The Relationship between Health Expenditures and Economic Growth: Evidence from Turkey

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ABSTRACT

This study examines the relationship between health expenditures and economic growth in Turkey during the period 1975-2019 by using the Fourier Engle-Granger cointegration and the Fourier Toda-Yamamoto causality tests. Firstly, the Fourier ADF unit root test with fractional frequency is employed in order to investigate the stationary of the variables, and it is determined that both are I(1). Then, the Fourier Engle-Granger cointegration test revealed that there is a unidirectional long-run relationship from real GDP per capita to health expenditures. Accordingly, a one percent increase in economic growth causes a 0.32 percent increase in health expenditures. The findings from the Fourier Toda-Yamamoto causality test also support results of the Fourier Engle-Granger cointegration test. As a result, this study indicates that income view hypothesis and Wagner's law are valid for Turkey.

Keywords: Health Economics, Health Expenditures, Economic Growth, Wagner's Law, Fourier Approach

JEL Classification: C32, I15, O11

Sağlık Harcamaları ile Ekonomik Büyüme Arasındaki İlişki: Türkiye'den Kanıtlar

ÖZ

Bu çalışma, Türkiye'de 1975-2019 yılları arasında sağlık harcamaları ile ekonomik büyüme arasındaki ilişkiyi Fourier Engle-Granger eşbütünleşme ve Fourier Toda-Yamamoto nedensellik testleri aracılığıyla incelemektedir. İlk olarak, değişkenlerin durağanlık durumlarını araştırmak için kesirli frekanslı Fourier ADF birim kök testi uygulanmış ve her iki değişkenin de I(1) olduğu tespit edilmiştir. Daha sonra uygulanan Fourier Engle-Granger eşbütünleşme testi, değişkenler arasında kişi başına reel GSYİH'den sağlık harcamalarına doğru olmak üzere tek yönlü uzun dönemli ilişki olduğunu ortaya koymuştur. Buna göre, ekonomik büyümede meydana gelen yüzde birlik, artış sağlık harcamalarının yüzde 0,32 artmasına neden olmaktadır. Fourier Toda-Yamamoto nedensellik testinden elde edilen bulgular da Fourier Engle-Granger eşbütünleşme testine ait sonuçları desteklemektedir. Sonuç olarak, bu çalışma Türkiye'de gelir görüşü hipotezinin ve Wagner yasasının geçerli olduğuna işaret etmektedir.

Anahtar Kelimeler: Sağlık Ekonomisi, Sağlık Harcamaları, Ekonomik Büyüme, Wagner Yasası, Fourier Yaklaşımı

JEL Sınıflandırması: C32, I15, O11

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1. INTRODUCTION

The human race desires to be happy, and it is generally accepted that happiness comes largely from health. Health spending is essential for protecting people's health and solving various medical problems. On the other hand, economic growth is the most important economic goal and every nation aims to achieve a high and sustainable growth rate. Therefore, it is very important to unveil the relationship between these two indicators.

In general, there are four different hypotheses regarding the relationship between economic growth and health (Chen, 2016: 834):

The first is the income view hypothesis (growth-led health hypothesis), which argues that there is a unidirectional relationship between the variables from economic growth rate to health. This effect can be positive, as economic growth improves living conditions and allows more resources to deal with a wide range of medical problems. On the contrary, economic growth can also leads to negative externalities on health by causing several environmental and psychological problems (Sahnoun, 2018: 128). However, considering health expenditures, this effect is probably positive, because more spending is required to eliminate or at least minimize the aforesaid externalities. In addition, healthcare is generally identified as a necessary or luxurious good, not inferior.

Health spending occupies an important place in total public spending. So, the income view hypothesis also supports Wagner's law, which implies that public spending tends to increase due to economic growth. Economic growth leads to industrialization, urbanization, division of labor, complex society, and increases the relative expansion of income-elastic spending. Furthermore, keeping natural monopolies under control boosts economic productivity (Irandoust, 2019: 637). For all these reasons, the income view hypothesis and Wagner's law are valid.

The second is the health view hypothesis (health-led growth hypothesis), which alleges that there is a unidirectional relationship between the variables from health to economic growth. According to this hypothesis, health encourages economic growth both directly and indirectly. It prevents output losses caused by worker disease, enhances life expectancy which is believed to stimulate economic growth, rises the efficiency of workers and economy, contributes to stability and learning of school children, permits the use more of natural resources (Lusting, 2004). Additionally, Verulava (2019) notes that health expenditures decrease inequality in health and income, and so lower inequalities positively affect economic growth.

The health view hypothesis supports Keynesian hypothesis. According to the Keynesian hypothesis, the increase in public expenditure triggers economic growth. On the other hand, classical economists do not advice public expenditures because they believe that these expenditures can lead to economic contraction (Abbasov & Aliyev, 2018). Sahnoun (2018) points out that health is very costly and it is a huge burden on the nation. Hence, especially large and unproductive public health expenditures can negatively affect the output level.

The third is the feedback hypothesis. Barro (2013) criticizes old models that foreground the contribution of education to human capital and disregard the importance of health. Therewith, he develops a new model of health and economic growth. One of the most important features of this model is that it takes into account the bidirectional causality between economic growth and health. That is to say, health assists economic growth, whereas economic growth increases health capital accumulation (Barro, 2013: 351). The fourth and last is the neutral hypothesis that implies no causality between health and economic growth.

The main purpose of this study is to determine which of the aforementioned four alternative hypotheses is valid for Turkey. For this purpose, we utilize the Fourier Engle-

Granger cointegration and the Fourier Toda-Yamamoto causality tests, unlike the others. The rest of the study is structured as follows: the second section reports the related empirical literature. The third section gives information about the data and econometric methodology. The fourth section presents the empirical findings and the fifth section finalizes the paper.

2. LITERATURE REVIEW

The literature on the relationship between health expenditures and economic growth for various countries and country groups is summarized as follows:

Safdari, Mehrizi & Elahi (2013) examine Iran for the period 1973-2008 using VAR model. Şahbudak & Şahin (2015) research BRIC countries over the period 1995-2013 using panel cointegration test. Aboubacar & Xu (2017) scrutinize 36 Sub-Saharan Africa countries from 1995 to 2014 through General Method of Moments technique. Haini (2020) analyzes 30 Chinese provinces for the period 1996-2015 using spatial autoregressive panel model. All of these studies conclude that health expenditures trigger economic growth. Wang (2011) examines 31 OECD countries for the period 1986-2007 by applying panel cointegration test and supports this claim. On the other hand, he reports that economic growth diminishes health spending.

Mehrara & Musai (2011) investigate 11 oil exporting countries over the period 1971-2007 using panel cointegration test. Alhowaish (2014) examines Saudi Arabia during the period 1981-2013 using Granger causality test. Ayuba (2014) analyzes Nigeria from 1990 to 2009 through VAR model. Behera & Dash (2019) explore 21 Indian states for the period 1980-2015 by applying panel cointegration test. Ibukun & Osinubi (2020) peruse 47 African countries during the period 2000-2018 through both static and dynamic modelling techniques. These studies emphasized that economic growth has a positive impact on health spending.

Yardımcıoğlu (2012) examines 25 OECD countries over the period 1975 -2008 through panel cointegration test. Bedir (2016) investigates 16 developing countries during the period 1995-2013 by applying Toda-Yamamoto and Dolado-Lütkepohl causality tests. Saraçoğlu & Songur (2017) analyse 10 Eurasian countries from 1975 to 2008 using panel Cointegration and panel causality tests. All the studies mentioned determined that there is a bilateral relationship between the health expenditure and economic growth. However, Çetin & Ecevit (2010) investigate 15 OECD countries over the period 1990-2006 by applying panel OLS and maintain that there is no significant relationship between health spending and economic growth.

In the literature, there are also various studies investigating the relationship between health expenditure and economic growth for Turkey. The vast majority of these studies put forward that health expenditures stimulate economic growth (Arısoy, Ünlükaplan & Ergen, 2010; Tıraşoğlu & Yıldırım, 2012; Akar, 2014; Aydemir & Baylan, 2015; Başar, Künü & Bozma, 2016; Atılgan, Kılıç & Ertuğrul, 2017; Altun, İşleyen & Görür, 2018; Çalışkan, Karabacak & Meçik, 2018; Erçelik, 2018; Kızıl & Ceylan, 2018). However, Kar & Taban (2003), Yumuşak & Yıldırım (2009) and Öztürk & Uçan (2017) argue that health expenditure negatively affects economic growth. Kar & Ağır (2006) stated that there is a unidirectional causality relationship between the variables running from economic growth to health expenditures. Taban (2006), Ak (2012) and Şen & Bingöl (2018) unveil that economic growth and health spending affect each other significantly, whereas Köksel Tan, Mert & Özdemir (2010) and Uçan & Atay (2016) reveal that there is no relationship among the aforementioned variables.

3. DATA AND METHODOLOGY

3.1. Data and Variables

The main goal of this paper is to examine the long-run relationship between health expenditure and economic growth for Turkey. Health expenditure as a percent of GDP (LNHE) is retrieved from OECD database, whereas real GDP per capita (LNGDP) is sourced from WB Open Data. The two aforementioned annual series covering the period from 1975 to 2019 are in their logarithmic form.

3.2. Fourier ADF Unit Root Test with Fractional Frequency

Economic time series usually involve structural breaks. This situation leads to questioning the reliability of the results obtained from unit root tests that do not take into account structural breaks. Fourier unit root tests activate trigonometric terms in order to capture the fundamental features of structural breaks. These unit root tests employ stingy number of parameters because they do not need a priori knowledge. Thus, Fourier unit root tests attain much stronger results than other unit root tests (Enders & Lee, 2012).

The Fourier ADF unit root test with fractional frequency, developed by Christopoulos & Leon-Ledesma (2011), determines whether structural breaks are temporary or permanent. This test by considering the following model:

$$y_t = \delta(t) + v_t \tag{1}$$

where y_t denotes LNGDP or LNHE, $v_t \sim N(0, \sigma)$ and $\delta(t)$ is a deterministic function of t. $\delta(t)$ is identified as:

$$\delta(t) = \delta_0 + \delta_1 \sin\left(\frac{2\pi k t}{T}\right) + \delta_2 \cos\left(\frac{2\pi k t}{T}\right) \tag{2}$$

where $\pi = 3.1416$, T and t represent number of observations and trend term, respectively. $k = [0.5, 1, 1.5, 2, 2.5, 3]$ and it indicates the number of frequencies. The value that minimizes the Bayesian Information Criterion is defined as the optimal (k^*). Integer frequencies show that the structural breaks are temporary, while fractional frequencies mean that these breaks are permanent (Christopoulos & Leon-Ledesma, 2011: 10). k^* is determined and then the residues are obtained:

$$\hat{v}_t = y_t - \left[\hat{\delta}_0 + \hat{\delta}_1 \sin\left(\frac{2\pi k^* t}{T}\right) + \hat{\delta}_2 \cos\left(\frac{2\pi k^* t}{T}\right)\right] \tag{3}$$

In the next stage, the unit root test is applied on the residues:

$$\Delta v_t = \alpha_1 v_{t-1} + \sum_{j=1}^{p} \beta_j \Delta v_{t-j} + u_t \tag{4}$$

where p stands for lag length and u_t is a white noise error term. The null and alternative hypotheses are as follows:

$$H_0: \alpha_1 = 0 \tag{5}$$

$$H_1: \alpha_1 \neq 0 \tag{6}$$

The necessary critical values for the test are tabulated by Christopoulos & Leon-Ledesma (2011). If the null hypothesis implying that the series includes a unit root is rejected, the F test is applied. The hypotheses for the F-test are as follows:

$$H_0: \delta_1 = \delta_2 = 0 \tag{7}$$

$$H_1: \delta_1 = \delta_2 \neq 0 \tag{8}$$

The null hypothesis implies that trigonometric terms are insignificant. The necessary critical values for the F-test are tabulated by Becker, Enders & Lee (2006). If trigonometric terms are insignificant, the ADF unit root test is implemented instead of the Fourier ADF unit root test.

3.3. Fourier Engle-Granger Cointegration Test

Fourier cointegration tests can capture unknown form, location and number of structural breaks in the variables (Tsong, Lee, Tsai & Hu, 2016: 1087). This study employs the following Fourier Engle-Granger cointegration test of Yılancı (2019) to examine the long-term relationship between the variables:

$$y_{1t} = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta' y_{2t} + u_t \tag{9}$$

where y_{1t} is the dependent variable and represents LNGDP or LNHE. $x_t = (x_{1t}, \ldots, x_{mt})'$ is a $(m \times 1)$ vector of explanatory variables. $k = [1, 2, 3, 4, 5]$ and it indicates the number of frequencies. The value that minimizes the SSR is defined as the optimal (k^*). $\gamma_1 = \gamma_2 = 0$ implies that there is no nonlinear trend, in that circumstance the standard Engle-Granger cointegration test arises (Yılancı, 2019). To test the null hypothesis of no cointegration against the alternative hypothesis of the presence of cointegration, the ADF test is implemented to the residues obtained from eq. (9):

$$\Delta \hat{u}_t = \rho \hat{u}_{t-1} + \sum_{i=1}^{p} \gamma_i \hat{u}_{t-1} + \varepsilon_t \tag{10}$$

where $\varepsilon_t \sim i.i.d.(0, \sigma^2)$, the Fourier Engle-Granger cointegration test statistic (τ_{FEG}) is identified in eq. 11:

$$\tau_{FEG} = \frac{\hat{\rho}}{se(\hat{\rho})} \tag{11}$$

where $\hat{\rho}$ and $se(\hat{\rho})$ represent the ordinary least squares estimators of ρ and standard error of $\hat{\rho}$, respectively. The necessary critical values for the test are tabulated by Yılancı (2019).

3.4. Fourier Toda-Yamamoto Causality Test

The Fourier Toda-Yamamoto causality test proposed by Nazlıoğlu, Görmüş & Soytaş, (2016) captures both gradual and smooth structural breaks and gives strong results. The test by considering the following model (Nazlıoğlu, Görmüş & Soytaş, 2016: 172):

$$y_t = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 y_{t-1} + \cdots + \beta_{p+d} y_{t-(p+d)} + \varepsilon_t \tag{12}$$

where d represents the maximum integration level of the variables, p the optimal lag length, ε_t residuals and y_t LNGDP or LNHE. Firstly, the optimal p and dmax are determined. Then, the optimal k that minimizes the SSR is selected. To test the null hypothesis of no causality against the alternative hypothesis of the presence of causality, the Wald statistic is used. Bootstrap simulation is preferred to acquire the necessary critical values. When the test statistic surpasses the critical value, the null hypothesis is rejected (Yılancı, Özgür & Görüş, 2019).

4. EMPIRICAL RESULTS

The Fourier Engle-Granger cointegration test aims to detect whether there is a long-run relationship among the variables using Fourier functions. Just as in the Engle-Granger cointegration test, all the variables must be I(1) in this test. Moreover, the Fourier Toda-Yamamoto causality test, which researches the existence and direction of causality between the variables, needs to know the stationary degrees of the variables. For this purpose, we use the ADF and PP unit root tests and show the results in Table 1.

Table 1: Results of the ADF and PP Unit Root Tests

Variable	ADF	p-value	PP	p-value
LNGDP	0.505987	0.9851	0.561766	0.9870
LNHE	-2.253248	0.1922	-1.048406	0.7275
DLNGDP	-3.155799*	0.0023	-5.278057*	0.0000
DLNHE	-2.027889**	0.0422	-6.786427*	0.0000

Notes: (*) and (**) represent rejection of the null hypothesis at the 1% and 5% significance level respectively.

Prior to testing the Fourier unit root test, we apply the ADF and PP unit root tests and find LNGDP and LNHE as integrated at first differences. However, these tests ignore possible structural breaks in time series. Thus, we employ the Fourier ADF unit root test with fractional frequency and display the test results in Table 2.

Table 2: Results of the Fourier ADF Unit Root Test with Fractional Frequency

Variable	k	Min BIC	FADF	ADF	F-stat
LNGDP	0.5	-2.450307	-2.506160		607.7636*
LNHE	1.0	-0.776245	-0.543703		23.17550*
DLNGDP	2.0	-3.331803	-7.004786*	-3.155799*	1.079001
DLNHE	1.5	-1.500696	-6.247619*	-2.027889**	2.342832

Notes: (*) and (**) represent rejection of the null hypothesis at the 1% and 5% significance level respectively. FADF critical values are -4.57 (1%), -3.97 (5%), -3.64 (10%); -4.43 (1%), -3.85 (5%), -3.52 (10%); -4.19 (1%), -3.48 (5%), -3.14 (10%); -3.95 (1%), -3.28 (5%), -2.91 (10%) for k=0.5, k=1, k=1.5 and k=2 respectively. Critical values for F-test are 6.730 (%1), 4.929 (%5), 4.133 (%10).

As seen in Table 2, the optimal k for LNGDP and LNHE is 0.5 and 1, respectively. This implies that the structural break in the first series is permanent, while the break in the second series is temporary. The situation is the exact opposite for the difference series which are DLNGDP and DLNHE. The test results show that LNGDP and LNHE are not stationary at the levels whereas they are stationary at the first differences. Christopoulos and Leon-Ledesma (2011) recommend that the F-statistic should be used only when the null hypothesis is rejected. According to the F-statistic, trigonometric terms are insignificant for both DLNGDP and

DLNHE. Thus, the ADF unit root test is performed for these difference variables. In a nutshell, the results obtained from the stationary analysis demonstrate that both LNGDP and LNHE are I(1). When the graphs in Figure 1 are examined, it is seen that the Fourier estimates are reasonable and capture the long-run oscillations in the series.
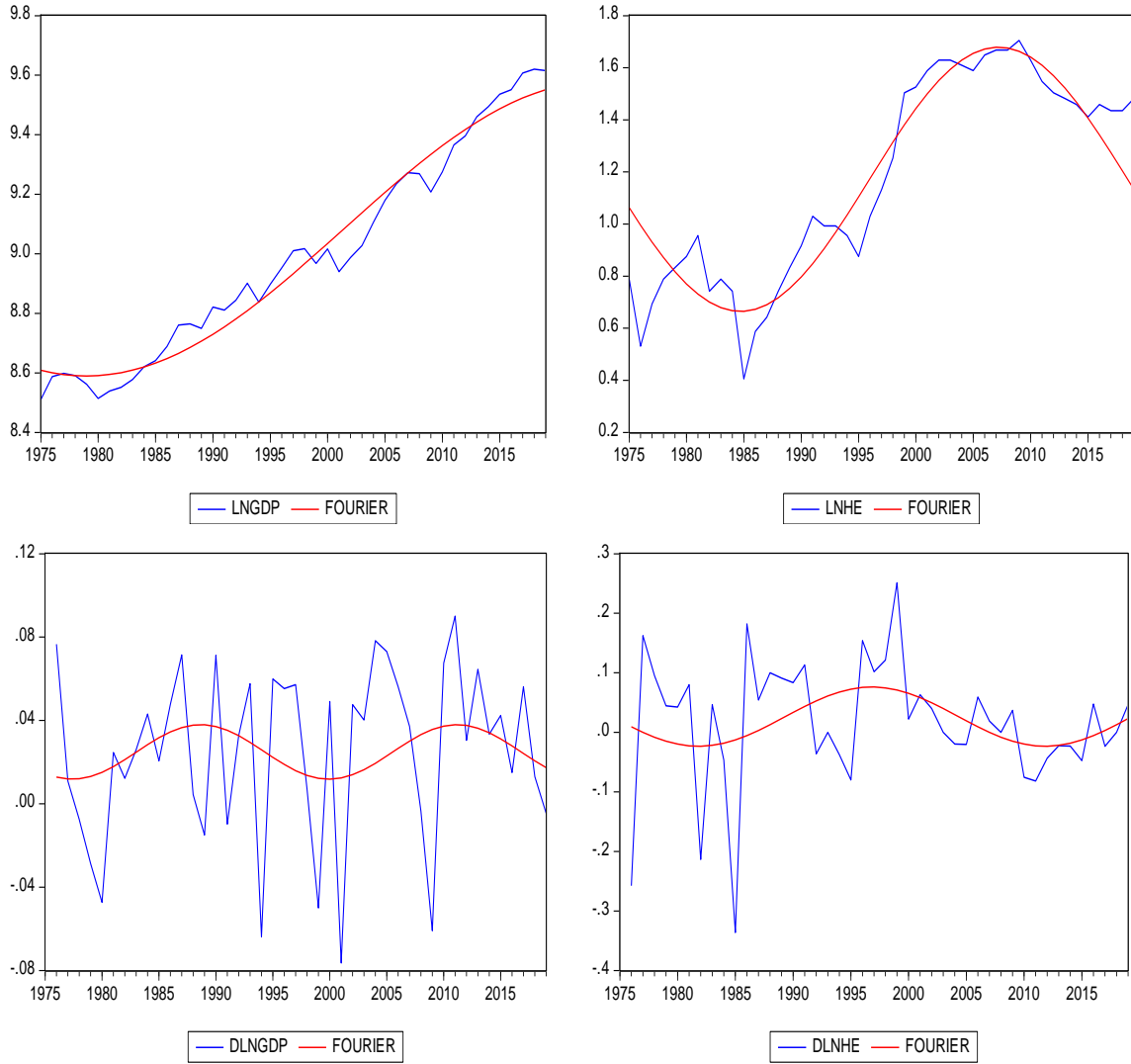
Figure 1: *Plots of Variables and Fourier Estimations*

In the next stage, it is possible to perform the Fourier Engle-Granger cointegration test to investigate the presence of the long-run relationship between LNGDP and LNHE.

Table 3: Results of the Fourier Engle-Granger Cointegration Test

Dependent Variable	Independent Variable	k	Min SSR	FEG	F-stat	Long-run Coefficients
LNGDP	**LNHE**	2	0.931329	-1.348232	63.81509	
LNHE	**LNGDP**	1	0.715995	-6.420929*	114.8321	0.321932*

Notes: (*) denotes rejection of the null hypothesis at the 1% significance level. FEG critical values are -4.906 (1%), -4.302 (5%), -3.988 (10%); -4.665 (1%), -3.995 (5%), -3.648 (10%) for k=1 and k=2 respectively.

The results from the Fourier Engle-Granger cointegration test are illustrated in Table 3. The null hypothesis cannot be rejected in the first model, where LNGDP and LNHE are dependent and independent variables respectively. Conversely, the null hypothesis is rejected for the second model. These results unveil that there is a unidirectional long-run relationship from LNGDP to LNHE. Moreover, the long-run coefficient estimated for the second model is positive and statistically significant. The magnitude of the coefficient demonstrates that one percent increase in LNGDP leads to 0.32 percent increase in LNHE. This study also employs Fourier Toda-Yamamoto causality test to investigate the causal relationship between LNGDP and LNHE.

Table 4: Results of Fourier Toda-Yamamoto Causality Test

Dependent Variable	Independent Variable	k	p	Min SSR	F-stat	p-value
LNGDP	**LNHE**	5	1	0.103362	0.437494	0.5123
LNHE	**LNGDP**	1	1	0.435159	5.763073**	0.0214

Notes: (**) represent rejection of the null hypothesis at the 5% significance level. To determine optimal p and k, the Hatemi-J information criterion is preferred.

The results of the Fourier Toda-Yamamoto causality test are reported in Table 4. The null hypothesis cannot be rejected for the first model, whereas it is rejected for the second model. This result implies that there is a unidirectional causality runs from LNGDP to LNHE. The results of the Fourier Toda-Yamamoto causality test are similar to the results of the Fourier Engle-Granger cointegration test. Both show that LNHE does not affect LNGDP in Turkey.

5. CONCLUSION

This study tries to find the relationship between health expenditures and economic growth in Turkey over the period 1975-2019. For this purpose, we employ the Fourier unit root, the Fourier Engle-Granger cointegration and the Fourier Toda-Yamamoto causality tests. According to the Fourier unit root test with Fractional Frequency, the variables are I(1). The results of the Fourier Engle-Granger cointegration test show that there is a unidirectional long-term relationship from real GDP per capita to health spending. The Fourier Toda-Yamamoto causality test also confirms this result. Moreover, the long-term coefficient is positive and significant. These results demonstrate that income view hypothesis and Wagner's law are valid in Turkey.

Getzen (2000) claimed that health is a necessary good for persons, whereas it is a luxury good for nations. Although the long-term coefficient is less than one (0.32), it does not imply that health is a necessary good for Turkey. This is because this study uses the share of health expenditures in GDP as a health indicator.

This study also reveals that the health view hypothesis and Keynesian hypothesis are invalid in Turkey. In other words, health spending is not effective on economic growth, and this shows that health expenditures are unproductive. Health spending is not an appropriate policy tool to stimulate economic growth because increasing health expenditures does not create a positive externality on the economy. It is estimated that health expenditures will continue to increase in the future due to Covid-19 pandemic. However, this study does not provide evidence that these expenditures will have a negative or positive impact on economic growth in the long-term.

Research and Publication Ethics Statement

This study has been prepared in accordance with the rules of scientific research and publication ethics.

Contribution Rates of Authors

The author's contribution is 100%.

Conflicts of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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