025). Expanding budget space to improve health outcomes in low- and middle-income countries: What role for tax expenditures? Health Policy and Planning, czaf079. https://doi.org/10.1093/heapol/czaf079

Tandon, A., & Cashin, C. (2010). Assessing public expenditure on health from a fiscal space perspective (HNP Discussion Paper No. 56053). World Bank.

Wang, Y., Tao, C., & Xiong, Q. (2022). Government health expenditure, economic growth, and regional development differences—Analysis based on a non-parametric additive model. Frontiers in Public Health, 10, 925910. https://doi.org/10.3389/fpubh.2022.925910

Westerlund, J. (2007). Testing for error correction in panel data. Oxford Bulletin of Economics and Statistics, 69(6), 709–748. https://doi.org/10.1111/j.1468-0084.2007.00477.x

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics, 126(1), 25–51. https://doi.org/10.1016/j.jeconom.2004.02.005

World Bank. (2024). World Development Indicators [Data set]. World Bank. https://databank.worldbank.org/source/world-development-indicators

World Health Organization. (2024). Global Health Expenditure Database (GHED) [Data set]. WHO. https://apps.who.int/nha/database

Zhou, L., Ampon-Wireko, S., Asante Antwi, H., Xu, X., Salman, M., Antwi, M. O., & Afua, T. M. N. (2020). An empirical study on the determinants of health care expenses in emerging economies. BMC Health Services Research, 20, 774. https://doi.org/10.1186/s12913-020-05658-9