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Analysis of the Relationship Between Health Expenditure and Economic Growth in Egypt (2000-2022)

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تحليل العلاقة بين الانفاق على الصحة والنمو الاقتصادى فى مصر (2000-2022)

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Abstract

Achieving sustainable economic growth that promotes welfare is a major challenge for governments worldwide. Economic growth is influenced by various factors, with the accumulation of physical and human capital being key determinants. Among these, health plays a crucial role in impacting productivity through improved worker efficiency and reduced sick leave days. In Egypt, the healthcare system is facing challenges such as underfunding and high out-of-pocket payments. The aim of this study is to analyze the relationship between health expenditure and economic growth over the period 2000–2022. To determine the optimal lag length, the study employs time series methods, including unit root tests, the augmented Dickey-Fuller test, and the Akaike Information Criterion. The results indicate a significant short-run relationship between health expenditure and gross domestic product (GDP). The study concluded with policy recommendations emphasizing the importance of monitoring the progress of health sector reforms, particularly from the perspective of health expenditure. As the ongoing Universal Health Insurance (UHI) system rollout involves key changes in health financing arrangements, these changes could serve as a valuable avenue for future research.

Keywords: Economic growth, health expenditure, GDP, human capital

Introduction

Achieving sustainable economic growth that promotes economic welfare is one of the most significant challenges facing governments worldwide. The factors influencing economic growth are widely discussed in theoretical and empirical economic literature. Understanding these factors is essential, as economic growth forms the basis for increasing welfare. Among the key determinants of economic growth identified in economic theories is the accumulation of physical and human capital.

In this regard, health stands out as a key driver of growth, representing a fundamental aspect of human life that affects all dimensions of existence. For instance, good health and proper nutrition reduce incapacity, debility, and the number of sick leave days, which enhances overall productivity. Healthier workers are more productive, as they possess greater strength, creativity, and resilience. Furthermore, Sustainable Development Goal 3 calls on countries to ensure health for all by 2030, emphasizing achieving universal health coverage (Marinko & Sabina, 2015; United Nations Development Programme, 2017).

Accordingly, health economists and policymakers are interested in health based on the assumption that a healthy population is more productive than one that is sick. Fogel (1993), Barro and Sala (1995), and Barro (1996) were among the pioneers in exploring the relationship between economic growth and health, and their research subsequently led to a substantial body of work examining the link between growth and health. Moreover, many studies have examined the relationship between health expenditure and economic growth in various countries worldwide using different methods (Ramadan & Abed, 2015; Esen & Keçili, 2021).

In Egypt, the healthcare system is a complex combination of public, quasi-governmental, private, and NGO providers and payers. A significant challenge for the Egyptian health system is insufficient funding, with out-of-pocket payments traditionally exceeding those in most peer countries and other lower-middle-income nations. In 2019/2020, these payments accounted for 59.3% of the Current Health Expenditure (CHE), reflecting the financial burden on households (World Health Organization, 2023; Dinana et al., 2024).

Furthermore, the Egypt's Vision 2030 identifies the key factors influencing the population's health and outlines the optimal approach to implementing universal healthcare coverage. The Ministry of Health and Population (MoHP), in collaboration with the Ministry of Finance (MoF), is working to achieve the country’s health sector reform objectives as part of efforts to establish universal health coverage, which includes providing health services at all levels across the country and implementing universal health insurance to alleviate the burden of high out-of-pocket expenditures and enhance access to quality healthcare services (World Bank, 2020; World Health Organization, 2023).

On the one hand, various studies have explored the structure of the healthcare system and examined the implications of implementing Universal Health Coverage (UHC) from different perspectives. Additionally, several articles and official reports have assessed healthcare financing in Egypt, analyzing expenditure patterns from both governmental and household viewpoints (Fasseeh et al., 2022). On the other hand, to the best of the authors' knowledge, very few empirical studies have investigated the relationship between health expenditure and economic growth in Egypt during the period following the implementation of the Health Sector Reform Program (HSRP), launched in 1997 to achieve universal coverage for all citizens through high-quality basic health services. For instance, Ramadan and Abed (2015) analyzed this relationship over the period 1980–2010. Considering the significance of this issue, this paper aims at analyzing the relationship between health expenditure and economic growth in Egypt over the period 2000–2022. To this end, the impact of health expenditure on economic growth in Egypt is investigated using time series methods.

Additionally, variables such as household consumption per capita, trade, life expectancy at birth, and foreign direct investment (FDI) are included to further assess the influence of health expenditure on economic growth. The effects of these variables on economic growth are also analyzed.

This study consists of five main sections, excluding the introduction. The first section introduces the theoretical framework and literature review. The second section analyzes the financing of the health system in Egypt. The third section describes the methodology adopted. Further, the fourth section presents the empirical results and analysis. Finally, the fifth section presents conclusions and some policy recommendations.

Literature Review

Over the past few decades, research investigating the relationship between health expenditure and economic growth has increased significantly. These studies have produced mixed results, utilizing various methods. This section reviews both theoretical and empirical studies on this issue.

Theoretical Background

Economic growth is defined as an increase in the economy's output of goods and services. Economic growth is measured by the increase in real gross domestic product (GDP), whether in total or on a per capita basis.

Various economic models are used to analyze and determine the factors driving economic growth. Among these, the neo-Keynesian model (developed by Evsey Domar and Roy F. Harrod) and the neoclassical model (developed by Robert Solow) are considered the key ones (Boyko et al., 2019).

The literature indicates that Mankiw et al. (1992) expanded the Solow Model, which initially included only physical capital, to incorporate human and physical capital accumulation. They emphasized the importance of human capital, referring to the possibility that its exclusion could lead to incorrect conclusions. In other words, including human capital may alter either the theoretical modeling or the empirical analysis of economic growth (Esen & Keçili, 2021).

Moreover, the augmented Solow Model is a foundational empirical framework for analyzing economic growth. It identifies four key determinants: initial income, the accumulation rates of human and physical capital, and population growth. These determinants are represented through metrics such as the ratio of real investment to GDP, the average years of education, and demographic factors like life expectancy, the labor force-to-population ratio, and population growth (Moral-Benito, 2009).

However, Hagemann (2009) explained that the first wave of interest in growth theory, shaped by the contributions of Harrod and Domar, emerged as a by-product of John Maynard Keynes's General Theory. The second wave of interest in growth theory emerged with the development of the neoclassical model by Robert Solow (1956, 1957) and Trevor Swan (1956), following earlier contributions from Jan Tinbergen (1942) and James Tobin (1955).

Exogenous and Endogenous Models

More specifically, the theoretical economic growth literature is divided into exogenous and endogenous models. On the one side, exogenous growth models, introduced by Solow, propose that productivity growth is driven by direct investment, population growth, and technological progress. While investment and population growth affect output levels, only technological progress influences long-term growth rates, explaining productivity differences among nations. On the other hand, endogenous growth theorists build on this idea by asserting that capital investment can achieve increasing returns to scale when directed toward innovative activities, such as investments in intellectual and innovative capital. Additionally, another category of endogenous growth models has

expanded on this concept by incorporating factors that influence capital efficiency, including real interest rates, fiscal policy, inflation, and real exchange rates (Chirwa et al., 2018).

The Importance of Human Capital

Pelinescu (2015), Marinko, and Sabina (2015), along with many other theoretical and empirical studies, confirmed that human capital is considered one of the most important factors that affect economic growth through its significant impact on production via labor productivity. Esen and Keçili (2021) noted that the health-led growth hypothesis views health as a form of capital, emphasizing that health investment enhances productivity, income per capita, and economic growth. Further, when Romer (1986) introduced the 'endogenous growth model'—mentioned above—in the 1980s, he asserted that an educated, healthy, and skilled labor force is more efficient and better equipped to utilize technology productively.

Furthermore, Sarwar et al. (2021) explained that human capital has been defined in various ways in literature. These definitions often include health, education, knowledge, migration, training, and other investments in labor that can enhance labor productivity, thereby contributing to a country's gross domestic product (GDP).

Health as a Key Driver of Economic Growth

Marinko and Sabina (2015) revealed that various concepts are commonly used as proximate determinants of human capital in economic growth theories. In this regard, while the traditional approach measures human capital based on educational attainment, it has disadvantages. As a result, other factors have been identified as key determinants of human capital in economic growth theories, such as the quality of formal and informal education, health and nutrition, labor market structure, institutions, culture, and geography.

Moreover, in their study, Esen and Keçili (2021) explained that among all these different determinants influencing economic growth, health stands out as a primary driver. In other words, the health levels of a population affect both the domestic product and welfare. In addition, they discussed the health-led growth hypothesis, which views health as a form of capital. This hypothesis suggests that investments in health lead to increased productivity, which, in turn, drives higher income per capita and economic growth.

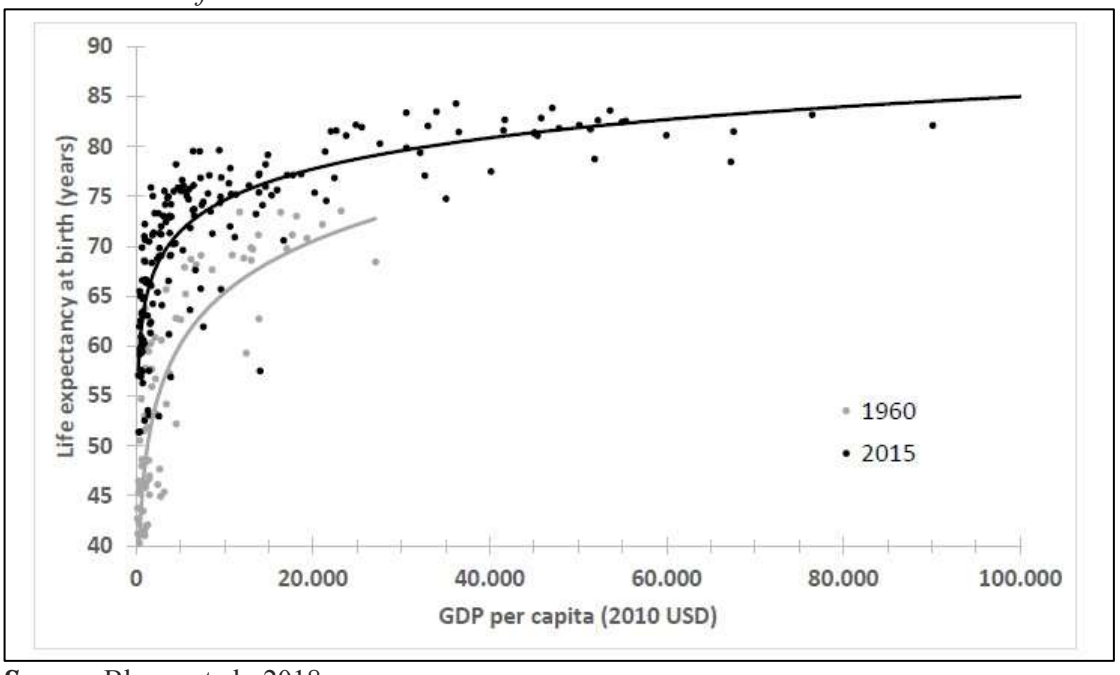
Further, Malak and Arshad (2024) emphasized that barriers such as high healthcare costs, insufficient insurance coverage, and inadequate infrastructure limit access to essential services. They explained that according to the World Bank, many individuals still face challenges getting basic healthcare needs, as poor health hinders children and adults from performing effectively. In this respect, improving healthcare systems can be driven by economic factors like enhanced human capital, which play a crucial role in promoting overall economic growth.

Marinko and Sabina (2015) emphasized the importance of good health and nutrition in increasing workforce productivity. They explained that health status and nutrition data provide a broader and more realistic perspective on the proximate determinants of human capital. They explained that the suitable health indicators that can be used in measuring economic growth include public health expenditures as a percentage of GDP, life expectancy at birth, infant survival rates, and other relevant variables. In addition, a combination of education and health indicators can be utilized to create a more accurate proxy for human capital. For instance, Qadri and Waheed (2011) propose a health-adjusted education indicator calculated by multiplying primary-level enrollment rates by health expenditures as a percentage of GDP.

Bloom et al. (2018) reveal that the data demonstrate a clear positive correlation between health and GDP, commonly referred to as the "Preston curve" (Preston, 1975). Countries with higher health statuses generally exhibit higher income levels than those with poorer health. Figure 1 illustrates the Preston curve, based on available data for life expectancy at birth and real per capita GDP in 2010 US dollars from 2015 to 1960. The figure highlights a consistent positive relationship between health and income across countries in both years, along with significant increases in life expectancy and income from 1960 to 2015.

Figure 1

Preston curves for 1960 and 2015



Source: Bloom et al., 2018.

Most importantly, Bloom et al. (2018) explain that the relationship between health and economic growth is still in its early stages. In their study, the authors explain that the various economic and social pathways through which health affects economic growth and the reverse causal relationship where economic prosperity fosters better health make it difficult to fully describe this relationship. Furthermore, factors like technological progress and institutional improvements contribute to both population health and economic growth, complicate the issue, and create challenges for developing theoretical models and empirical analysis. They also emphasized that the argument for a positive impact of health on economic growth is strongest in less developed and post-demographic transition countries[1]For instance, in less developed countries, even low-intensity health interventions can strongly impact the health of the working-age population, where health status is initially low. They also concluded that the growing inequality in the distribution of health gains should be the main focus of concern rather than the amount of health expenditure.

Empirical Literature

1 Kaneko and Sato (2013) mentioned that there are many examples of using the word “post-demographic transition. They defined this phase as "an age of downsizing in the population-economic-social system as a whole". They explained that the concept of the “post-demographic transitional phase” has evolved. It is no longer seen as a stage of equilibrium but rather as a new phase marked by continuous population decline, below-replacement fertility, and an extremely aging population—conditions humanity has never encountered before.

The relationship between economic growth and health expenditure has been investigated using various methods. The results of these studies demonstrate that this relationship varies based on the conditions and characteristics of the related country (Esen; Keçili, 2021).

In general, there is no common conclusion, especially when investigating short-run and long-run causality, to analyze the relationship between health expenditure and economic growth. By evaluating the long-run and short-run causality for the confirmation of the relationship between healthcare spending and economic growth, there is no common result in the existence and direction of the causality in studies. The differences in results may stem from variables, specific reasons of countries, or methods. Thus, it is important to use the proper variables and methods for the related countries to get reliable results. Esen and Keçili (2021) investigated the impact of health expenditure on economic growth in Turkey over the period 1975-2018. The results of the study confirmed the existence of a long-run relationship among all the variables analyzed, including GDP per capita, health expenditure per capita, household consumption per capita, life expectancy at birth, trade, and FDI. The long-run findings suggest that health expenditure, along with the other variables, plays a crucial role in sustaining economic growth. Furthermore, the causality test results indicate a unidirectional causality between health expenditure and economic growth in Turkey in the short run.

Niu et al. (2021) mention that universal health coverage in China covers nearly 95% of the population. In general, medical reform has started in 2009. The study defined economic growth as GDP per capita and public health as health expenditure. Using the panel threshold regression model (PTRM) and a linear regression model, the study concluded that over the period 2000 to 2017, economic growth in China resulted in an increase in health expenditures, and it also has a significant threshold effect[2] on public health. In this respect, the study reveals that the threshold effect is heterogeneous at the regional level, and it differs among the 30 provinces in the country. In general, the provinces are divided into three regions: eastern China, which enjoys a high level of economic growth, while central China and western China are least developed from an economic growth perspective. However, there is no threshold effect in the eastern region, while economic growth thresholds in the central region are 9.595 and in the western region is 9.448. As a result, when economic growth exceeds these thresholds, the effect of economic growth on public health will increase.

In this respect, Fan et al. (2024) explained that successful health insurance programs help reduce economic burdens by lowering out-of-pocket expenses in cases of illness. Furthermore, health insurance encourages consumption by minimizing uncertainty about illness and the need to save for potential health-related expenses. In addition, health insurance affects the productivity of the workforce, as illness negatively reduces productivity. In their study, Fan et al. (2024) applied meta-analysis to analyze the relationship between health insurance and economic performance; the study extracted 479 effect sizes from the 34 empirical studies. However, the study reveals that there is a strongly positive correlation between the two variables. The correlation coefficient between health insurance and economic performance was 0.429, with a 95% confidence interval of (0.381, 0.475). In this respect, the study confirmed that health insurance influences economic growth positively.

Moreover, Sarwar et al. (2021) investigated the effects of financial development and human capital on economic growth in 83 emerging countries worldwide over the period from 2002 to 2017. In their study, they employed the two-step system generalized method of moments within the endogenous growth model, accounting for both time and country-specific effects. The study concluded that both

2 The term "threshold effect" means an effect in a dependent variable that does not occur until a certain level, or threshold, of an independent variable is reached. For example, a drug may have no effect at all until a certain dosage level (the threshold value) is reached.

financial development and human capital have a positive impact on economic growth in these countries.

In addition, many studies concentrated on the relationship between health insurance and economic growth, and most of these studies confirmed that health insurance positively affects economic growth and social human capital and promotes sustainable economic development.

Ramadan and Abed (2015) conducted an empirical study to examine the direction of Granger causality between health expenditure and economic growth in Egypt over the period 1980–2010. Using annual data for real per capita health expenditure and real per capita GDP, the study employed the Johansen-Juselius cointegration test, which revealed that the variables are cointegrated. This finding indicates the existence of a unique long-run equilibrium relationship between health spending and income in Egypt. To further explore the causality, the study utilized a Vector Error Correction Model (VECM). The results indicated a one-way directional relationship in the short run, running from real GDP per capita to real health expenditure per capita. In contrast, the long-run analysis revealed a one-way directional relationship running from real health expenditure per capita to real GDP per capita.

To conclude, considering the differing conditions across countries, the literature emphasizes the significant relationship between health expenditure and economic growth. Health investments improve labor productivity, positively impacting economic performance. The health-led growth hypothesis highlights health as a form of capital that drives economic growth through improved health outcomes. Overall, increasing health expenditure is crucial for promoting sustainable economic development. In addition, most studies have concluded that the relationship between health insurance and economic growth is increasingly recognized as significant. Health insurance reduces economic burdens by lowering out-of-pocket expenses and encouraging consumption, as it reduces the uncertainty of catastrophic health-related costs. Additionally, it increases workforce productivity by minimizing the negative impact of illness on work efficiency.

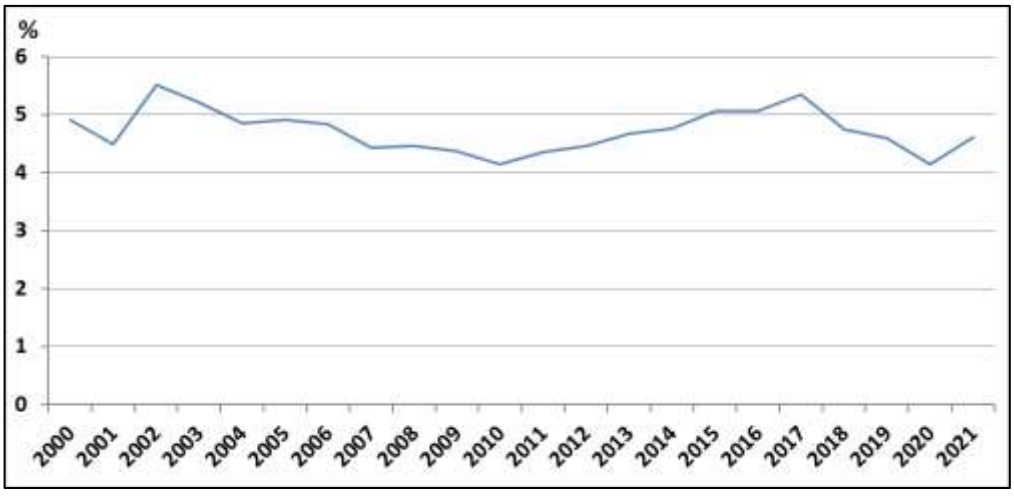
Financing Health System in Egypt

National Health Accounts (2023) indicate that for the fiscal year 2019/2020, Egypt's current health expenditure (CHE) is estimated at EGP 255.6 billion, or EGP 2,560 per capita, accounting for 4.6% of GDP as shown in Figure 2. Only a relatively small portion of CHE (1.5%) is directed toward preventive services.

In addition, total health expenditure (THE), which includes both CHE and capital formation, is estimated at EGP 271.4 billion, or EGP 2,718 per capita, representing 4.9% of GDP. From 2000 to 2020, CHE increased at an average annual rate of 4.1% in real terms, adjusting for inflation. Moreover, the trend in capital formation has shown steady growth over the past decade, both in current EGP and constant EGP, as well as in relation to total government health expenditure. By 2019/2020, capital investment accounted for 17%, and it further increased to nearly 21% in the fiscal year 2020/2021, reflecting the government's ongoing commitment to investing in the health system (World Development Indicators, 2024; World Health Organization, 2023).

Figure 2

Current Health Expenditure - % GDP (2000–2021)



Source: Prepared by authors based on World Development Indicators, 2024.

Further, Egypt's current General Government Health Expenditure from domestic sources (GGHE-D) represents 1.5% of GDP. This share is relatively lower compared to many similar countries and peer groups, such as other lower-middle-income nations or countries within the World Health Organization's (WHO) Eastern Mediterranean Region.

However, the first source of health financing is households' out-of-pocket payments, which constitute the largest source of health system financing, amounting to approximately EGP 151.6 billion, representing 59.3% of Current Health Expenditure (CHE) and 55.9% of total Health Expenditure (THE). In other words, out-of-pocket payments constitute over half of THE in Egypt. These payments are largely dependent on households' financial capacity, highlighting the direct burden of medical expenses borne at the time of care. Moreover, 20% of Egyptians experience catastrophic health expenditures (Fasseeh et al., 2022; World Health Organization, 2023).

The second-largest source of health financing is General Government Health Expenditure (GGHE), which includes domestic government revenue allocated to health, foreign-origin transfers managed by the government, and social contributions. The GGHE contributes approximately EGP 84 billion, or 33% of CHE. In general, GGHE-D in Egypt is comparatively lower than in these reference countries.

In addition to revenues from out-of-pocket payments and GGHE-D, other significant sources of financing include voluntary prepayments, public corporations, non-governmental organizations (NGOs), and direct foreign transfers (World Health Organization, 2023).

In light of the above-mentioned, the main challenges facing healthcare financing can be summarized as follows:

- The system is primarily funded through out-of-pocket payments, making it largely inequitable, as the financial burden of healthcare disproportionately affects the poor. Further, Out-of-pocket payments as a share of CHE are significantly higher than those in many peer countries, including other lower-middle-income nations and countries within the WHO's Eastern Mediterranean Region.
- Although the level of General Government Health Expenditure from domestic sources (GGHE-D) in Egypt has grown steadily, when adjusted for inflation and demographic growth,

government health funding per capita has shown little significant increase over the past decade (World Health Organization, 2023). Most importantly, around one-third of total health expenditure (THE) in Egypt is allocated to pharmaceuticals. While the government plays a significant role in pharmaceutical spending, it has consistently aimed at reducing public funding for medicines, thereby increasing private out-of-pocket expenditures. This approach has further exacerbated the financial burden on citizens (Fitch, 2023; Dinana et al., 2024).

- The primary source of health funding that can help reduce out-of-pocket payments is domestic general government health expenditure (GGHE-D). In this regard, increasing (GGHE-D) is recommended. Especially since the share of (GGHE-D) is relatively low compared to many similar countries and peer groups, such as other lower-middle-income nations or countries within the World Health Organization's (WHO) Eastern Mediterranean Region, but this increase is a complicated issue. For instance, recent reform initiatives, such as the presidential public health campaigns and the implementation of the Universal Health Insurance (UHI) system, are expected to enhance the prioritization of health in government spending, thereby increasing government health expenditure as a share of both general government expenditure (GGE) and GDP. In this respect, the effect of increasing the prioritization of health in government expenditure should be approached with caution. Since the compulsory prepayments made by UHI members will be included under GGHE-D, the net impact of increasing government health expenditure on the one hand, and funding through UHI contributions on the other, as it may result in either an increase or stagnation in GGHE-D (World Health Organization, 2023).

Methodology and Data Source

As discussed earlier in the literature, various models illustrate the positive impact of human capital on economic growth. This study aims at analyzing the relationship between health expenditure and economic growth in Egypt. In this context, economic growth and health expenditure are used as proxy variables for human capital. The study tests the following hypothesis: "There is a significant positive relationship between health spending and economic growth in the short run".

The study adopts a model similar to the one explored by Esen and Keçili (2021) with modifications to make it suitable for the Egyptian context. The model can be represented as follows:

$$GDP\ per\ capita = \alpha + \beta\ (health\ expenditure\ per\ capita) + \lambda\ (life\ expectancy) + \delta\ (household\ consumption\ per\ capita) + \xi\ (trade) + \lambda\ (FDI) + \varepsilon_t$$

The model's coefficients are represented by α, β, λ, δ, ξ, and λ. Furthermore, equation (1) demonstrates the significance of human capital accumulation, economic growth, and health expenditure serving as proxy variables for human capital. Table 1. Provides a description of the variables used in the study.

Regarding variable descriptions: GDP is gross domestic product per capita (logged); the dependent. Independent variables are Health, which refers to Health expenditure per capita (logged). Life means life expectancy at birth. Cons are household consumption per capita (logged). Trade stands for trade as a percentage of GDP. Further, FDI refers to foreign direct investment (logged), and *t* is the time from 2000 to 2022.

Table 1
Variable descriptions

Variable	Definition
GDP	Gross domestic product per capita (logged)
Health	Health expenditure per capita (logged)
Life	Life expectancy at birth
Cons	Household consumption per capita (logged)
Trade	Trade as a percentage of GDP.
FDI	Foreign direct investment (logged)

Source: Prepared by authors.

The study uses annual data for Egypt covering the period from 2000 to 2022. The data were taken from the OECD and World Development Indicators (WDI). In this regard, the exclusion of years prior to 2000 is due to data limitations in the health sector in Egypt. Specifically, data on the health sector, as sourced from the World Development Indicators (WDI), was unavailable before 2000. The early 2000s marked a shift toward greater focus on developing comprehensive developmental indicators, including those for health, coinciding with the launch of international agendas such as the Sustainable Development Goals (SDGs), adopted in 2000. Additionally, health sector reforms in Egypt began in 1997, which makes data preceding this period less relevant for analyzing the program's outcomes.

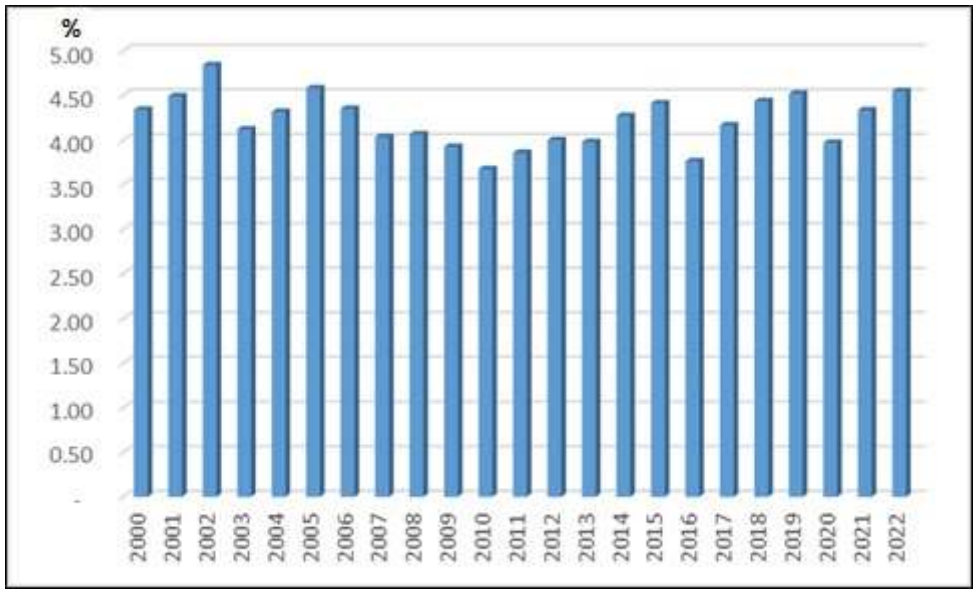
This study incorporates health as a key indicator of human capital, using life expectancy at birth as a common proxy for health in related research. Health expenditure and life expectancy at birth are key parameters in this analysis. In addition, various studies highlight the influence of human capital and trade as significant determinants of economic growth, with this study also emphasizing trade's economic impact. Household final consumption, representing the largest share of GDP's final uses, is included as a critical variable for economic demand analysis. Additionally, FDI is considered an essential control variable to assess the impact of health expenditure on growth[3] (Esen & Keçili, 2021).

Figure 3. shows health expenditure per capita (% of GDP) over the period 2000–2022. According to Egypt National Health Accounts (2019/2020), CHE per capita (in real terms) grew at an average rate of 1.4% per year. In this respect, population growth has exceeded the growth of CHE, leading to negative growth in CHE per capita since 2017 (World Development Indicators, 2024; World Health Organization, 2023).

3 Variable descriptions, indicators, data sources and the indicators of health expenditure (Logged data) are explained in table 1 and table 2 in the annex.

Figure 3

Health expenditure per capita - % of GDP (2000-2022)

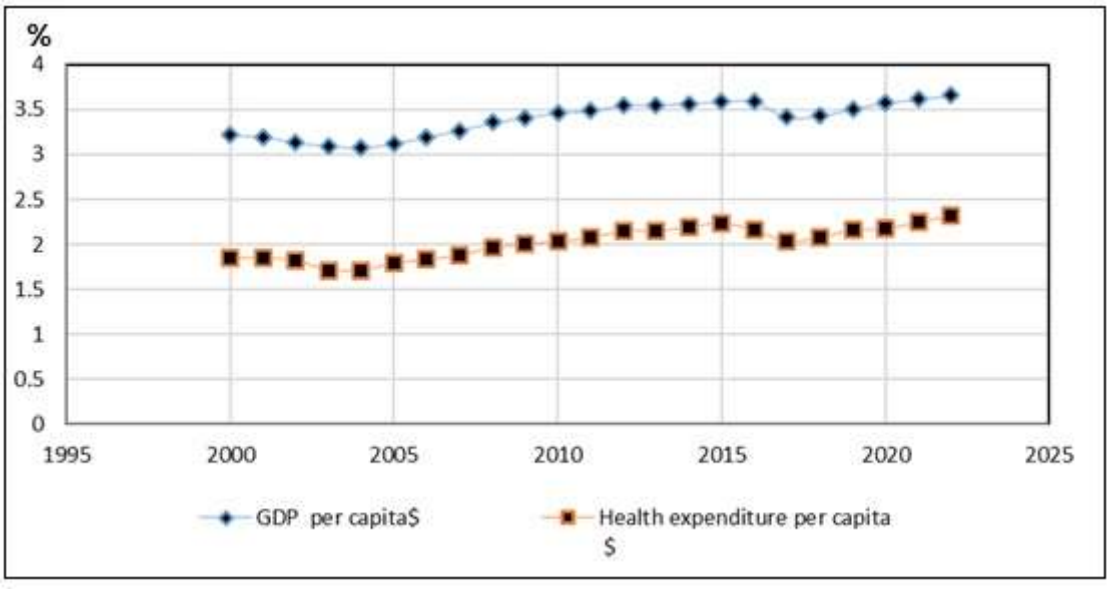


Source: Prepared by authors based on OECD, 2024 and World Development Indicators, 2024.

Moreover, figure 4 demonstrates a general upward trend in GDP per capita over the period 2000–2022, reflecting consistent economic growth. However, the growth rate appears relatively stable, with some fluctuations. Similarly, health expenditure per capita shows an upward trend, indicating an increase in healthcare spending. The data suggests a positive correlation between GDP and health expenditure, meaning that as GDP increases, health expenditure tends to rise as well.

Figure 4

GDP & Health expenditure per capita (2000 – 2022)



Source: Prepared by authors.

Empirical Results and Analysis

In this study, time series analysis is used to investigate the relationship between health expenditure and economic growth in Egypt. For this purpose, the unit root test was first used to control the stationarity of the series. If a probability distribution of a series is constant over time, the series is accepted as stationary. Dickey and Fuller (1979, 1981) developed the augmented Dickey-Fuller (ADF) test, which is mostly used as a unit root test. This test uses a parametric approach, and the Dickey-Fuller (DF) approach was developed. The ADF test determines the presence of unit root in series by performing the ordinary least squares (OLS) estimator. The stationarity test results of the variables are shown in Table 2. The test results indicate the level and trend with intercept types of variables. The results of the stationarity test for all variables at level 1 show that the variables which are used in the econometric model are non-stationary. In the second stage, the null hypothesis of unit root is rejected; in other words, the second difference results of all variables are stationary, and the series are integrated of order 2.

Table 2

Augmented Dickey-Fuller test Result

Variable	Level		1st difference		2nd difference	
	Trend and intercept	Probability	Trend and intercept	Probability	Trend and intercept	Probability
GDP	0.0564	-3.607	-3.35	0.0859	-5.44	0.0015
Health	0.2504	-2.687	-3.17	0.1173	-4.49	0.0109
Life	0.2969	-2.566	-3.10	0.1316	-3.42	0.0339
Cons	0.0438	-3.746	-3.14	0.1242	-3.21	0.0115
Trade	0.0302	-3.949	-3.35	0.1025	-3.11	0.0107
Fdi	0.0827	-3.369	-3.85	0.0349	-3.14	0.0150

Source: Prepared by authors based on E-views statistical package.

Selection of the optimal lag number is necessary to analyze the determination of the existence of cointegration. The ongoing issue is to determine the optimal lag length criteria for a VAR. The optimal lag length result is shown in Table 3. There is more than one selection criterion in the table. Akaike information criteria (AIC) are applied to select the optimal lag length. According to AIC, the optimal lag length is 2. As a result, this analysis is limited to the short runs[4].

Table 3

Optimal lag length selection

Lag	AIC	HQ	SC	FBE
1	49.59177	49.65654	49.89021	1.39E+14
2	42.06646	42.51983	44.1555	8.78E+10
3	37.50870*	38.35068*	41.38836*	2.75e+09*

* Significant at the 0.05 level.

Source: by the authors based on E-views statistical package.

4 Short-Run Impact: In time series analysis, the short-run refers to the immediate and direct impact of a past value of the series on the current value. In this table, we observe that the criteria improve significantly from Lag 1 to Lag 2 and then a little less from lag 2 to lag 3. This would mean that the value of the time series in the current period is significantly affected by the two previous values (periods), and slightly less with the values that are 3 periods in the past.

Table 4. presents the correlation coefficients (R), R-squared values (R^2), F-statistics, and p-values for the relationship between GDP and five other variables: Health, Life, Co, Trade, and FDI. It shows the relationships between study variables (all variables with GDP):

- Health: The correlation coefficient (R) between GDP and health is 0.64, indicating a moderately positive correlation. The R-squared value (R^2) of 0.409 suggests that 40.9% of the variation in Health can be explained by GDP. The F-statistic of 13.165 and p-value of 0.002 indicate that the relationship between GDP and Health is statistically significant.
- Life: The correlation coefficient (R) between GDP and Life is 0.205, indicating a weak positive correlation. The R-squared value (R2) of 0.042 suggests that only 4.2% of the variation in Life can be explained by GDP. The F-statistic of 0.830 and p-value of 0.374 indicate that the relationship between GDP and Life is not statistically significant.
- Cons: The correlation coefficient (R) between GDP and Cons is 0.088, indicating a very weak positive correlation. The R-squared value (R2) of 0.008 suggests that only 0.8% of the variation in Cons can be explained by GDP. The F-statistic of 0.150 and p-value of 0.703 indicate that the relationship between GDP and Cons is not statistically significant.
- Trade: The correlation coefficient (R) between GDP and Trade is 0.522, indicating a moderate positive correlation. The R-squared value (R2) of 0.272 suggests that 27.2% of the variation in Trade can be explained by GDP. The F-statistic of 7.104 and p-value of 0.015 indicate that the relationship between GDP and Trade is statistically significant.
- FDI: The correlation coefficient (R) between GDP and FDI is 0.285, indicating a weak positive correlation. The R-squared value (R2) of 0.081 suggests that only 8.1% of the variation in FDI can be explained by GDP. The F-statistic of 1.677 and p-value of 0.211 indicate that the relationship between GDP and FDI is not statistically significant.

Table 4

Relations between study variables (All variables with GDP)

	R	R^2	F	Probability
Health	0.64	0.409	13.165	0.002
Life	0.205	0.042	0.830	0.374
Cons	0.088	0.008	0.150	0.703
Trade	0.522	0.272	7.104	0.015
FDI	0.285	0.081	1.677	0.211

Source: Prepared by authors based on E-views statistical package.

The paper concludes that the results of the regression test indicate that GDP exhibits a statistically significant relationship with health expenditure and trade in the short run, which is consistent with expectations in economic theory. In other words, as discussed in the literature, the results of the study align with endogenous growth models, which emphasize the role of human capital and capital investment, particularly in the health system. These findings, therefore, support the view that such investments significantly contribute to economic growth. Figure 5. shows the relationship between GDP & health expenditure.

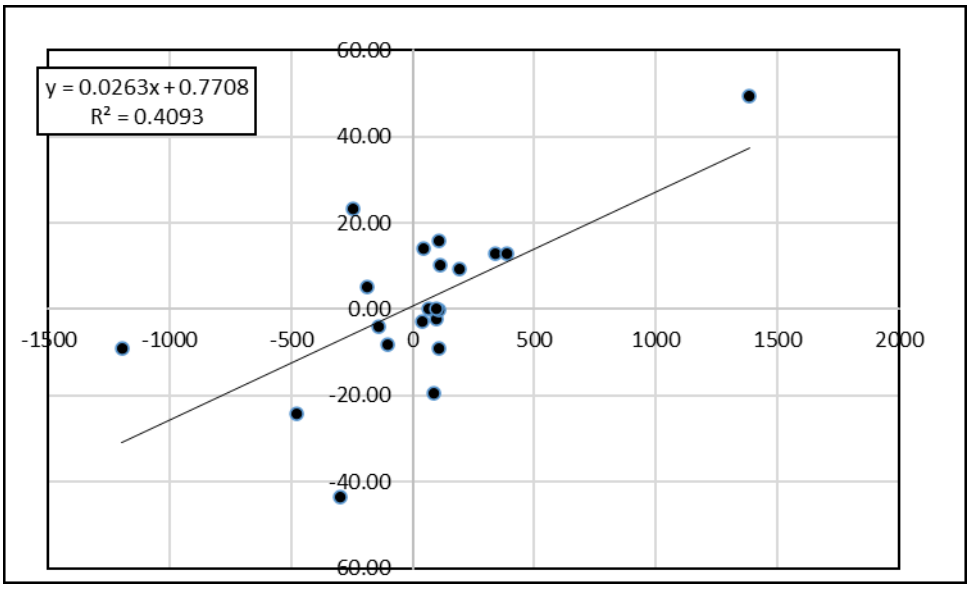
In contrast, the relationships between GDP and life expectancy, consumption, and FDI are weak or statistically insignificant, suggesting that these variables may be influenced by factors other than GDP. The statistically insignificant relationship between consumption and GDP, in particular, contradicts theoretical expectations, emphasizing the complexity of the economic growth process and the need to explore additional determinants, including social, institutional, and policy factors. In this

context, the inclusion of additional variables could further influence these relationships. For instance, factors such as investment, government spending, exports, and other economic indicators may play a significant role in determining the relationship between consumption and GDP.

Moreover, this complexity is further emphasized by the results for these dependent variables. In this regard, the difference is significant results before (0.000) and after (0.703); taking the second difference is both statistically logical and expected. It reflects the fact that the relationship between variables may differ before and after differencing and that the differencing process is necessary to address non-stationarity in time series data, removing trends and cyclical fluctuations. This enables a more accurate analysis of the relationship between variables.

Figure 5

Relationship between GDP & health expenditure



Source: Prepared by authors based on E-views statistical package.

Conclusions and Policy Recommendation

This study empirically examines the relationship between economic growth and health expenditure using a time series dataset for Egypt. The analysis begins with unit root tests, specifically the augmented Dickey-Fuller (ADF) test, to assess the stationarity of the series. The optimal lag length is determined using the Akaike Information Criterion (AIC), which identifies a lag length of 2. Correlation coefficients, R-squared values, F-statistics, and p-values are utilized to analyze the relationship between GDP and key variables. The results reveal a significant short-run relationship between GDP and health expenditure, as well as between GDP and trade, consistent with economic theory. Conversely, the short-run relationships between GDP and other variables, including life expectancy, consumption, and FDI, are found to be statistically insignificant, suggesting that these variables may be influenced by factors beyond GDP. In this regard, incorporating additional variables may affect the relationship between these factors and GDP, as previously discussed.

The results of this study present important policy implications. It confirms that health plays a vital role in driving economic growth by enhancing productivity, income levels, and overall welfare. In general, investments in health, including health insurance, are widely acknowledged as a form of human capital that fosters sustainable economic development. However, health expenditure is

regarded as one of the most important factors influencing economic growth in Egypt in the short run. Therefore, the study provides the following recommendations for policymakers:

Egypt's healthcare system remains heavily reliant on out-of-pocket payments. While out-of-pocket expenditures have recently declined, further reductions are still critical. In this context, the strong correlation between household out-of-pocket payments and government health expenditure (GGHE-D)—where an increase in one typically leads to a decrease in the other—should be carefully considered.

On the one hand, GGHE-D represents the second-largest component of health financing in Egypt, yet its percentage of GDP remains relatively low compared to many peer countries. On the other hand, increasing government budget allocations to health, though important, is not a sufficient solution to address the issue. As mentioned earlier, the net effect of increasing government health expenditure, combined with the flow of funding through UHI contributions, on GGHE-D may not always be positive. Therefore, evaluating the impact of implementing UHI on various components of health expenditure is essential. In general, monitoring the progress of health sector reforms, particularly with regard to health expenditure in the coming years, is of great importance.

Furthermore, several other challenges must be considered. For instance, since a relatively small share of current health expenditure is directed toward preventive care, prioritizing funding in this area is crucial.

Finally, reducing the high proportion of healthcare spending allocated to pharmaceuticals remains a critical challenge in improving efficiency and overall healthcare outcomes.

Future Research

The analysis highlights statistically significant relationships between GDP and certain variables, such as health expenditure and trade. However, it is important to emphasize that this study does not test for causality. The results reflect statistical relationships between GDP and the other variables but do not provide insights into the direction of influence. Establishing causality requires additional analyses, such as a Granger causality test or cointegration analysis, which were not conducted in this study due to data limitations. These aspects could serve as promising avenues for future research.

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Appendix

Table 1

Indicators of health expenditure

Year	GDP per capita$	Health expenditure per capita $	Life expectancy at birth years	Household consumption per capita $	Trade % GDP	FDI B $
2000	1636.75	71.04	68.007	1979.515	39.02	1.24
2001	1566.20	70.37	68.308	2016.439	39.81	0.51
2002	1355.28	65.59	68.564	2014.220	40.99	0.65
2003	1252.40	51.60	68.402	2018.477	46.18	0.24
2004	1195.60	51.60	68.613	2019.376	57.82	1.25
2005	1331.36	60.99	68.779	2075.315	62.95	5.38
2006	1563.74	68.03	68.977	2166.296	61.52	10.04
2007	1862.16	75.13	69.128	2271.794	65.08	11.58
2008	2271.23	92.33	69.319	2355.401	71.68	9.49
2009	2578.88	101.22	69.48	2440.638	56.55	6.71
2010	2922.80	107.42	69.664	2490.110	47.94	6.39
2011	3077.34	118.70	69.88	2570.497	45.26	0.48
2012	3569.48	142.76	70.085	2675.893	40.71	2.8
2013	3583.85	142.60	70.052	2701.878	40.37	4.19
2014	3705.47	158.21	70.415	2755.304	36.92	4.61
2015	3933.93	173.52	70.483	2778.197	34.85	6.93
2016	3862.01	145.28	70.844	2847.365	30.25	8.11
2017	2592.71	107.99	71.302	2908.208	42.83	7.41
2018	2710.16	120.22	71.367	2886.056	45.91	8.14
2019	3214.30	145.31	71.358	2878.738	41.12	9.01
2020	3802.44	150.91	70.99	3037.600	32.13	5.85
2021	4145.94	179.68	70.221	3172.919	29.86	5.12
2022	4587.17	208.68	70.159	3210.129	36.98	11.4

Source: OECD, 2024; World Development Indicators, 2024.

Table 2

Indicators of health expenditure (Logged data)

Year	GDP per capita$	Health expenditure per capita $	Life expectancy at birth years	Household consumption per capita $	Trade % GDP	FDI B $
2000	3.213983	1.851477	68.007	3.296559	39.02	0.093422
2001	3.194847	1.847375	68.308	3.304585	39.81	-0.29243
2002	3.132028	1.816817	68.564	3.304107	40.99	-0.18709
2003	3.097744	1.712655	68.402	3.305024	46.18	-0.61979
2004	3.077585	1.712651	68.613	3.305217	57.82	0.09691
2005	3.124296	1.785271	68.779	3.317084	62.95	0.730782
2006	3.194164	1.832704	68.977	3.335718	61.52	1.001734
2007	3.270018	1.875806	69.128	3.356369	65.08	1.063709
2008	3.356261	1.965342	69.319	3.372065	71.68	0.977266
2009	3.411432	2.005258	69.48	3.387503	56.55	0.826723
2010	3.465799	2.031081	69.664	3.396219	47.94	0.805501

2011	3.488176	2.074437	69.88	3.410017	45.26	-0.31876
2012	3.552605	2.154605	70.085	3.427469	40.71	0.447158
2013	3.55435	2.154112	70.052	3.431666	40.37	0.622214
2014	3.568843	2.199222	70.415	3.44017	36.92	0.663701
2015	3.594826	2.239348	70.483	3.443763	34.85	0.840733
2016	3.586814	2.162199	70.844	3.454443	30.25	0.909021
2017	3.413753	2.033377	71.302	3.463625	42.83	0.869818
2018	3.432995	2.079988	71.367	3.460305	45.91	0.910624
2019	3.507087	2.162296	71.358	3.459202	41.12	0.954725
2020	3.580062	2.178708	70.99	3.482531	32.13	0.767156
2021	3.617623	2.254503	70.221	3.501459	29.86	0.70927
2022	3.661545	2.319481	70.159	3.506523	36.98	1.056905

Source: Prepared by authors based on OECD, 2024 and World Development Indicator, 2024.

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تحليل العلاقة بين الإنفاق على الصحة والنمو الاقتصادي في مصر (2000-2022)

المستخلص

يمثل تحقيق استدامة النمو الاقتصادي وتعزيز الرفاهية الاقتصادية تحديًا كبيرًا أمام الحكومات في جميع دول العالم. ويُعد تراكم رأس المال المادي والبشري من المحددات الأساسية للنمو الاقتصادي. في هذا السياق، تلعب الصحة دورًا محوريًّا باعتبارها أحد مكونات رأس المال البشري، حيث تؤثر في الإنتاجية من خلال تحسين كفاءة العمال وتقليص أيام الإجازات المرضية. ويواجه النظام الصحي في مصر تحديات كبيرة، مثل نقص التمويل وارتفاع حجم الإنفاق الصحي من الجيب. وتهدف هذه الدراسة إلى تحليل العلاقة بين الإنفاق الصحي والنمو الاقتصادي خلال الفترة من 2000 إلى 2022. وقامت الدراسة باستخدام تحليل السلاسل الزمنية، بما في ذلك اختبارات جذر الوحدة (Unit root tests) واختبار ديكي- فولر الموسع Augmented Dickey-Fuller (test) ومعيار أكايكي للمعلومات (Akaike Information Criterion). وخلصت نتائج الدراسة إلى وجود تأثير معنوي بين الإنفاق الصحي والناتج المحلي الإجمالي في الأجل القصير. وختامًا توصي الدراسة بضرورة مراقبة تقدم الإصلاحات في قطاع الصحة من منظور الإنفاق الصحي، نظرًا لأن تطبيق نظام التأمين الصحي الشامل من المتوقع أن يُحدث تغييرات جوهرية في آليات تمويل الرعاية الصحية، وتمثل تلك التغييرات المتوقعة آفاقًا واسعة للأبحاث المستقبلية.

الكلمات الدالة: النمو الاقتصادي، الإنفاق على الصحة، الناتج المحلي الإجمالي، رأس المال البشري