Health expenditures (total, public and private) and per capita income in the BRICS+T: panel bootstrap causality analysis

Şerif Canbay and Mustafa Kırca
Department of Economics,
Akçakoca Bey Faculty of Political Sciences, Düzce University, Düzce, Turkey

Abstract

Purpose – The study aims to determine whether there is a bidirectional causality relationship between health expenditures and per capita income in Brazil, Russia, India, China, South Africa and Turkey (BRICS+T).

Design/methodology/approach – For that purpose, the 2000–2018 period data of the variables were tested with the Kónya (2006) panel causality test. Additionally, the causality relationships between public and private health expenditures and per capita income were also investigated in the study.

Findings – According to the analysis results, there is no statistically significant causality relationship from total health expenditures and public health expenditures to per capita income in the relevant countries. Besides, there is a unidirectional causality relationship from private health expenditures to per capita income only in Turkey. On the other hand, a unidirectional causality relationship from per capita income to total health expenditures in China, Russia, Turkey and South Africa and from per capita income to public health expenditures in India, Russia, Turkey and South Africa were determined. Consequently, a causality relationship from per capita income to private health expenditures was found out in Russia and Turkey.

Originality/value – The variables are tested for the first time for BRICS+T countries, *vis-à-vis* the period under consideration and the method used.

Keywords Economic growth, Per capita income, BRICS+T, Private health expenditures, Public health expenditures, Panel bootstrap causality analysis

Paper type Research paper

Introduction

One of the most important inputs involved in the production process is the labor factor. Even though a transition from labor-intensive to capital-intensive production was experienced after the Industrial Revolution, labor efficiency and efforts to increase this productivity always remain important. To this end, efforts to increase labor productivity led to the emergence of the concept of human capital. Schultz (1961) was the first researcher to express the concept of human capital. The determinations regarding the contribution of human capital to the production process and economic growth resulted in the inclusion of this variable in growth models. For instance, Lucas (1988) included human capital in his model as a production factor, just like real capital. In recent years, many scientific studies have suggested the positive effect of human capital on economic growth (e.g. Gruzina *et al.*, 2021;

Nathaniel, 2021; Tahir *et al.*, 2020; Cuevas Ahumada and Calderón Villarreal, 2019; Pelinescu, 2015). Although the concept of human capital is limited to education (Adejumo *et al.*, 2021; Özdoğan Özbal, 2021; Ranjan, 2020; Burgess, 2016; Adedeji and Campbell, 2013), in the growth literature some are regarding health as another fundamental element of human capital (Hatak and Zhou, 2021; Thinagar *et al.*, 2021; Zhao and Du, 2021; Currie, 2020; Parro and Pohl, 2018; Churchill *et al.*, 2015; Barro, 2013; Bloom *et al.*, 2001; Mushkin, 1962; Schultz, 1961). Researchers continued to study with the idea that a well-educated and healthy workforce could be a more productive factor in the economic growth process. On the other hand, economic growth can also positively affect the health level of the population. In this regard, Fogel (1997) states that economic growth, increasing per capita income, can maintain people's better nutrition and health levels. Therefore, considering the contribution of the workforce without health problems to economic growth, investments in the health sector are important for both the public sector and private entrepreneurs. Thus, governments allocate large shares from their budgets to the health sector, a public service. Besides, the low flexibility of health services causes the private sector to invest in this sector. Health expenditures are also an important expenditure item for economic growth, as they are both public expenditures and private investment expenditures.

Assessing the similarities and differences between education and health in the concept of human capital together, Mushkin (1962) suggested that health expenditures could accelerate economic growth. Mushkin (1962) states that health is an important capital in this study, which is suggested as the health-led growth hypothesis. Therefore, investment in health can lead to economic growth by increasing income. Similarly, Barro (1996) refers to health expenditures as an engine of the economy as a capital-generating factor. The health-led growth hypothesis is tested in many studies as in Esen and Keçili (2021), Akinwale (2021) and Atilgan *et al.* (2017).

According to the data of The World Health Organization Global Health Expenditure Database (2021), health expenditures constituted 8.69% of the global gross domestic product (GDP) in 2000 and 9.85% in 2018. This indicates that health expenditures as a share of the global GDP increased from 2000 to 2018. This whole process toward the development of healthcare services leads to an increase in the average life expectancy worldwide. According to The World Bank (2021a) database, the average life expectancy in the world was calculated as 52.58 in 1960, 67.55 in 2000 and 72.56 in 2018.

The World Health Organization Global Spending on Health: Weathering the Storm Report (2020, p. 9) shows that global health expenditures continuously increased from 2018 to 2020 and reached US$ 8.3 trillion or 10% of the global GDP. The report also states that out-of-pocket spending, i.e. private health expenditure, remained high in low- and middle-income countries, accounting for more than 40% of total health expenditures in 2018. As the coronavirus disease-2019 (COVID-19) pandemic put the economies of developed and developing countries into a contraction process in 2019 and 2020, it has an effect that will lead to a large increase in health expenditures. It is considered that this effect might have stronger effects on the economies of developing countries. For this reason, determining the relationship between health expenditures and per capita income in developing countries is significant in revealing how the increase in welfare will be in these countries. The reason is that per capita income is one of the most important variables showing the increase in welfare. Among the prominent examples of developing countries in economic studies are BRICS+T countries.

According to The World Health Organization Global Health Expenditure Database (2021), Brazil's health expenditures as a share of GDP was 8.3% in 2000, while this rate was 9.5% in 2018. During the same period, Russia's health expenditures as a share of GDP increased from 5 to 5.3%, from 4 to 4.5% in India, from 4.5 to 5.4% in China and from 7.4 to 8.3% in South Africa, while it decreased from 4.6 to 4.1% in Turkey. According to these figures, while Brazil allocates the highest share from national income to health expenditures for 2018, Turkey allocates the lowest share. In the study, health expenditures are considered as a whole, as well

as private and public health expenditures. Besides, while the share of private health expenditures in total health expenditures in Brazil in 2000 was 58%, this was 58.2% in 2018. Similarly, this ratio goes from 40.4 to 40.5% in Russia, from 76.6 to 72.4% in India, from 78 to 43.6% in China and from 61.7 to 44.1% in South Africa, while there is a decrease from 38.3 to 22.6% in Turkey. Again in 2018, India was the country with the highest private health expenditure among health expenditures, while Turkey was the lowest.

According to The World Bank (2021b) data, the country with the highest per income capita for 2019 in this country group is Turkey with US$ 28,424 at constant/real prices, while the country with the lowest one is India with US$ 6,700. Moreover, the per capita income in Russia is US$ 27,044; 16,117 in China; US$ 14,652 in Brazil and US$ 12,484 in South Africa as of the end of 2019. Additionally, according to The World Bank (2021c) data, the fastest growth in this country group's economies in the same year was seen in China with 5.7%. In comparison, the highest contraction was seen in South Africa with -1.2%. During this period, India's economy grew by 3.1%, Russia by 1.4% and Brazil by 0.4%. Nevertheless, Turkey's economy was contracted by -0.4%.

In this context, this study mainly aims to determine whether there is a unidirectional causality relationship between total health expenditures, public and private health expenditures and per capita income, which is an important indicator of welfare, in the context of BRICS+T countries. The review period of the study is between 2000 and 2018. The relationships between the specified variables are tested with the Kónya (2006) panel causality test. This study differs from other studies because there are very few studies in the literature that primarily and separately research the effects of public and private health expenditures on growth. On the other hand, these variables are tested for the first time with this country group and the period under consideration. In the study, first, the literature review related to the subject is conducted and then the methodology part of the analysis used in the study is included. After the methodology chapter, the analysis findings are discussed and economic and political inferences are made based on the findings in the conclusion chapter.

Literature review

The relationship between health expenditure and economic growth has been a topic of interest for researchers for a long time. This interest leads many researchers to consider and examine the subject with different variables, periods, country/country groups and methods. Thus, these studies reveal different findings on this research subject. Some studies conducted to determine the relationship between health expenditures and economic growth suggest findings that there is unidirectional causality between variables, while others indicate bidirectional causality. For example, Erdil and Yetkiner (2004) determined the causality relationship from health expenditures to economic growth in high-income countries and from economic growth to health expenditures in low- and middle-income countries with the data of 75 countries in the period 1990–2000. In a study conducted in Turkey in the period 1984–1998, Kıymaz et al. (2006) found a unidirectional causality relationship between GDP per capita and health expenditures. Besides, Mehrara and Musai (2011) determined a unidirectional causality relationship from economic growth to health expenditures in the study using data from the period 1971–2007 of 11 oil-exporting countries, and the same result was obtained by Ke et al. (2011) in the data of 143 developing countries in the period 1995–2008 and by Acar (2020) in Turkey in the period 1975–2017. On the other hand, a bidirectional causality relationship between the variables was found by Taban (2006) in Turkey in the period 1968–2003; by Pradhan (2011) for 11 Organisation for Economic Co-operation and Development (OECD) countries in the period 1961–2007; by Yardımcıoğlu (2012) in 25 OECD countries in the period 1975–2008; by Saraçoğlu and Songur (2017) in 10 Eurasian countries including

Turkey in the period 1995–2014; by Ağır and Tıraş (2018) in 34 low-income, 48 lower-middle-income, 57 upper-middle-income and 55 high-income countries in the period 1995–2014 and by İşleyen (2019) in the data of OECD countries for the period 1998–2016. Additionally, Elmi and Sadeghi (2012) found a bidirectional causality relationship between health expenditures and economic growth in the long run and a unidirectional causality relationship from economic growth to health expenditures in the short term as a result of the causality analysis with the 1990–2009 data of 20 developing countries. Ogungbenle et al. (2013) investigated the relationship between Nigeria's public health expenditures and economic growth for the 1977–2008 period and reported a mutual causality relationship between the variables. In another similar study, Sghari and Hammami (2013) observed a bidirectional causality relationship between the variables in the analysis of the relationship between per capita health expenditures and GDP per capita, using data covering the period 1975–2011 in 30 developed countries. More recently, Mohapatra (2017) found that there is a causality relationship in the short and long run from economic growth to public health expenditures and from public health expenditures to economic growth only in the long run with the data of 16 states of India between 1990–1991 and 2010–2011. Bayraktutan and Alancıoğlu (2020) investigated the causality relations between health expenditures and economic growth by using the 2000–2017 period data of 17 OECD countries through the Kónya (2006) causality test. Their findings reported a unidirectional causality relationship from economic growth to health expenditures for Denmark, Germany and Sweden and from health expenditures to growth for Belgium, Greece, Iceland, Italy, Luxembourg, the Netherlands and Portugal. A bidirectional causality relationship was observed between the variables for Austria, Switzerland, Ireland and Turkey. Overall, the panel found that there is a bidirectional causality relationship between health expenditures and economic growth. Odhiambo (2021) concluded that there is unidirectional causality from public health expenditure to economic growth in low-income Sub-Saharan African countries. Tunalı Sarı et al. (2021), in a study conducted for 16 Euro countries in the 2000–2018 period, concluded that there is a bidirectional causality relationship between health expenditures and economic growth. In another study, in which Sökmen (2021) examined the period 2000–2018 of the BRICS and Turkish countries using the Kónya (2006) bootstrap causality test and concluded that there is a relationship between causality from health expenditures to economic growth in the study. Finally, Konat (2021) – in his study examining the relationship between health expenditures and economic growth for 17 selected OECD countries during the 1976–2017 period – found a unidirectional causal relationship from economic growth to health expenditures.

Another finding of the studies conducted on the subject is that there is a positive and negative relationship between health expenditures and economic growth. For example, Bhargava et al. (2001) demonstrated a positive but weak relationship between health expenditures and economic growth using panel data of developed and developing countries for the period 1965–1990. Heshmati (2001) analyzed the relationship between health expenditures and GDP per capita in OECD countries for the years 1970–1992 based on the Solow model. Analysis findings showed that health expenditures had a positive effect on economic growth. On the other hand, Aurangzeb (2003) examined the relationship between Pakistan's health expenditures and economic growth figures with the data of the 1973–2001 period and found a positive and statistically significant relationship between variables in the short and long term. Gyimah and Wilson (2004), who conducted a study similar to Heshmati's (2001) study, reported that health expenditures positively affected per capita income growth for African and OECD countries. Besides, Kıymaz et al. (2006) found a long-term positive relationship between GDP per capita and private health expenditures in Turkey's 1984–1998 data. Li and Huang (2009) concluded that health expenditure increased economic growth in China's 28 provinces during the period 1978–2005, and similarly Yardımcıoğlu (2012) in 25 OECD countries during the period 1975–2008, Ay et al. (2013) in Turkey for the 1968–2006

period, Boussalem *et al.* (2014) in Algeria for the period 1974–2014, Cebeci and Ay (2016) in the BRICS countries and Turkey in the period 2000–2014, Atilgan *et al.* (2017) in Turkey for the 1975–2013 period, Kesbiç and Salman (2018) in Turkey for the 1980–2014 period, Binay (2019) in 18 OECD countries with data for the period 1975–2012 of 21 OECD countries and Çelik (2020) in G20 countries in the period 2000–2016.

Yumuşak and Yıldırım (2009) concluded that there is a weak negative causality relationship from health expenditures to economic growth in their study of 1980–2005 in Turkey. Wang (2011), on the other hand, found out that the increase in health expenditures increases economic growth but that economic growth reduces health expenditure in 31 countries for the period 1986–2007. Rizvi (2019) asserted that health expenditures increased economic growth in 20 developing countries in the South, East and the Asia Pacific for the period 1995–2017. According to the results of the study conducted by Günay and Atilgan (2020) for seven selected OECD countries (Australia, Canada, Finland, Germany, Turkey, England and the USA), expenditures on health services increase economic growth in Australia, Canada, Turkey, England and the USA. In the findings of the study conducted by OECD countries for the period of 2000–2018, Suzan and Yaşar Dinçer (2021) concluded that health expenditures cause economic growth. Finally, Sağdıç and Yıldız (2021), in their study conducted at the level of 81 provinces for the period of 2004–2019 in Turkey, revealed that public health expenditures had a positive effect on economic growth in the long run.

Some studies in the literature also indicate no statistically significant causality relationship between health expenditures and economic growth. For example, Kıymaz *et al.* (2006) did not find any causality relationship between GDP per capita and total and public health expenditures in Turkey's 1984–1998 study. On the other hand, Akram *et al.* (2008) did not identify a statistically significant relationship between health expenditure and economic growth in Pakistan for the period 1972–2006, and the same result was found by Çetin and Ecevit (2010) 15 OECD countries for the period 1990–2006, by Balaji (2011) in the 4 southern states of India for the period 1960–2009, by İspir and Türkmen (2019) in G7 countries for the period 1988–2017, by Uçan and Atay (2016) in Turkey for the period 2006:Q1 and 2014:Q4 and by Olayiwola *et al.* (2021) in Nigeria's 2000–2016 period.

Lastly, Bedir (2016) carried out another study that reveals findings as a review of the findings of all studies on the subject. In their study using data from 16 countries for the period 1995–2013, Bedir (2016) found out a bidirectional causality in Korea, South Africa, Czech Republic and Russia; a unidirectional causality from income to health expenditures in Greece, Poland, United Arab Emirates and Indonesia; a unidirectional causality from health expenditures to income in Egypt, Hungary and the Philippines and no causality relationship in Turkey, China, India and Thailand.

With regards to the studies examined, the findings obtained change with the seasonal differences and the differentiation of the countries included in the analysis. Besides, only Kıymaz *et al.* (2006) examined the relationship between GDP per capita, taking total and public health expenditures into account. In this study, Kıymaz *et al.* (2006) made a comprehensive analysis for BRICS+T countries by adding private health expenditures to the study in addition to total and public health expenditures. In the study of Sökmen (2021) for BRICS+T countries, it is seen that only total health expenditures are considered. However, unlike the study of Sökmen (2021), with the thought that the relations between public and private health expenditures and GDP per capita could differ, our study examines the relationships between total, private and public health expenditures and GDP per capita. When evaluated in this context, it is clearly seen that this study differs from the studies in the literature.

This study separately examines the relationships between total, private and public expenditures and national income per capita in BRICS+T countries with medium and low per

capita incomes. Thus, considering both the countries and variables used, this study fills an important gap in the literature.

Data and methodology

Per capita income (*lpgdp*), total health expenditures (*lthe*), public health expenditures (*lheg*) and private health expenditures (*lhep*) data of the BRICS+T countries were retrieved from The World Bank database (2021d) in accordance with the research objective are used in the research analysis. The review period in the study was determined as 2000–2018.

This study examines the relationship between per capita income and total health expenditures, public health expenditures and private health expenditures. Hence, the relationships between the variables are investigated with the panel bootstrap causality test developed by Kónya (2006). In the Kónya (2006) panel bootstrap causality test, it is unnecessary to have a cointegration relationship between variables or examine the stationarity levels of variables. However, there are cross-section dependence and heterogeneous conditions for the coefficients of the models in the relevant test equation models [1]. Kónya (2006, p. 983) developed a causality test based on this seemingly unrelated regression (SUR) estimator developed by Zellner (1962), stating that the SUR estimator is more effective than the ordinary least squares (OLS) estimator. As Kónya (2006, p. 980) expressed, each equation in the SUR system is based on the vector autoregressive (VAR) approach developed by Sims (1980). The SUR estimator has VAR equations as many as the number of countries. Since this method is basically based on the VAR approach, the variables do not need to be cointegrated. Furthermore, there is a simultaneous correlation between VAR models belonging to each country. Based on this, the relationships between variables used in the study are modeled using the SUR system as follows:

$$
\left.\begin{array}{l}
lpgdp_{1,t} = \varphi_{1,1} + \displaystyle\sum_{l=1}^{ml\_lpgdp_1} \alpha_{1,1,l} lpgdp_{1,t-1} + \sum_{l=1}^{ml\_lthe_1} \beta_{1,1,l} lthe_{1,t-1} + \xi_{1,1,t} \\[3ex]
lpgdp_{2,t} = \varphi_{1,2} + \displaystyle\sum_{l=1}^{ml\_lpgdp_1} \alpha_{1,2,l} lpgdp_{2,t-1} + \sum_{l=1}^{ml\_lthe_1} \beta_{1,2,l} lthe_{2,t-1} + \xi_{1,2,t} \\[3ex]
\qquad\qquad\qquad\qquad . \\
\qquad\qquad\qquad\qquad . \\
\qquad\qquad\qquad\qquad . \\
lpgdp_{N,t} = \varphi_{1,N} + \displaystyle\sum_{l=1}^{ml\_lpgdp_1} \alpha_{1,N,l} lpgdp_{N,t-1} + \sum_{l=1}^{ml\_lthe_1} \beta_{1,N,l} lthe_{N,t-1} + \xi_{1,N,t}
\end{array}\right\} \quad (1)
$$

$$
\left.\begin{array}{l}
lthe_{1,t} = \varphi_{2,1} + \displaystyle\sum_{l=1}^{ml\_lthe_2} \beta_{2,1,l} lthe_{1,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{2,1,l} lpgdp_{1,t-1} + \xi_{2,1,t} \\[3ex]
lthe_{2,t} = \varphi_{2,2} + \displaystyle\sum_{l=1}^{ml\_lthe_2} \beta_{2,2,l} lthe_{2,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{2,2,l} lpgdp_{2,t-1} + \xi_{2,2,t} \\[3ex]
\qquad\qquad\qquad\qquad . \\
\qquad\qquad\qquad\qquad . \\
\qquad\qquad\qquad\qquad . \\
lthe_{N,t} = \varphi_{2,N} + \displaystyle\sum_{l=1}^{ml\_lthe_2} \beta_{2,N,l} lthe_{N,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{2,N,l} lpgdp_{N,t-1} + \xi_{2,N,t}
\end{array}\right\} \quad (2)
$$

$$\left.\begin{aligned}
lpgdp_{1,t} &= \varphi_{3,1} + \sum_{l=1}^{ml_{lpcap1}} \alpha_{3,1,l} lpgdp_{1,t-1} + \sum_{l=1}^{ml_{lheg1}} \beta_{3,1,l} lheg_{1,t-1} + \xi_{3,1,t} \\
lpgdp_{2,t} &= \varphi_{3,2} + \sum_{l=1}^{ml_{lpcap1}} \alpha_{3,2,l} lpgdp_{2,t-1} + \sum_{l=1}^{ml_{lheg1}} \beta_{3,2,l} lheg_{2,t-1} + \xi_{3,2,t} \\
&\qquad\qquad \vdots \\
lpgdp_{N,t} &= \varphi_{3,N} + \sum_{l=1}^{ml_{lpgdp1}} \alpha_{3,N,l} lpgdp_{N,t-1} + \sum_{l=1}^{ml_{lheg1}} \beta_{3,N,l} lheg_{N,t-1} + \xi_{3,N,t}
\end{aligned}\right\} \quad (3)$$

$$\left.\begin{aligned}
lheg_{1,t} &= \varphi_{4,1} + \sum_{l=1}^{ml\_lheg_2} \beta_{4,1,l} lheg_{1,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{4,1,l} lpgdp_{1,t-1} + \xi_{4,1,t} \\
lheg_{2,t} &= \varphi_{4,2} + \sum_{l=1}^{ml\_lheg_2} \beta_{4,2,l} lheg_{2,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{4,2,l} lpgdp_{2,t-1} + \xi_{4,2,t} \\
&\qquad\qquad \vdots \\
lheg_{N,t} &= \varphi_{4,N} + \sum_{l=1}^{ml\_lheg_2} \beta_{4,N,l} lheg_{N,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{4,N,l} lpgdp_{N,t-1} + \xi_{4,N,t}
\end{aligned}\right\} \quad (4)$$

$$\left.\begin{aligned}
lpgdp_{1,t} &= \varphi_{5,1} + \sum_{l=1}^{ml\_lpgdp_1} \alpha_{5,1,l} lpgdp_{1,t-1} + \sum_{l=1}^{ml\_lhep_1} \beta_{5,1,l} lhep_{1,t-1} + \xi_{5,1,t} \\
lpgdp_{2,t} &= \varphi_{5,2} + \sum_{l=1}^{ml\_lpgdp_1} \alpha_{5,2,l} lpgdp_{2,t-1} + \sum_{l=1}^{ml\_lhep_1} \beta_{5,2,l} lhep_{2,t-1} + \xi_{5,2,t} \\
&\qquad\qquad \vdots \\
lpgdp_{N,t} &= \varphi_{5,N} + \sum_{l=1}^{ml\_lpgdp_1} \alpha_{5,N,l} lpgdp_{N,t-1} + \sum_{l=1}^{ml\_lhep_1} \beta_{5,N,l} lhep_{N,t-1} + \xi_{5,N,t}
\end{aligned}\right\} \quad (5)$$

$$\left.\begin{aligned}
lhep_{1,t} &= \varphi_{6,1} + \sum_{l=1}^{ml\_lhep_2} \beta_{6,1,l} lhep_{1,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{6,1,l} lpcagdp_{1,t-1} + \xi_{6,1,t} \\
lhep_{2,t} &= \varphi_{6,2} + \sum_{l=1}^{ml\_lhep_2} \beta_{6,2,l} lhep_{2,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{6,2,l} lpgdp_{2,t-1} + \xi_{6,2,t} \\
&\qquad\qquad \vdots \\
lhep_{N,t} &= \varphi_{6,N} + \sum_{l=1}^{ml\_lhep_2} \beta_{6,N,l} lhep_{N,t-1} + \sum_{l=1}^{ml\_lpgdp_2} \alpha_{6,N,l} lpgdp_{N,t-1} + \xi_{6,N,t}
\end{aligned}\right\} \quad (6)$$

Model 1 is used to test the causality relationship from *lthe* to *lpgdp*, Model 2 from *lpgdp* to *lthe*, Model 3 from *lheg* to *lpgdp*, Model 4 from *lpgdp* to *lheg*, Model 5 from *lhep* to *lpgdp* and Model 6 from *lpgdp* to *lhep*. *N* shows the number of countries ($i = 1,2,3, \ldots, 6$) and *t* is the time interval ($t = 2000, 2001, \ldots, 2018$). Besides, *ml* is the lag length [2] and $\xi_{1,1,t}, \xi_{1,2,t}, \ldots, \xi_{1,N,t}, \xi_{2,1,t}, \xi_{2,2,t}, \ldots, \xi_{2,N,t}, \xi_{3,1,t}, \xi_{3,2,t}, \ldots, \xi_{3,N,t}, \ldots$ are the error terms, which are supposed to be white noises.

In the Kónya (2006) panel bootstrap causality test, Wald test statistics are calculated using the estimated VAR equations for each country in the above SUR system. However, with the bootstrap method, critical values for each country are derived. The following hypotheses are then tested by comparing the calculated Wald test statistics with the critical values calculated by the bootstrap method. As shown below, the causality relationships between variables can be determined by applying constraints to the coefficients.

If not all $\beta_{1,N,l}$ s are zero but all $\alpha_{2,N,l}$ s are zero, there is unidirectional Granger causality from *lthe* to *lpgdp*. If not all $\alpha_{2,N,l}$ s are zero but all $\beta_{1,N,l}$ s are zero, there is unidirectional Granger causality from *lpgdp* to *lthe*. If all $\beta_{1,N,l}$ s and $\alpha_{2,N,l}$ s are zero, there is no causality relationship between *lthe* and *lpgdp*. If neither $\beta_{1,N,l}$ nor $\alpha_{2,N,l}$ are zero, there is bidirectional Granger causality. Similarly, if not all $\beta_{3,N,l}$ s are zero but all $\alpha_{4,N,l}$ s are zero, there is a unidirectional Granger causality from *lheg* to *lpgdp*. If not all $\beta_{5,N,l}$ s are zero but all $\alpha_{6,N,l}$ s are zero, there is a unidirectional Granger causality from *lhep* to *lpgdp*.

Results and discussion

As expressed in the methodology chapter, before the Kónya (2006) panel causality test is performed, it should be shown that the presence of cross-sectional dependence in models and that the coefficients of the models are heterogeneous. In this context, the cross-section dependence and homogeneity test results are indicated in Table 1.

According to the results in Table 1, all models have cross-section dependence regarding the results of four cross-section dependence tests. This indicates that a shock that occurs in one country also affects other countries. In a globalizing world, some events occurring in countries can already affect other countries. It is seen that heterogeneity, which is another requirement, is met based on the homogeneity test results. According to the homogeneity test results, it was observed that the coefficients for each of the six models differ by country, i.e. the models are heterogeneous. For example, for Model 1 and Model 2, the effect of a change in *lpgdp* of a country on *lthe* or the effect of a change in *lthe* on *lpgdp* differ from the other countries.

As a result of the findings obtained after both stages, necessary conditions for the Kónya (2006) panel causality test are achieved. Table 2 contains the findings of the Kónya (2006) causality test for Model 1 and Model 2.

The findings in Table 2 indicate that there is no statistically causality relationship from *lthe* to *lpgdp* for all countries. This indicates that health expenditures for these countries do not affect welfare growth. It is important to note that, as Erdil and Yetkiner (2004) underlined, health expenditures affect economic growth in high-income countries. Although most of the studies in the literature determined a relationship between total health expenditures and economic growth, considering per capita income in this study led to a different finding. Besides, some studies do not present significant causality relationships between health

Tests	Cross-section dependence				Slope homogeneity	
Models	BP_{LM}	CD_{LM}	LM_{BC}	LM_{adj}	$\tilde{\Delta}$	$\tilde{\Delta}_{adj}$
Model 1	138.09*	22.30*	22.30*	5.54*	16.57*	17.98*
Model 2	164.23*	27.24*	27.08*	11.64*	7.93*	8.60*
Model 3	136.81*	22.23*	22.07*	2.70*	14.08*	15.27*
Model 4	179.53*	30.04*	29.87*	4.07*	9.14*	9.92*
Model 5	93.45*	14.32*	14.15*	2.04*	9.69*	10.51*
Model 6	203.98*	34.50*	34.33*	4.93*	12.15*	13.18*

Table 1.
Cross-section dependence and slope homogeneity tests results

Note(s): * signifies the cross-section dependence and heterogeneity by a 5% statistical significance level
Source(s): Own elaboration

Countries	Test statistics Wald	10%	Critical values **** 5%	1%
H₀: lthe is not the Granger causality of lpgdp (Model 1)				
Brazil	6.306	12.475	17.83	34.031
China	4.633	9.544	13.785	24.767
India	4.556	21.023	28.748	54.571
Russia	0.113	11.217	16.364	32.542
Turkey	0.987	15.794	22.434	39.996
South Africa	8.609	10.201	14.963	27.773
H₀: lpgdp is not the Granger causality of lthe (Model 2)				
Brazil	0.148	6.273	9.495	18.568
China	*32.689**	*11.526*	*16.299*	*31.107*
India	6.737	6.858	10.141	20.522
Russia	*25.751**	*8.963*	*12.79*	*25.359*
Turkey	*10.533****	*8.842*	*13.075*	*24.935*
South Africa	*16.232**	*6.107*	*8.79*	*15.432*

Note(s): * and *** indicate rejection of the null hypothesis at the 1 and 10% levels of significance, respectively; **** the bootstrap is based on 10,000 replications
The italics values indicate the hypotheses of the models
Source(s): Own elaboration

Table 2.
Kónya (2006) bootstrap panel causality test results (total health expenditures and per capita income)

expenditures and economic growth (İspir and Türkmen, 2019; Uçan and Atay, 2016; Çetin and Ecevit, 2010; Balaji, 2011; Akram *et al.*, 2008). On the other hand, a unidirectional causality relationship from *lpgdp* to *lthe* was identified in China, Russia, Turkey and South Africa. Thus, this finding coincides with the significant relationship from economic growth to health expenditures that Erdil and Yetkiner (2004) found for low- and middle-income countries. Although China is in the top 10 of the highest GDP and Turkey is in the top 20, they are at the middle-income level in terms of per capita income. For this reason, our findings are consistent with the study of Erdil and Yetkiner (2004). It is also consistent with the findings of Kıymaz *et al.*'s (2006). Besides our study, Acar (2020), Koç (2018), Yardimcioglu (2012), Mehrara and Musai (2011), Pradhan (2011) and Ke *et al.* (2011) also revealed significant causality relationships from economic growth to health expenditures. These findings are important in showing that the improvement in the economy could also positively affect health indicators. The increase in the GDP per capita of a country's citizens also increases people's health expenditures. The findings of the Kónya (2006) causality test for Model 3 and Model 4 are shown in Table 3.

The findings in Table 3 show that there is no statistically causality relationship from *lheg* to *lpgdp* for all countries. On the other hand, a unidirectional causality relationship from *lpgdp* to *lheg* was determined in India, Russia, Turkey and South Africa. According to the analysis findings, it was found that there is no causality relationship between public health expenditures and per capita income. Turkey is the country with the highest share of public health expenditure in BRICS+T countries. In South Africa, China and Russia, which are close to Turkey, the share of public health expenditure in total health expenditure is over 50%. The insignificant effect of public health expenditures on per capita income, especially in these three countries, raises a question mark about the effectiveness of expenditures. From a different point of view, the lack of profit motive in public health expenditures renders its impact on per capita income insignificant. As discussed above, the absence of a causality relationship from total health expenditures to per capita income in these countries explains this finding. Moreover, the share of public health expenditures in total health expenditures is

Countries	Test statistics Wald	10%	Critical values **** 5%	1%
H$_0$: lheg is not the Granger causality of lpgdp (Model 3)				
Brazil	1.645	6.575	9.848	19.308
China	3.969	7.007	10.585	22.004
India	0.193	16.037	22.855	42.996
Russia	0.277	6.844	10.309	19.194
Turkey	5.231	6.119	9.205	18.129
South Africa	6.4	7.087	11.007	26.068
H$_0$: lpgdp is not the Granger causality of lheg (Model 4)				
Brazil	1.377	6.356	9.284	19.044
China	5.073	15.934	22.337	38.935
India	*24.547***	*12.979*	*18.396*	*33.128*
Russia	*23.850**	*8.32*	*12.66*	*23.423*
Turkey	*7.165****	*6.541*	*9.805*	*19.708*
South Africa	*16.140***	*6.3*	*9.335*	*16.798*

Note(s): *, ** and *** indicate rejection of the null hypothesis at the 1, 5 and 10% levels of significance, respectively;**** the bootstrap is based on 10,000 replications
The italics values indicate the hypotheses of the models
Source(s): Own elaboration

smaller in Brazil and India. Furthermore, dense populations in Brazil and India are thought to cause the effect of public health expenditure on per capita income to be insignificant. Unlike these findings, a unidirectional causality relationship from per capita income to public health expenditures was determined in India, Russia, Turkey and South Africa. It is an expected result that changes in per capita income increase public health expenditures through public expenditures. However, since these countries are mostly low- and middle-income countries, they are still the countries with a high demand for health services from the public.

Finally, the findings of the Kónya (2006) causality test for Model 5 and Model 6 are presented in Table 4.

Countries	Test statistics Wald	10%	Critical values **** 5%	1%
H$_0$: lhep is not the Granger causality of lpgdp (Model 5)				
Brazil	5.173	6.344	9.543	19.51
China	1.605	6.917	10.269	20.539
India	2.214	6.729	10.346	21.235
Russia	1.229	8.039	12.179	22.897
Turkey	*31.628**	*7.477*	*11.59*	*23.742*
South Africa	4.558	6.844	9.906	18.231
H$_0$: lpgdp is not the Granger causality of lhep (Model 6)				
Brazil	1.354	6.385	9.749	20.329
China	0.372	5.347	8.06	16.755
India	3.38	20.195	30.884	124.832
Russia	*24.259**	*6.574*	*9.844*	*19.942*
Turkey	*9.214****	*7.949*	*11.954*	*24.202*
South Africa	4.977	5.318	7.698	14.48

Note(s): * and *** indicate rejection of the null hypothesis at the 1 and 10% levels of significance, respectively;**** the bootstrap is based on 10,000 replications. Source: Own elaboration

The findings in Table 4 reflect that there is a bidirectional causality relationship between *lhep* and *lpgdp* variables only in Turkey. On the other hand, a causality relationship from *lpgdp* to *lhep* was found in Russia. Since per capita income in these countries is low and moderate, it is expected that the relationship between private health expenditures and national income per capita is limited. The significant causality effect of private health expenditures on per capita income for Turkey is a key finding that differs from many studies. We can associate this situation with health tourism revenues for Turkey. According to the data published by the World Tourism Organization in 2018, Turkey ranks third with a share of 4.7% after the USA (27.8%) and France (5.2%) in the ranking of health tourism revenues in the world. Other BRICS countries are not in the top ten in health tourism revenues. In fact, Turkey is a country that attaches great importance to policy development for health tourism, especially after the COVID-19 pandemic (UNWTO Exploring Health Tourism, 2018). However, the fact that there is a causality relationship from per capita income to private health expenditures in both Turkey and Russia is thought to be because per capita income is higher than other countries based on the ten-year average. Increases in per capita income also raise private health expenditures within the framework of the private health sector opportunities in the country.

Conclusion and policy implementation

In this study, the relationships between per capita income and total health expenditures, public health expenditures and private health expenditures in Brazil, Russia, India, China, South Africa and Turkey were examined in the context of the period 2000–2018. The Kónya (2006) panel bootstrap causality test results revealed significant and noteworthy findings. The main findings of the study are as follows:

(1) There is no causality relationship from total health expenditures to per capita income in all countries studied;

(2) A unidirectional causality relationship from income per capita to total health expenditures was identified in China, Russia, Turkey and South Africa.

(3) There is no causality relationship from public health expenditures to per capita income in all countries studied;

(4) A unidirectional causality relationship was found from per capita income to public health expenditures in India, Russia, Turkey and South Africa;

(5) There is a bidirectional causality relationship between private health expenditures and per capita income only in Turkey and

(6) There is a unidirectional causality relationship from national income per capita to private health expenditures in Russia.

When these findings are evaluated in general, it is seen that the relations between total, public and private health expenditures and per capita national income differ by the revenue status of the countries.

Consequently, the relationships between total, public and private health expenditures and per capita income were presented in this study. However, the countries' economic structure and the differences in health systems accordingly change the relationship between these variables based on different countries. In terms of similarity, the fact that there are significant effects from per capita income to total and public health expenditures shows that the place of the public in the health sector is important in these countries. The reason is that per capita income in these countries is in the middle- or low-income classification. In such a case, it is

inevitable that changes in per capita income affect public health expenditures. However, as stated in the analysis findings, determining a relationship between private health expenditures and per capita income in Turkey and Russia, where per capita income is higher than in other countries, is an important finding. In this context, this study reveals the importance of public health expenditure, especially in countries where per capita income is still low.

Economic policymakers should make their public health investments precisely and in a way that reaches every citizen without any profit motive. However, the main purpose of private health investments is profit. Considering the sensitivity of the issue, the public should have serious supervisory power over the private sector in this regard. Although private investors look to the health sector for profit, economic policymakers should establish an exemplary system for private health investments that will be an alternative to public health investments. In addition, a positive externality of this situation is that the increase in private sector health expenditures will also affect the increase in new employment opportunities. As health expenditures increase, the level of development in these countries will increase.

In future studies, more subjective health expenditure items may be considered rather than public and private health expenditures. The effect of subjective health expenditure items on per capita income can be investigated. In addition, the impact of per capita income on these subjective health expenditures will be an important research topic.

Notes

1. The BP_{LM} test developed by Breusch and Pagan (1980), CD_{LM} test developed by Pesaran (2004), LM_{adj} test developed by Pesaran $et\ al.$ (2008) and finally determined by LM_{BC} tests developed by Baltagi $et\ al.$ (2012) are the tests that are frequently used in panel data econometrics for cross-section dependency testing. The homogeneity/heterogeneity test of the coefficients is determined by the $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ test statistics suggested by Pesaran and Yamagata (2008).

2. These lag lengths are determined by a combination that minimizes the values of Schwartz information criteria (SC) and Akaike information criteria (AIC).

References

Acar, Y. (2020), "The relationship between health expenditure, per capita income and life expectancy at birth: the case of Turkey", *Business and Management Studies: An International Journal*, Vol. 8 No. 1, pp. 624-639.

Adedeji, O. and Campbell, O. (2013), "The role of higher education in human capital development", SSRN, available at: https://ssrn.com/abstract=2380878 or http://dx.doi.org/10.2139/ssrn.2380878.

Adejumo, O., Asongu, S. and Adejumo, A. (2021), "Education enrollment rate vs employment rate: implications for sustainable human capital development in Nigeria", SSRN, available at: https://ssrn.com/abstract=3798657 or http://dx.doi.org/10.2139/ssrn.3798657.

Ağır, H. and Tıraş, H.H. (2018), "Healthcare expenditure and economic growth relation: panel causality analysis", *Gaziantep University Journal of Social Sciences*, Vol. 17 No. 4, pp. 1558-1573, doi: 10.21547/jss.444411.

Akinwale, Y.O. (2021), "Health expenditure, economic growth and life expectancy at birth in resource rich developing countries: a case of Saudi Arabia and Nigeria", *Journal of Economic Cooperation and Development*, Vol. 42 No. 2, pp. 1-22.

Akram, N., Padda, I.U. and Khan, M. (2008), "The long term impact of budget deficits on economic growth in Ghana", *Journal of Business Research*, Vol. 47 No. 4, pp. 487-500.

Atilgan, E., Kılıç, D. and Ertuğrul, H.M. (2017), "The dynamic relationship between health expenditure and economic growth: is the health-led growth hypothesis valid for Turkey?", *European Journal of Health Economics*, Vol. 18 No. 5, pp. 567-574, doi: 10.1007/s10198-016-0810-5.

Aurangzeb, A.Z. (2003), "Relationship between health expenditure and GDP in an augmented Solow growth model for Pakistan: an application of cointegration and error-correction modeling", *The Lahore Journal of Economics*, Vol. 8 No. 2, pp. 1-16.

Ay, A., Kızılkaya, O. and Koçak, E. (2013), "The Relationship between health indicators and economic growth: the case of Turkey", *Niğde Üniversitesi İİBF Dergisi*, Vol. 6 No. 1, pp. 163-172.

Balaji, B. (2011), "Causal nexus between public health expenditure and economic growth in four Southern Indian States", *IUP Journal of Public Finance*, Vol. 9 No. 3, pp. 7-22.

Baltagi, B.H., Feng, Q. and Kao, C. (2012), "A Lagrange multiplier test for cross-sectional dependence in a fixed effects panel data model", *Journal of Econometrics*, Vol. 170 No. 1, pp. 164-177.

Barro, R. (1996), "Determinants of economic growth: a cross-country empirical study", doi: 10.3386/w5698.

Barro, R.J. (2013), "Health and economic growth", *Annals of Economics and Finance*, Vol. 14 No. 2A, pp. 305-342.

Bayraktutan, Y. and Alancıoğlu, E. (2020), "Health expenditures- economic growth relationship: panel bootstrap granger causality analysis for selected OECD countries", *Usak University Journal of Social Sciences*, Vol. 13 No. 2, pp. 1-12.

Bedir, S. (2016), "Healthcare expenditure and economic growth in developing countries", *Advances in Economics and Business*, Vol. 4 No. 2, pp. 76-86.

Bhargava, A., Jamıson, D.T., Lau, L.J. and Murray, C.J.L. (2001), "Modeling the effects of health on economic growth", *Journal of Health Economics*, Vol. 20, pp. 423-440.

Binay, M. (2019), "Optimization of health expenditures in OECD countries maximizing economic growth", *Journal of Social Security*, Vol. 9 No. 2, pp. 449-476.

Bloom, D., Canning, D. and Sevilla, J. (2001), "The effect of health on economic growth", NBER Working Paper Series, Vol. 32, pp. 1-13.

Boussalem, F., Boussalem, Z. and Taba, A. (2014), "The relationship between public spending on health and economic growth in Algeria: testing for cointegration and causality", *International Journal of Business and Management*, Vol. 2 No. 3, pp. 25-39.

Breusch, T.S. and Pagan, A.R. (1980), "The Lagrange multiplier test and its applications to model specification in econometrics", *The Review of Economic Studies*, Vol. 47 No. 1, pp. 239-253.

Burgess, S. (2016), *Human Capital and Education: The State of the Art in the Economics of Education*, IZA Discussion Papers, No. 9885, Institute for the Study of Labor, Bonn.

Cebeci, E. and Ay, A. (2016), "The effects of health expenditures on economic growth: a panel regression analysis on BRICS countries and Turkey", *Dumlupınar University Journal of Social Science*, ICEBSS special issue, pp. 91-102.

Çelik, A. (2020), "Analysis of the effect of health expenditures on economic growth in G20 countries", *Yönetim ve Ekonomi*, Vol. 27 No. 1, pp. 1-20, doi: 10.18657/yonveek594695.

Çetin, M. and Ecevit, E. (2010), "The effect of health expenditures on economic growth: a panel regression analysis on OECD countries", *Doğuş Üniversitesi Dergisi*, Vol. 11 No. 2, pp. 166-182, doi: 10.31671/dogus.2019.160.

Churchill, A., Yew, S.L. and Uğur, M. (2015), "Effects of government education and health expenditures on economic growth: a meta-analysis", *Econstor*, available at: https://gala.gre.ac.uk/id/eprint/14072/.

Cuevas Ahumada, V.M. and Calderón Villarreal, C. (2019), "Human capital formation and economic growth across the world: a panel data econometric approach", *Economía, Sociedad y Territorio*, Vol. 20 No. 62, pp. 655-684.

Currie, J. (2020), "Child health as human capital", *Health Economics*, Vol. 29 No. 4, pp. 452-463.

Elmi, Z.M. and Sadeghi, S. (2012), "Health care expenditures and economic growth in developing countries: panel cointegration and causality", *Middle East Journal of Scientific Research*, Vol. 12 No. 1, pp. 88-91, doi: 10.5829/idosi.mejsr.2012.12.1.64196.

Erdil, E. and Yetkiner, H. (2004), "A panel data approach for income-health causality in the economics of health reforms", in Yfantopoulus, J.N. (Ed.), *Working Papers FNU-47, Research unit Sustainability and Global Change*, Hamburg University, Hamburg, pp. 701-724.

Esen, E. and Keçili, M.Ç. (2021), "Economic growth and health expenditure analysis for Turkey: evidence from time series", *Journal of the Knowledge Economy*, doi: 10.1007/s13132-021-00789-8.

Fogel, R.W. (1997), "New findings on secular trends in nutrition and mortality: some implications for population theory", in Rosenzweig, M. and Stark, O. (Eds), *Handbook of Population and Family Economics*, North Holland, Amsterdam, Vol. 1, pp. 433-481.

Gruzina, Y., Firsova, I. and Strielkowski, W. (2021), "Dynamics of human capital development in economic development cycles", *Economies*, Vol. 9 No. 2, p. 67.

Günay, E. and Atilgan, D. (2020), "Health expenditures and economic growth for selected OECD countries: new generation panel cointegration analysis", *Business and Management Studies: An International Journal*, Vol. 8 No. 3, pp. 3640-3654.

Gyimah-Brempong, K. and Wilson, M. (2004), "Health human capital and economic growth in Sub-Saharan African and OECD countries", *The Quarterly Review of Economics and Finance*, Vol. 44 No. 2, pp. 296-320.

Hatak, I. and Zhou, H. (2021), "Health as human capital in entrepreneurship: individual, extension, and substitution effects on entrepreneurial success", *Entrepreneurship Theory and Practice*, Vol. 45 No. 1, pp. 18-42.

Heshmati, A. (2001), "On the causality between gdp and health care expenditure in augmented Solow growth model", SSE/EFI Working Paper Series in Economics and Finance, Vol. 423, pp. 1-19.

İşleyen, Ş. (2019), "Health expenditure, environmental pollution and economic development relation: 1998–2016 the case of OECD countries", *Van YYÜ İİBF Dergisi*, Vol. 4 No. 7, pp. 63-79.

İspir, T. and Türkmen, S. (2019), "The relationship between healthcare expenditures and economic growth in the G7 countries: panel analysis", *Research Journal of Politics, Economics and Management*, Vol. 7 No. 3, pp. 107-114.

Ke, X., Saksena, P. and Holly, A. (2011), "The determinants of health expenditure: a country-level panel data analysis", *Working Paper, Results for Development Institute*, World Health Organization.

Kesbiç, C.Y. and Salman, G. (2018), "Türkiye'de sağlık harcamaları ve ekonomik büyüme arasındaki ilişkinin tespiti: 1980-2014 VAR model analizi", *Finans Politik and Ekonomik Yorumlar*, Vol. 639, pp. 163-180.

Kıymaz, H., Akbulut, Y. and Demir, A. (2006), "Tests of stationarity and cointegration of health care expenditure and gross domestic product", *The European Journal of Health Economics*, Vol. 74, pp. 285-289.

Kónya, L. (2006), "Exports and growth: granger causality analysis on OECD countries with a panel data approach", *Economic Modelling*, Vol. 23 No. 6, pp. 978-992.

Konat, G. (2021), "Health Expenditure and economic growth relationship: panel data analysis for OECD countries", *Journal of Yaşar University*, Vol. 16 No. 61, pp. 348-360.

Koç, Ö.E. (2018), "Sağlık harcamaları ve ekonomik büyüme ilişkisi: Türkiye üzerine bir nedensellik analizi", available at: https://www.researchgate.net/publication/337623661_SAGLIK_HARCAMALARI_ve_EKONOMIK_BUYUME_ILISKISI_TURKIYE_UZERINE_BIR_NEDENSELLIK_ANALIZI (accessed 12 February 2021).

Li, H. and Huang, L. (2009), "Health, education, and economic growth in China: empirical findings and implications", *China Economic Review*, Vol. 20 No. 3, pp. 374-387.

Lucas, R.E. (1988), "On the mechanics of economic development", *Journal of Monetary Economics*, Vol. 22 No. 1, pp. 3-42.

Mehrara, M. and Musai, M. (2011), "Granger causality between health and economic growth in oil exporting countries", *Interdisciplinary Journal of Research in Bussiness*, Vol. 1 No. 8, pp. 103-108.

Mohapatra, S. (2017), "Economic growth, public expenditure on health and IMR in India: an econometric investigation of causal linkages", *International Journal of Social Economics*, Vol. 44 No. 12, pp. 1-32.

Mushkin, S.J. (1962), "Health as an investment", *Journal of Political Economy*, Vol. 70 No. 5, pp. 129-157, available at: https://sci-hub.tw/10.1002/iroh.19620470121.

Nathaniel, S.P. (2021), "Environmental degradation in ASEAN: assessing the criticality of natural resources abundance, economic growth and human capital", *Environmental Science and Pollution Research*, Vol. 28 No. 17, pp. 21766-21778.

Odhiambo, N.M. (2021), "Health expenditure and economic growth in sub-Saharan Africa: an empirical investigation", *Development Studies Research*, Vol. 8 No. 1, pp. 73-81.

Ogungbenle, S., Olawumi, O.R. and Obasuyi, F.O.T. (2013), "Life expectancy, public health spending and economic growth in Nigeria: a vector autoregressive (VAR) model", *European Scientific Journal*, Vol. 9 No. 19, pp. 2010-2235.

Olayiwola, S.O., Bakare-Aremu, T.A. and Abiodun, S.O. (2021), "Public health expenditure and economic growth in Nigeria: testing of Wagner's hypothesis", *African Journal of Economic Review*, Vol. 9 No. 2, pp. 130-150.

Özdoğan Özbal, E. (2021), "Dynamic effects of higher education expenditures on human capital and economic growth: an evaluation of OECD countries", *Policy Reviews in Higher Education*, Vol. 5 No. 2, pp. 174-196.

Parro, F. and Pohl, V. (2018), "Health shocks, human capital, and labor market outcomes", Upjohn Institute Working Paper, No. 18-290.

Pelinescu, E. (2015), "The impact of human capital on economic growth", *Procedia Economics and Finance*, Vol. 22, pp. 184-190, doi: 10.1016/S2212-5671(15)00258-0.

Pesaran, M.H. (2004), "General diagnostic tests for cross section dependence in panels", Cambridge Working Papers in Economics.

Pesaran, M.H. and Yamagata, T. (2008), "Testing slope homogeneity in large panels", *Journal of Econometrics*, Vol. 142 No. 1, pp. 50-93.

Pesaran, M.H., Ullah, A. and Yamagata, T. (2008), "A bias-adjusted LM test of error cross-section independence", *The Econometrics Journal*, Vol. 11 No. 1, pp. 105-127.

Pradhan, R.P. (2011), "Effects of health spending on economic growth: a time series approach", *Decision*, Vol. 38 No. 2, pp. 68-83.

Ranjan, R. (2020), "Role of education in human capital formation in Bihar", *Research Review International Journal of Multidisciplinary*, Vol. 5 No. 4, pp. 105-107.

Rizvi, S.A.F. (2019), "Health expenditures, institutional quality and economic growth", *Empirical Economic Review*, Vol. 2 No. 1, pp. 63-82.

Sağdıç, E.N. and Yıldız, F. (2021), "An empirical investigation on the relationship between public health expenditures and economic growth in Turkey", *International Journal of Afro-Eurasian Research*, Vol. 6 No. 12, pp. 14-31.

Saraçoğlu, S. and Songur, M. (2017), "Health expenditures and economic growth nexus: an example of Eurasian countries", *Kafkas University, Journal of Economics*, Vol. 8 No. 16, pp. 353-372, doi: 10.9775/kauiibfd.2017.016.

Schultz, T.W. (1961), "Invest in human capital", *The American Economic Review*, Vol. 51 No. 1, pp. 1-17.

Sghari, M.B.A. and Hammami, S. (2013), "Relationship between health expenditure and GDP in developed countries", *IOSR Journal of Pharmacy*, Vol. 3 No. 4, pp. 41-45.

Sims, C.A. (1980), "Macroeconomics and reality", *Econometrica*, Vol. 48 No. 1, pp. 1-76.

Sökmen, F.Ş. (2021), "Does health expenditures affect economic growth in BRICS-T countries? An empirical investigation", *Journal of Academic Researches and Studies*, Vol. 13 No. 24, pp. 1-10.

Suzan, O. and Yaşar Dinçer, F.C. (2021), "The effect of educational and health expenditures on economic growth in OECD countries: a panel data analysis", *International Journal of Management Economics and Business*, Vol. 17 No. 1, pp. 47-62.

Taban, S. (2006), "The causality relationship between health and economic growth in Turkey", *Sosyo Ekonomi Dergisi*, Vol. 4 No. 4, pp. 31-46.

Tahir, M., Hayat, A., RashidAfridi, K.M.A. and Tariq, Y.B. (2020), "Human capital and economic growth in OECD countries: some new insights", *Journal of Economic and Administrative Sciences*, Vol. 36 No. 4, pp. 367-380.

Thinagar, S., Ismail, M.K., Vy, L.A. and Haron, A.A. (2021), "Human capital investment and economic growth: a study on ASEAN countries", *International Journal of Academic Research in Business and Social Sciences*, Vol. 11 No. 18, pp. 12-24.

Tunalı Sarı, N., Özkan, E. and Yıldırım, S. (2021), "The relationship between health expenditures and economic growth: a panel data analysis on Euro countries", *İzmir Journal of Economics*, Vol. 36 No. 1, pp. 191-210.

Uçan, O. and Atay, S. (2016), "An analysis of health expenditure and growth in Turkey", *Niğde Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, Vol. 9 No. 3, pp. 215-222.

Wang, K. (2011), "Health care expenditure and economic growth : quantile panel-type analysis", *Economic Modelling*, Vol. 28 No. 4, pp. 1536-1549.

World Bank (2021a), available at: https://data.worldbank.org/indicator/SP.DYN.LE00.IN.

World Bank (2021b), available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD.

World Bank (2021c), available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG.

World Bank (2021d), available at: https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.CD&country=.

World Health Organization Global Health Expenditure Database (2021), available at: https://apps.who.int/nha/database/Select/Indicators/en.

World Health Organization Global Spending on Health (2020), Weatherıng The Storm Report, available at: https://www.who.int/publications/i/item/9789240017788.

World Tourism Organization (2018), available at: https://www.e-unwto.org/doi/abs/10.18111/9789284420209.1.

Yardımcıoğlu, F. (2012), "An econometric analysis of the relationship between health and economic growth in OECD countries", *Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi*, Vol. 13 No. 2, pp. 27-47.

Yumuşak, İ.G. and Yıldırım, D.Ç. (2009), "An econometric examination over the relation between health expenditure and economic growth", *The Journal of Knowledge Economy and Knowledge Management*, Vol. 4, pp. 57-70.

Zellner, A. (1962), "An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias", *Journal of the American Statistical Association*, Vol. 57 No. 298, pp. 348-368.

Zhao, R. and Du, Y. (2021), "The impact of higher education and human capital quality on "local-neighborhood" economic growth"", *Best Evidence in Chinese Education*, Vol. 8 No. 1, pp. 1041-1057.

Corresponding author

Mustafa Kırca can be contacted at: mustafakirca52@gmail.com