

Investigating the Relationship between Healthcare Expenses and Life Expectancy with Gross Domestic Product (GDP) in Developing Countries of Asia and Europe

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Abstract: Economic growth and GDP increase along with the heightening of the quality of life and equality of income distribution are amongst the primary goals of the economic systems and development programs. The present study tries to investigate the relationship between healthcare expenses and life expectancy with GDP in the developing countries of Asia and Europe.

The present study is a retrospective analytical research that uses the data from the websites of the global bank and WHO for such a study population as the developing countries in Asia and Europe.

Considering the findings of the developing countries in Asia and Europe and based on the fact that the probability value (P-value) of the stationarity test is below 0.1 for the two variables “healthcare expenses” and “GDP”, it can be concluded that the null hypothesis (existence of a unit root) is rejected in this level (without differentiation) and that the variables are reliable hence there is no reason for rejecting the opposite presumption, i.e. the nonexistence of a unit root).

The summary of the results obtained from this study indicated that there is a long-term relationship between healthcare expenses and GDP in many of these countries that have stationary data (with at least one of the stationarity tests) in such a way that the causality of these two variables is from the side of GDP towards the healthcare expenses in some of the developing countries and from the healthcare expenses’ side towards GDP in some and bilateral in some others.

Keywords: developing countries, healthcare expenses, life expectancy

1. Introduction

Healthcare has been recognized globally as a human right and a social goal in such a way that healthcare is considered necessary for the meeting of the essential needs and improvement of the human beings’ quality of life and it has to be made available to all mankind. Healthcare has always been investigated as the main part of social-economic development and also as a means for the assessment of the social systems [1] in such a way that WHO defines healthcare as “the enjoyment of perfect psychological, physical and social well-being and not just absence of disease or disability” [2].

During the past decades, many of the countries experienced progress in their health statuses through increasing life expectancy and reducing children’s mortality [3]. Enhancement of healthiness causes an increase in life expectancy hence the tendency towards saving money and, eventually, increase in the investment and faster economic growth. In the studies related to national health and income, various scales have been taken into account for health [4]. The increase in healthiness and healthcare services in the society along with the reduction in the mortality rate and increase in the life expectancy encourages the people to save more money [5] following which the physical capital is increased and this is per se indirectly influences the productivity of the workforce and economic growth [6].

Although spending money has positive effects on healthcare and treatment such as on the economic growth through making investments in the healthcare services, the less-developed countries and the developing countries do not have enough financial resources for hygiene sectors due to the low-income levels. This navigates the governments towards the transferring of the financial resources from the other sectors towards the healthcare and treatment sector and, due to the same reason, the production level is decreased, especially in the less-developed and developing countries [7]. Therefore, the society that does not enjoy a good situation in terms of the healthcare indices is not expected to have a good position in terms of the economic indices, as well. The individuals’ health levels can be different from a country to another from the perspective of the education level, employment, income, political system, money spent on healthcare services, and GDP [8].

When the countries are more developed and richer, they dedicate more general resources to healthcare and spend a larger quotient on the per capita of healthcare [9]. According to the WHO’s statistics, governments allocate a substantial share of their incomes to the healthcare costs in many of the developed countries. On average, 60% of the healthcare costs created in the various countries around the globe have been shouldered by the governments [4]. Often, the share of the healthcare costs is larger than GDP in the developed countries as compared to underdeveloped countries in such a way that most of the high-income country members of the economic cooperation and

development organization spend more than 7% of their GDP for healthcare services whereas this figure is smaller in the developing countries that spend less than half of the aforesaid figure for healthcare services; the high-income countries differ from the poor countries in terms of the income level but their differences are more intense in terms of the importance of such a subject as the health and the level of the money spent in this ground. This way, while the share of the healthcare and treatment costs in the GDP of the poor countries is only 3.8%, this index has been increased to 5.7% in the countries with intermediate incomes and 5.1% in the North African (Mena) countries [10].

In an analytical and causal study for the countries with intermediate-to-high income, Shahraki and Ghaderi indicated that there is a bilateral causal relationship between the public healthcare expenses and health status. Moreover, the increase in public and individual healthcare expenses, national gross income, and education expenses were found to have a positive effect on life expectancy.

The increase in the public healthcare expenses leads to the improvement of the health status and better health status ends in reductions in the public healthcare expenses [11].

The results of the study by Sayed Nizam Al-Din Makkian et al indicated that there is a negative relationship between life expectancy and an individual's healthcare expenses. The government's healthcare expenses have positive and negative relationships with life expectancy respectively in the countries with high and low income per capita. Furthermore, there was found a positive relationship between life expectancy and each of such variables as education, improvement of water resources, and per capita of the national income [12].

In a study by Bloom et al, the effect of the individuals' health and well-being on economic performance was examined. It was found out that the healthcare and healthcare expenses exert a significant effect on the growth of the national income in such a way that a year of reduction in the society's life expectancy causes a reduction by 4% in the national production. Therefore, the notable effect of healthcare on the economic indices can justify the healthcare costs [13]. On the other hand, the healthcare expenses, as well, can per se influence the GDP of the countries. As believed by some economists, healthcare expenses cause a reduction in GDP due to their deviating of the resources from reaching generative investments [14]. Many of the studies concentrate on the estimation of healthcare expenses in the relationship between healthcare expenses and income. On the other hand, life expectancy at the beginning of birth is amongst the important indices expressing the cultural, social, economic, and health statuses of every society. Besides, this index can be useful to the evaluation of the offered services (healthcare services).

On the other hand, the existence of undulations in the healthcare expenses' trends is reflective of the absence of a coherent and long-term program in the area of healthcare and treatment for a given period [15]. Based thereon, the present study investigates the relationship between healthcare expenses and GDP per capita. Because the per capita of the national income can, as an appropriate and available index, give a general view of the society members' life levels, the present study aims at investigating the relationship between the healthcare expenses and per capita of GDP in the developing countries with the study question being whether the incomes of most of the society members (stemming from more GDP) have led to the increase in healthcare expenses or not? It is better to say whether the increase in healthcare expenses has resulted in the improvement of the health outcomes such as life expectancy or not? On the other hand, the relationship between the healthcare expenses' outcomes (such as life expectancy) in the countries of the two aforementioned continents specifies the extent to which healthcare expenses account for life expectancy. Resultantly, it becomes clear that the increase in healthcare expenses leads to the improvement of the GDP along with the heightening of life expectancy but in which set of the studied countries?

2. Study Method:

The present study is a retrospective analytical research that uses the data from the websites of the global bank and WHO for such a study population as the developing countries with populations over one million persons and without any war being in progress in them. Besides, these countries have been selected from Asia and Europe and, considering the low number of the developing countries in Europe (11), the countries of each continent with available data are organized based on their ranks in terms of the human development index and the first 11 countries will be studied. Based on the HDI-based ranking, the Asian and European countries have been found with intermediate to high HDI.

To collect data on the healthcare expenses and GDP and life expectancy in this study, the author entered the website of the global bank and extracted the data for each of the variables in separate for the continents and the studied countries in the form of EXCEL files. Then, the data related to each of the variables for the aforementioned continents were summarized and organized in a separate EXCEL file in such a way that each file contained data related to 22 developing countries for 20 years about each variable.

Considering the different nature of the study, the data related to healthcare expenses and GDP and life expectancy were collected from the global bank separately for the continent and the country. To perform the various stages of the research, use will be made of the extant documents and evidence, including articles, books, and dissertations.

2.1. Study Model:

The use will be made herein of the blended data and the data panel will be compiled through the utilization of the econometric model. The panel data method is the summation of the two methods, namely time series and cross-sectional data collection. In this study, the information related to the time series is indexed with t for the years between 1995 and 2015, and the information related to the countries is indexed with i. The general form of the present study's intended equation is as shown below:

$$Y_{it} = \beta + \alpha X_{it} + U_{it} \quad (1)$$

$$i = 1, 2, \dots, n$$

$$t = 1, 2, \dots, t$$

Where Y_{it} denotes the per capita of the healthcare expenses (dependent variable) and X_{it} indicates the GDP per capita (independent variable) for the countries studied from 1995 to 2015. U_{it} , as well, designates the contingent variables influencing Y_{it} and they are out of the researcher's control. α and β are the model's coefficients that are estimated using econometric methods.

After correcting the model, the intended coefficients (α and β) are estimated in this study, and statistical tests are employed for determining the significance of each of the estimated coefficients as well as the model's suitability.

After preparing the information and the required data that have been extracted from the website of the global bank in EXCEL files, they will be inserted into EViews Software, Version 10, within the format of the healthcare expenses' index and GDP per capita and all the data gathered in this software will be analyzed based on the study goals. To use the data for the estimation of the model, the constancy of the variance and covariance of the time-series data should be ensured (variables' durability test) in such a way that Dickey-Fuller's unit root test will be undertaken for all of the model's variables; the data will be revised, if needed, and, after ensuring the durability of the time-series data, the regression model will be estimated.

3. Findings:

3.1. Findings Related to the Developing Countries in Asia:

The developing countries of Asia have been Iran, Oman, Jordan, China, Turkmenistan, Thailand, Philippines, Uzbekistan, Indonesia, Kyrgyzstan, and Tajikistan and the data related to these countries have been explored for the years from 1995 to 2015.

Investigating the Variables' Stationarity:

In this study, Levene et al (LLC), Im et al. (IPS), Fisher's ADF, and Fisher's PP tests have been applied for determining the stationarity of the study variables in the level (without differentiation) with the null hypothesis of the proposed tests being the existence of a unit root.

Table (1) shows the results of the stationarity test (in the form of p-value) for the studied variables.

Table 1: stationarity test for the developing countries in Asia

	Continent	Asia	
	Name of the variable	P-value of the GDP	p-value of the healthcare expenses
Kind of the stationarity test			
	Levene and other's test	0.5212	0.4265
	Im, Pesaran and Shin's test	0.317	0.0213
	Fisher's ADF	0.259	0.0183
	Fisher's PP	0.0132	0.0124

Based on the stationarity test for the developing countries in Asia, the GDP and healthcare expenses are reliable variables in the level (without differentiation) according to the results of Im et al, Fisher's ADF and Fisher's PP tests but they have been found having a unit root hence not reliable according to Levene's test.

3.2. Analyzing the Cointegration and Estimation of the Long-Term Relationships:

The co-integration test is conducted when using the panel data generally based on the method proposed by Pedroni. In this study, Johansen and Phillips’s test has been used for analyzing cointegration with the null hypothesis in the posited test being the existence of no cointegration. Table (2) shows the findings of the cointegration test.

Table 2: cointegration test for the developing countries in Asia

Probability (Johansen)		t-statistic (Johansen)		
0.0071		23.1325		
Phillips’s test				
Variable	t-statistic	Probability	z-statistic	Probability
GDP	-3.432705	0.0451	-22.29654	0.0289
HE	-3.472805	0.0412	-22.26768	0.0298

Based on the probability value and the t- and z-statistics in Table (2), it is observed that the null hypothesis indicating the absence of cointegration in the developing countries of Asia is rejected or, in other words, the assumption indicating the existence of co-integration is not rejected (probability value smaller than 0.1 means the rejection of null hypothesis). Considering the cointegration test, there is a long-term relationship between the studied variables in the developing countries.

3.3. Granger’s Causality Test:

Table 3: Granger’s causality test for the developing countries in Asia

Dependent variable	Influential variable	F-statistic	Probability	Conclusion
GDP	HE	0.75133	0.3972	HE does not cause GDP
HE	GDP	0.41120	0.5382	GDP does not cause HE
HE	Life expectancy (LE)	1.49868	0.2314	LE does not cause HE
LE	HE	1.23171	0.2787	HE does not cause LE
GDP	LE	0.91781	0.3482	LE does not cause GDP
LE	GDP	0.98201	0.3331	GDP does not cause LE

According to Table (3), there is no unilateral causal relationship in the short run from GDP towards healthcare expenses and vice versa in the Asian developing countries; there is also no unilateral causal relationship in the short run from healthcare expenses towards life expectancy and vice versa in the Asian developing countries. Additionally, there is no unilateral causal relationship in the short run from GDP towards life expectancy and vice versa in the Asian developing countries.

3.4. Findings Related to the European Developing Countries:

The developing countries of Europe have been Romania, Bulgaria, Belarus, Albania, Bosnia and Herzegovina, Ukraine, Azerbaijan, Armenia, Kazakhstan, Turkey, and Moldavia and their data have been examined for the years between 1995 and 2015.

3.5. Investigating the Variables’ Stationarity:

Table 4: stationarity test for the European developing countries

Continent		Europe	
Kind of the stationarity test	Name of the variable	P-value of the GDP	p-value of the healthcare expenses
	Levene and other’s test		0.1882
Im, Pesaran and Shin’s test		0.0001	0.0001
Fisher’s ADF		0.0001	0.0006
Fisher’s PP		0.0006	0.0002

Based on the stationarity test’s results in Table (4) for the European developing countries, GDP is the reliable variable according to Im et al, Fisher’s ADF, and Fisher’s PP tests but it has a unit root in the level hence not reliable according to Levene and other’s test. The healthcare expenses are the reliable variable according to Fisher’s ADF and Fisher’s PP tests in the level (without differentiation).

3.6. Analyzing the Cointegration and Estimating the Long-Term Relationships:

Table 5: cointegration test for the European developing countries

Probability (Johansen)		t-statistic (Johansen)		
0.0001		39.17432		
Variable (Phillips)	t-statistic (Phillips)	Probability (Phillips)	z-statistic (Phillips)	Probability (Phillips)
GDP	-4.603453	0.0012	-36.63621	0.0009
HE	-4.981373	0.0003	-41.66875	0.0003

Based on probability values and t- and z-statistics presented in table (5), it is observed that the null hypothesis, based on the absence of co-accumulation in the developing countries of Europe, is rejected or, in other words, the assumption indicating the existence of cointegration is not rejected (probability value smaller than 0.1 means rejection of the null hypothesis). According to the results of cointegration analysis, there is a long-term relationship between the studied variables for the European developing countries.

3.7. Granger’s Causality Test:

Table 6: Granger’s causality test for the European developing countries

Dependent variable	Influential variable	F-statistic	Probability	Conclusion
GDP	HE	2.45636	0.0043	HE does not cause GDP
HE	GDP	0.97234	0.4935	GDP does not cause HE
GDP	Life expectancy (LE)	4.14238	0.0007	LE causes GDP
LE	GDP	0.20279	0.9911	GDP does not cause LE
HE	LE	4.66271	0.0001	LE causes HE
LE	HE	7.95324	0.0000007	HE causes LE

Based on table (6), there is no unilateral causal relationship in the short run from GDP towards healthcare expenses in the European developing countries but there is a unilateral causal relationship from healthcare expenses towards GDP. Put differently, an increase in healthcare expenses brings about increases in the GDP of the aforementioned countries. There is no unilateral causal relationship in the short run from GDP towards life expectancy in the European developing countries. Moreover, there is a bilateral causal relationship in the short run from healthcare expenses towards life expectancy and vice versa in the developing countries of the European continent.

4. Conclusion:

In this study, the relationship between the healthcare expenses and the GDP of the developing countries in Asia and Europe were investigated separately and in general for the period between 1995 and 2015. The obtained results are as explicated beneath:

1) According to the findings for the Asian developing countries, it can be concluded that the null hypothesis (existence of a unit root) is rejected in the level (without differentiation) hence the variables are reliable since the probability value (p-value) of the stationarity test for the variables “healthcare expenses” and “GDP” is below 0.1 so there is no reason for rejecting the opposite assumption, that is to say, the nonexistence of a unit root.

Considering the findings pertinent to the probability value and (t- and z-) statistics that have been calculated for cointegration analysis through Johansen and Phillips tests, the probability (p) value was found below 0.1 so the null hypothesis of these tests (absence of cointegration) is rejected hence there is no reason for rejecting the opposite presumption (presence of cointegration). Therefore, there is a long-term relationship between GDP and healthcare expenses.

To investigate this relationship which is unilateral (from GDP towards healthcare expenses or vice versa) or bilateral, use was made of Granger’s causality test. The results obtained from this test indicated that a causal short-term relationship between GDP and healthcare expenses or healthcare expenses and life expectancy or GDP and life expectancy cannot be proved for the Asian developing countries.

2) Considering the findings of the European developing countries, it can be concluded that the variables are reliable since the p-value of the stationarity test has been below 0.1 for healthcare expenses and GDP.

Considering the findings pertinent to the European developing countries' probability value and (t- and z-) statistics that have been calculated for cointegration analysis through Johansen and Phillips tests, the probability (p) value was found below 0.1 so the null hypothesis of these tests (absence of cointegration) is rejected hence there is a long-term relationship between GDP and healthcare expenses.

The results obtained from Granger's causality test indicated that there is a unilateral causal relationship in the short run from healthcare expenses towards GDP or, in other words, healthcare expenses cause the GDP ("healthcare expenses" is a variable influencing the GDP); this makes it concluded that the increase in the healthcare expenses' share enables the fostering of healthier individuals and better workforce in these countries and this per se leads to the increase in GDP in the European developing countries. There is a unilateral causal relationship between life expectancy towards GDP; in other words, life expectancy causes GDP (life expectancy is the variable influencing the GDP) so it can be concluded that the augmentation of life expectancy and the increase in the working-age in these countries increase production and GDP. There was found a bilateral causal relationship between healthcare expenses and life expectancy; in other words, life expectancy causes healthcare expenses and, in the same way, healthcare expenses cause life expectancy meaning that these two variables influence each other mutually. It can be figured out based on these findings that the increase in the healthcare expenses' share of the individuals' budgets enables the societies to have increasingly healthier individuals and this leads to the increase in the share of hygiene in the individuals' lives which per se results in the heightening of life expectancy of the individuals in the European developing countries. Mutually, the increase in the life expectancy causes higher healthcare expenses because the old individuals are increased in number in these countries and the money spent for the healthcare of these individuals would be increased. Granger's causality test showcases these relationships for the short run; however, no causality relationship is proved in the long run between these variables in the aforesaid countries.

In sum, the results obtained from this study indicated that there is a long-term relationship between healthcare expenses and GDP in many of the countries that have stationary data (with at least one of the stationarity tests). The causality of these two variables is from GDP towards healthcare expenses in some of the developing countries of the various continents and healthcare expenses towards GDP in some and bilateral in some others.

References

1. Park, K., (2004), "a lesson on the preventive medicine and social medicine", tr. Vafa'ei Shirpak Khosrow, Tehran, Iliia, pp.35-52
2. Salmani, Behzad and Mohammadi, Alireza, (2009), "investigating the effect of the government's healthcare expenses on the economic growth of Iran", seasonal journal of Iran's economic studies, summer, (39): 73-93
3. Rezapour, Aziz; Musavi, Abdolreza; Lotfi, Farhad; Soleimani Movahhed, Maryam and Alipour, Samira, (2019), "the effects of health expenditures on health outcomes based on the classification of public health expenditures: a panel data approach", Shiraz E-Med J, 20(12): 1-6
4. Ghanbari, Ali and Baskha, Mahdi, (2008), "investigating the effect of the changes in the government's hygiene costs on Iran's economic growth (1959-2004)", (2008), "journal of economic research, summer, pp.187-224
5. Rezai, Fatemeh; Nouri, Atefeh; Haghdoost, Ali Akbar and Shokuhi, Mustafa, (2011), "ecological investigation of the relationship between income in the rural regions of the country and the health index", Journal of Payesh, (11): 5-11
6. Emadzadeh, Mustafa; Sameti, Mortaza and Safi Dastjerdi, Davud, (2011), "the relationship between the healthcare expenses and the economic growth in Iran's provinces", journal of healthcare information management, 8(7): 928
7. Ra'eisi, Pouran; Rajabi, Mohammad Reza; Musavi, Abdolreza; Vahedi, Sajjad and Harati Khalilabad, Touraj, (2019), "investigating the determinants of healthcare expenditures in different healthcare systems", Shiraz, E-Med J, 20(9): 1-5
8. Babakhani, Muhammad, (2008), "investigating the relationship between the economic growth, income inequality, and health in Iran", seasonal journal of epidemiology in Iran (1978-2006), specialized journal of Iran's epidemiology, 5(1): 9-16
9. Hajibaba'ei, Hamid Reza; Sadeghi, Hossein; Faraji Dizaji, Sajjad and Ahmadi, Ali Mohammad, (2020), "health expenditures in developing countries: determinants and guidelines", Journal of research and health, 10(4): 257-266
10. Mehrara, Mohsen and Faza'eli, Ali Akbar, (2009), "the relationship between the healthcare expenses and economic growth in Middle-Eastern and North African (Mena) Countries", Journal of healthcare management, 12(35): 49-59

11. Shahraki, Mahdi and Ghaderi, Simin, (2019), “investigating the causality relationship between the public healthcare expenses and health status: panel’s vector autoregression model”, *Journal of health studies*, 4(4): 220-226
12. Makkian, Sayed Nizam Al-Din; Taherpour, Effat, and Zangiabadi, Parvaneh, (2016), “healthcare costs and life expectancy in the Islamic countries”, *seasonal journal of strategic and macro-level politics*, 4(13): 25-40
13. Bloom, D. E.; Conning, D. and Sevilla, J., (2001), “the effect of health on economic growth”, *Cambridge: national bureau of economic*, 50: 17-20
14. Beheshti, Muhammad Bagher and Sojudi, Sakineh, (2007), “experimental analysis of the relationship between healthcare expenses and GDP in Iran”, *seasonal journal of economic investigations*, winter, 4(4): 115-135
15. Bukenya, J., (2009), “do fluctuations in health expenditures affect economic growth?”, *the open economics journal*, 2: 31-38.