Identifying the Causality Relationship between Health Expenditure and Economic Growth: An Application on E7 Countries

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ABSTRACT

This study aims to identify the causality relationship between health expenditure and economic growth in emerging economies. Within this framework, E7 countries are evaluated by using Pedroni panel cointegration method and Dumitrescu Hurlin panel causality analysis. For this purpose, annual data for the years between 1996 and 2016 is considered. As a result of Pedroni panel cointegration test, it is defined that there is a long run relationship between economic growth with total health expenditure and public health expenditure, but this relationship is not valid between private health care expenditure and economic growth. According to Dumitrescu Hurlin panel causality analysis results, it is concluded that there is not a causality relationship from the health expenditure to the economic growth. However, it is also determined that economic growth is the main cause of total, public and private health expenditure. Therefore, it is recommended that the role of private sector in health should be improved so that the health expenditure can have a positive contribution to the economic development of emerging countries.

Keywords: Health Expenditure, E7 Countries, Economic Growth, Pedroni Panel Cointegration Analysis, Dumitrescu Hurlin Panel Causality Analysis.

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INTRODUCTION

Economic growth is the most important purpose of the countries. The main reason of this issue is that it explains the development of these countries. In other words, when economic growth increases, it means that production of the goods and services in this country goes up as well (Barro, 1991). Another important point of economic growth is that it is a very significant indicator of the economy of the country on the eyes of foreign investors. Hence, foreign investors prefer to invest to the countries that have high economic growth. Because of this condition, countries aim to take many actions in order to provide economic growth (Acemoğlu and Restrepo, 2017; Lisowsky et. al., 2017).

Health expenditure is the factor that shows the life quality of people. Since the health is an essential issue in the lives of the people, any expenditure that contributes to people's health has a positive influence on the welfare (Grigoli and Kapsoli, 2018). Therefore, it is accepted as the important aspect which gives information about the development of a country. Due to this condition, each country in the world aims to increase health expenditure (Stubbs et. al., 2017; Yip et. al., 2017). Within this framework, some governments make public health expenditure whereas some other countries try to attract the attention of private investors.

The relationship between economic growth and health care expenditure is a much-discussed topic in the literature. Most of the authors argue that health expenditure has a contribution to the economic improvement (Piabuo and Tieguhong, 2017; Erçelik, 201; Naidu and Chand, 2013). On the other hand, some researchers also believe that the countries, which have high economic growth, make more health expenditure (Wang et. al., 2018; Khoshnevis Yazdi and Khanalizadeh, 2017). In addition to them, the bidirectional relationship between these two different variables is also underlined (Mukherjee, 2017; Khan et. al., 2016). Moreover, some researchers also emphasize the importance of public health expenditure on economic improvement of the countries (Ghanbari and Basakha, 2008; Odior, 2011). Thus, it can be said that the studies that focus on this topic are very important in economic development of the countries.

Emerging countries refer to the countries that have not been developed yet.

Nevertheless, it is thought that they have a potential to grow (Karwowski and Stockhammer, 2017). Due to this situation, these countries try to take some actions in order to achieve this objective. For example, these countries may provide some incentives to the foreign investors to attract their attention (Armanios et. al., 2017). Thus, it can be possible to have economic development by increasing investments and decreasing unemployment rate. Within this context, health expenditure also plays a key role for this purpose because when the health level of the people goes up, they can be more productive (Jakovljevic et. al., 2017).

Parallel to the issues emphasized above, in this study, it is aimed to understand the causality relationship between economic growth and health expenditure. For this purpose, E7 countries are evaluated by using Pedroni panel cointegration method and Dumitrescu Hurlin panel causality analysis. In addition to these aspects, annual data for these variables between 1996 and 2016 is used. Also, in this process, the effects of public and private expenditure on economic development are taken into the consideration. As a result of this analysis, it can be possible to present recommendations that have a contribution to the development of emerging countries.

This study consists of 5 different sections. After the introduction part, some quantitative information about the health expenditure is given in the second part. In this section, the difference in health expenditure between different regions is shared. Moreover, the third part focuses on the details of similar studies in the literature. Therefore, it is aimed to identify the missing area in the literature related to this topic. Furthermore, in the fourth section, an application on E7 countries is given by using Pedroni panel cointegration method and Dumitrescu Hurlin panel causality analysis. Finally, recommendations are presented on the final part.

QUANTITATIVE INFORMATION ABOUT HEALTH EXPENDITURE

Health expenditure is accepted as a significant indicator of economic development. Hence, countries aim to increase the amount of this expenditure. Figure 1 illustrates the trends in current health expenditure in the world in the last decade.

Figure 1: Current Health Expenditure per Capita in US$
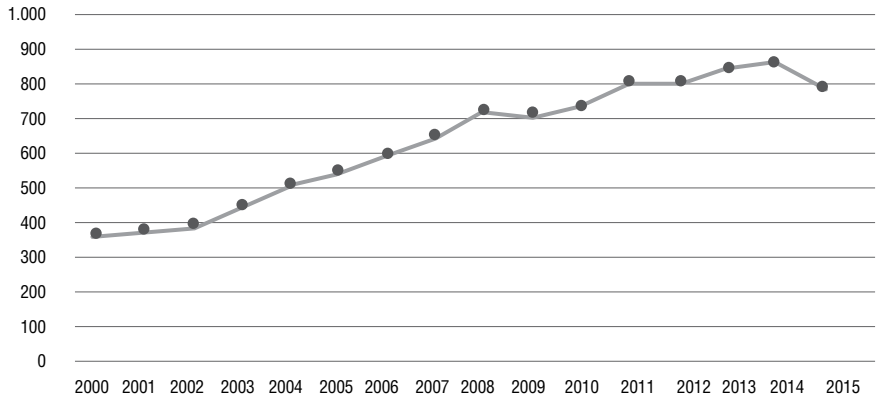
Figure 1 gives information that current health expenditure has an increasing trend in last 10 years. This situation shows that most of the countries all around the world give importance to the health expenditure. For example, while the average of current health expenditure per capita was 345$ in 2000, this amount jumped to the amount of 822$ in 2015. In addition to this aspect, Figure 2 shows the changes in the domestic and external health expenditure.

Figure 2: Domestic and External Health Expenditure as % of Current Health Expenditure


■ External Health Expenditure (EXT) as % of Current Health Expenditure (CHE)

■ Domestic Health Expenditure (DOM) as % of Current Health Expenditure (CHE)
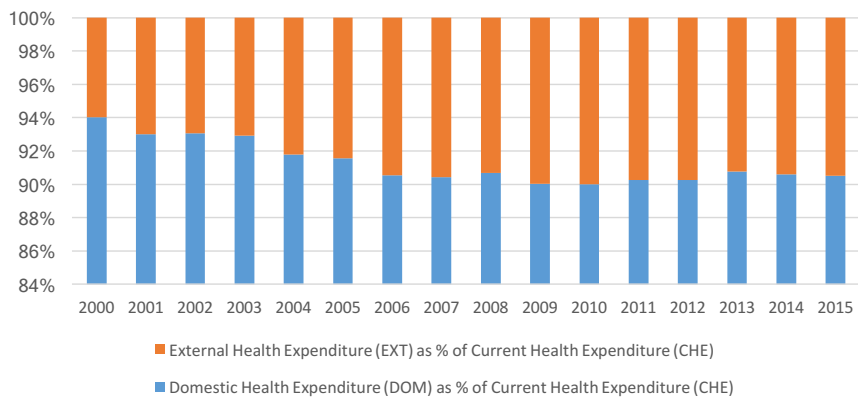
Figure 2 states that there is not a significant change in the ratio of domestic

and external health expenditure. Another important point in this figure is that domestic health expenditure has a very high percentage in comparison with external health expenditure. Figure 3 demonstrates the percentage of government and private health expenditure in the last years.

Figure 3: Government and Private Health Expenditure as % of Current Health Expenditure
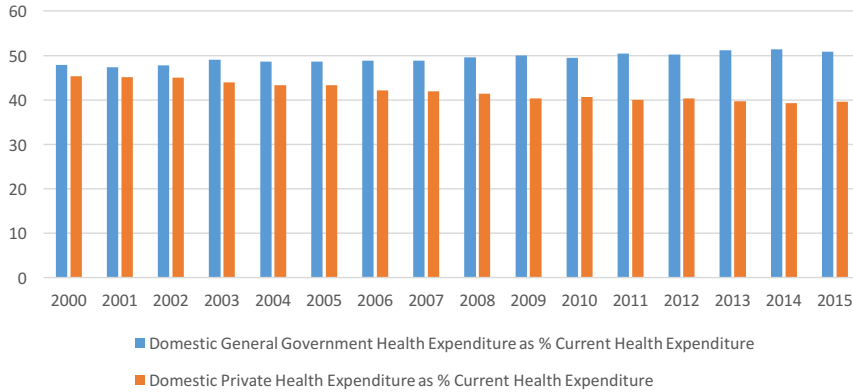
Source: *WHO*

Figure 3 indicates that domestic government health expenditure is greater than domestic private health expenditure. In addition to this condition, it can also be seen that there is an increase in this difference especially in the last years. Figure 4 illustrates the total health expenditure for selected regions in the world as the percentage of GDP.

Figure 4: Total Health Expenditure of Selected Regions (% of GDP)
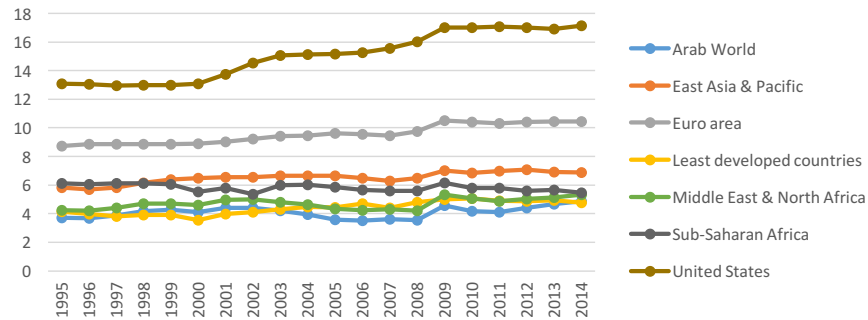
Source: *World Bank*

Figure 4 explains that the United States has the highest health expenditure ratio all around the world. Additionally, Euro area has also high percentage in comparison with other areas. On the other side, less developed countries and Africa have very low health expenditure percentage. While looking at this information, it can be understood that health expenditure percentage of GDP has a positive correlation with the income level of the countries.

LITERATURE REVIEW

The relationship between health expenditure and economic growth is evaluated by many different studies in the literature. Some selected studies are demonstrated in Table 1.

Table 1: Selected Studies in the Literature

Authors	Scope	Method	Result
Carrin and Politi (1996)	Least Developed Countries	Regression	The level of economic growth is an important indicator of health expenditure.
Leidl (1998)	European Countries	Granger Causality Analysis	Health care expenditure and economic growth affect each other significantly.
Scheffler (2004)	US	Descriptive Statistics	Health care expenditure leads to economic improvement.
Mojtahed and Javadipour (2004)	Developing Countries	Regression	It is concluded that health expenditure contributes to economic development.
Chang and Ying (2006)	15 OECD Countries	Descriptive Statistics	It is identified that there is a positive correlation between economic development and health care expenditure.
Ghanbari and Basakha (2008)	Iran	Regression	Government health expenditure in Iran positively affects economic improvement.
Haldar (2008)	India	Granger Causality Analysis	There is two-way causality relationship between economic growth and health care expenditure.
Bukenya (2009)	US	VAR Model	There is a positive relationship between health care expenditure and economic development.
Emadzadeh et. al. (2011)	Developing Countries	Regression	Health care has a positive effect on economic growth.
Balaji (2011)	India	Granger Causality Analysis	When there is an economic growth, the health care expenditure increases.

Wang (2011)	31 Different Countries	VECM Model	It is defined that health care expenditure has a positive influence on economic development.
Mehrara and Musai (2011)	Iran	Granger Causality Analysis	GDP growth is accepted as the significant cause of health expenditure.
Odior (2011)	Nigeria	Simulation Analysis	Public health expenditure leads to economic development.
Ogundipe and Lawal (2011)	Nigeria	Regression	Health care investment is the way of improving the economy.
Bakare and Olubokun (2011)	Nigeria	Regression	There is a positive relationship between health care expenditure and economic growth.
Luo (2011)	China	Data Envelopment Analysis	Public health expenditure has a positive influence on economic improvement.
Keehan et. al. (2012)	US	Descriptive Statistics	National health expenditure has a positive influence on economic growth.
Nasiru and Usman (2012)	Nigeria	ARDL	There is bidirectional relationship between health care and economic development.
Odubunmi et. al. (2012)	Nigeria	Johansen Cointegration Analysis	Health expenditure has a strong effect on economic improvement.
Cylus et. al. (2012)	24 European Countries	Descriptive Statistics	In case of economic recession, health care expenditure decreases.
Naidu and Chand (2013)	Pacific Island Countries	Regression	Health care expenditure is an important factor to have economic improvement.
Safdari et. al. (2013)	Iran	VAR	Health expenditure has a positive influence on economic growth.
Öztürk and Ada (2013)	European Countries	Johansen Cointegration Analysis	There is a bidirectional causality relationship between economic development of the countries and health expenditure.
Mehmood et. al. (2014)	26 Asian Countries	Granger Causality Analysis	There is a causality relationship from economic growth to the health expenditure.
Khan et. al. (2016)	SAARC Countries	Kao Panel Cointegration Analysis	There is two-way correlation between economic improvement and health expenditure.
Halıcı-Tülüce et. al. (2016)	44 Different Countries	GMM	There is a negative relationship between private health expenditure and economic growth.
Atılgan et. al. (2017)	Turkey	ARDL Method	Health care expenditure has a significant contribution to the economic growth.

De Mendonça and Baca (2017)	75 Developing Countries	Regression	Public health expenditure positively affects economic growth.
Aboubacar and Xu (2017)	African Countries	GMM	Health expenditure is accepted as the significant indicator of economic growth.
Mukherjee (2017)	India	VECM	It is concluded that health expenditure and economic growth affect each other
Khoshnevis Yazdi and Khanalizadeh (2017)	MENA Countries	ARDL	Economic growth causes higher health expenditure.
Piabuo and Tieguhong (2017)	African Countries	Regression	Any increase in health care expenditure has a positive influence on economic growth.
Wang and Lee (2018)	24 Different Countries	Regression	In case of increase in health care expenditure, economic growth will be affected positively.
Erçelik (2018)	Turkey	ARDL	There is a significant relationship between health expenditure and economic development.
Wang et. al. (2018)	22 Different Countries	VAR	When economic growth decreases, it has a negative effect on health expenditure.

Table 1 shows that most of the studies focus on the impact of health expenditure on economic growth. For example, Wang and Lee (2018) conducted a study to analyze this relationship in 24 different countries. By using regression analysis, it is determined that health care expenditure has a significant contribution to the economic growth. Moreover, Piabuo and Tieguhong (2017), Naidu and Chand (2013), Bakare and Olubokun (2011), Ogundipe and Lawal (2011), Emadzadeh et. al. (2011) and Mojtahed and Javadipour (2004) also reached the similar result by using the same methodology. Furthermore, Erçelik (2018) and Atılgan et. al. (2017) identified that health care expenditure has a positive influence on economic development with the help of ARDL methodology.

In addition to these studies, Bukenya (2009) tried to define the influence of health care expenditure on economic improvement of US. As a result of VAR analysis, it is concluded that health expenditure is accepted as the significant indicator of economic growth. Scheffler (2004) and Keehan et. al. (2012) also emphasized the same issue by using different methodology. Additionally, Wang (2011) focused on this relationship in 31 different countries. With the help of VECM, it is determined that health expenditure has a strong effect on economic improvement. Similarly, Chang and Ying (2006), Odubunmi et. al.

(2012), Safdari et. al. (2013) and Aboubacar and Xu (2017) also underlined the same situation for different countries, such as Iran and Nigeria.

By looking at Table 1, it can also be understood that some studies stated the opposite way of relationship between these variables. For instance, Wang et. al. (2018) aimed to identify this relationship in 22 different countries. By using VAR analysis, they determined that there is a causality relationship from economic growth to the health expenditure. Parallel to this study, Balaji (2011), Mehrara and Musai (2011) and Mehmood et. al. (2014) also reached this conclusion with the help of Granger causality analysis. Moreover, Carrin and Politi (1996), Cylus et. al. (2012) and Khoshnevis Yazdi and Khanalizadeh (2017) also identified that the level of economic growth is an important indicator of health expenditure.

Additionally, it is also seen that in some studies, mutual relationship between economic growth and health care expenditure is underlined. As an example, Mukherjee (2017) tried to define the relationship between these two variables in India. According to the VECM results, it is understood that there is a bidirectional causality relationship between economic development of the countries and health expenditure. Haldar (2008) also emphasized the similar aspect for the same country by using Granger causality analysis. Furthermore, Leidl (1998), Nasiru and Usman (2012), Öztürk and Ada (2013) and Khan et. al. (2016) are also other studies that showed the importance on two-way causality relationship between economic growth and health expenditure.

Moreover, it is also stated that some other studies made more specific analysis within this context. For instance, De Mendonça and Baca (2017) focused on 75 different developing economies by using regression analysis. They defined that public health expenditure positively affects economic growth. In addition to this study, Ghanbari and Basakha (2008), Odior (2011) and Luo (2011) also identified that public health expenditure has a positive influence on economic improvement. On the other hand, Halıcı-Tülüce et. al. (2016) conducted a study to evaluate the relationship between economic growth and health expenditure. With the help of GMM methodology, they concluded that there is a negative relationship between private health expenditure and economic growth.

While considering the studies emphasized in Table 1, it can be understood that the relationship between economic improvement and health care expenditure

attracted the attention of many different researchers. Owing to this aspect, many different studies were carried out for different countries. In addition to this condition, it can also be seen that different types of the methodology are also taken into the consideration, such as regression, VECM, Granger causality analysis and ARDL. Nevertheless, it is identified that there is a need for a new study in which the effects of public and private health expenditure on the economic growth are evaluated. Hence, making this kind of analysis with an original methodology makes a significant contribution to the literature.

AN EVALUATION ON E7 COUNTRIES
DATA AND SCOPE

In this study E7 countries are taken into the consideration. They are the biggest emerging economies, such as Brazil, China, India, Indonesia, Mexico, Russia, and Turkey. In the evaluation process, 3 different analyzes are performed to see the effect of total, public and private health expenditure on economic growth. The ratios of all health expenditures to the GDP are used. Moreover, with respect to the economic growth, annual GDP growth is considered. Annual data of these variables between the years 1996 and 2016 is used and this data is provided from the website of World Bank.

PEDRONI PANEL COINTEGRATION ANALYSIS

Cointegration analysis is used to understand whether there is a long-term relationship between the variables. In Pedroni panel cointegration analysis, there are 7 different tests which are Panel v-Statistic, Panel rho-Statistic, Panel PP-Statistic, Panel ADF-Statistic, Group rho-Statistic, Group PP-Statistic and Group ADF-Statistic. This methodology is suitable while making evaluation by using panel data. In this test, probability values of all these 7 tests are calculated. If the probability values of 4 or more tests are lower than 0.05, it means that there is cointegration between the variables. In other words, it can be said that these variables have long-run relationship (Pedroni, 2001; Pedroni, 1996).

DUMITRESCU HURLIN PANEL CAUSALITY ANALYSIS

Dumitrescu Hurlin panel causality analysis is the methodology which aims to understand the causal relationship between the variables. It is accepted as the advanced version of Granger causality analysis. In this approach, it is possible to evaluate by using panel data. The equation of Dumitrescu Hurlin panel causality analysis is shown below.

$$Y_{i,t} = a_i + \sum_{k=1}^{K} Y_i^k Y_{i,t-k} + \sum_{k=1}^{K} B_i^k X_{i,t-k} + \varepsilon_{i,t} \quad (1)$$

In this equation, X and Y represent the variables. Therefore, the aim of this methodology is to determine whether X is the main cause of Y. Furthermore, B is the coefficient of the variable and a is the constant term. Additionally, $\in$ refers to the error term and K gives information about the optimal lag interval (Dumitrescu and Hurlin, 2012).

Dumitrescu Hurlin panel causality analysis is studied in many different studies. For example, Latif et. al. (2017), Paramati et. al. (2016) and Adalı and Yüksel (2017) focused on the causality relationship between foreign direct investment and economic growth. In addition to these studies, Dinçer et. al. (2017), Hasanov et. al. (2017) and Kahia et. al. (2017) evaluated the causality relationship between economic growth and energy consumption. Moreover, the relationship between financial development and economic growth is emphasized by using Dumitrescu Hurlin panel causality analysis in many different studies (Aydın and Malcıoğlu, 2016; Salahuddin and Alam, 2016; Abubakar et. al., 2015). Khan et. al. (2016), Tunalı (2018) and Amiri and Linden (2016) are the studies that used Dumitrescu Hurlin panel causality analysis in health sector.

ANALYSIS RESULTS FOR E7 ECONOMIES

In order to understand whether there is a long-term relationship between health expenditure and economic growth, panel cointegration model is used. Within this scope, firstly, panel unit root test is performed to see whether the variables are stationary or not. The details of Im, Pesaran and Shin panel unit root test are given on Table 2.

Table 2: Im, Pesaran and Shin Panel Unit Root Test Results

Variables	Level Value (probability)	First Difference (probability)
Total Health Expenditure	0.4241	0.0000
Public Health Expenditure	0.4574	0.0000
Private Health Expenditure	0.1933	0.0001
Economic Growth	0.0615	0.0000

Table 2 gives information that level probability values of all 4 variables are higher than 0.05. It shows that these variables have unit roots. Therefore, the first differences of these variables are taken into the consideration, and it is seen that all new probability values are less than 0.05. It is identified that all variables become stationary in their first differences. While considering these aspects, it is concluded that unit root test results satisfy the precondition of panel cointegration analysis. After stationary analysis, Pedroni panel cointegration test is performed to define the relationship between these variables. The details of this test are demonstrated on Table 3.

Table 3: Pedroni Panel Cointegration Test Results

Relationship Type	Test Name	Probability Values
The relationship between total health expenditure and economic growth	Panel v-Statistic	0.0365
	Panel rho-Statistic	0.0000
	Panel PP-Statistic	0.0000
	Panel ADF-Statistic	0.0000
	Group rho-Statistic	0.0021
	Group PP-Statistic	0.0000
	Group ADF-Statistic	0.0001
The relationship between public health expenditure and economic growth	Panel v-Statistic	0.4358
	Panel rho-Statistic	0.1878
	Panel PP-Statistic	0.0028
	Panel ADF-Statistic	0.0093
	Group rho-Statistic	0.6027
	Group PP-Statistic	0.0009
	Group ADF-Statistic	0.0167
The relationship between private health expenditure and economic growth	Panel v-Statistic	0.8921

	Panel rho-Statistic	0.8249
	Panel PP-Statistic	0.4104
	Panel ADF-Statistic	0.2178
	Group rho-Statistic	0.9666
	Group PP-Statistic	0.6936
	Group ADF-Statistic	0.1991

Table 3 gives information that with respect to the relationship between total health expenditure and economic growth, the probability values of all 7 different tests are lower than 0.05. Therefore, it is determined that the null hypothesis of "no cointegration" is rejected. In other words, it can be seen that there is a long-run relationship between total health expenditure and economic growth for these countries. Moreover, as for the relationship between public health expenditure and economic growth, it can be understood that the probability values of 4 different tests are lower than 0.05 whereas for other 3 tests, these values are greater than 0.05. Hence, it is concluded that there is a long-run relationship between public health expenditure and economic growth.

In addition to these issues, regarding the relationship between private health expenditure and economic growth, it can be seen that probability values of all 7 different tests are higher than 0.05. While considering these results, the null hypothesis cannot be rejected. Thus, it is identified that there is not a long-run relationship between private health care expenditure and economic growth. After making panel cointegration analysis, panel causality analysis is also performed by using Dumitrescu Hurlin methodology. The details of this analysis are explained in Table 4.

Table 4: Dumitrescu Hurlin Panel Causality Analysis Results

The Way of the Relationship	Lag	Probability Values	Results
Total Health Expenditure → Economic Growth	1	0.6304	Total health expenditure does not cause economic growth.
	2	0.9158	
	3	0.4429	
Economic Growth → Total Health Expenditure	1	0.0000	Economic growth is the main cause of total health care expenditure.
	2	0.0000	
	3	0.0000	

Public Health Expenditure → Economic Growth	1	0.7030	Public health expenditure does not cause economic growth.
	2	0.7910	
	3	0.6992	
Economic Growth → Public Health Expenditure	1	0.0543	Economic growth is the main cause of public health care expenditure.
	2	0.0000	
	3	0.0000	
Private Health Expenditure → Economic Growth	1	0.0003	Private health expenditure does not cause economic growth.
	2	0.2245	
	3	0.7190	
Economic Growth → Private Health Expenditure	1	0.0000	Economic growth is the main cause of private health care expenditure.
	2	0.0000	
	3	0.0223	

Table 4 explains that there is not a causality relationship from the total health expenditure to the economic growth. The main reason is that the probability values of all lags are greater than 0.05. This situation is also similar with respect to the relationship from public health expenditure to the economic growth. Hence, the null hypothesis of "no causality relationship" cannot be rejected. Furthermore, as for the causality relationship from private health expenditure to the economic growth, the probability value for lag 1 (0.0003) is lower than 0.05. In spite of this situation, it can also be seen that the probability values for other lags are greater than 0.05. Hence, it can be said that private health expenditure does not cause economic growth.

Additionally, regarding the relationship from economic growth to the total health expenditure, it is defined that probability values of all lags are lower than 0.05. This situation indicates that the null hypothesis of "no causality relationship" can be rejected. Similar to this issue, all probability values are also lower than 0.05 with respect to the relationship from economic growth to the public and private health expenditure. Therefore, it can be concluded that in addition to the causality relationship between economic growth and total health expenditure, it can also be said that economic growth leads to higher public and private health expenditure for E7 countries.

CONCLUSION

Health expenditure plays a key role in the economic improvement of emerging economies. When people in these countries become healthier, they

can be more productive. Hence, it is believed that health expenditure has a contributing effect for emerging countries to reach the developed status. Because of this situation, many emerging countries try to take some actions so as to increase health expenditure. The main purpose behind this issue is to increase investment and decrease unemployment rate so that it can be possible to have economic development.

In this study, it is aimed to evaluate the relationship between economic growth and health expenditure in emerging economies. Within this context, E7 countries are examined by using Pedroni panel cointegration method and Dumitrescu Hurlin panel causality analysis. For this purpose, annual data for the years between 1996 and 2016 is considered to reach this objective. Moreover, two different additional analyses are also performed in order to identify whether public and private health care expenditure has an influence on economic improvement of these countries.

In the first process of the analysis, Im, Pesaran and Shin panel unit root test is performed to understand whether the variables are stationary or not. It is understood that level probability values of all 4 variables are higher than 0.05 and these values for the first difference of these variables are lower than 0.05. Hence, it is defined that variables become stationary in their first difference. Hence, it can be understood that panel unit root test results satisfy the precondition of panel cointegration analysis.

After stationary analysis, Pedroni panel cointegration test is performed to identify the relationship between these variables. Firstly, it is determined that the null hypothesis of "no cointegration" is rejected with respect to the relationship between total health expenditure and economic growth. It can also be seen that there is a long-run relationship between public health expenditure and economic growth. On the other side, it is identified that there is not a long-run relationship between private health care expenditure and economic growth.

According to Dumitrescu Hurlin panel causality analysis, it is concluded that there is not a causality relationship from the total health expenditure to the economic growth. Similarly, a significant causality relationship cannot be found between economic growth and public and private health care expenditure. On the other hand, it is determined that economic growth is the

main reason of total health expenditure, public health expenditure and private health expenditure.

By considering these results, it can be stated that health expenditure does not have a contributing influence on economic development of emerging countries. Nevertheless, it is concluded that when economic growth of these emerging countries increases, they can give more importance to health care expenditure. This situation is also underlined in many different studies in the literature (Carrin and Politi, 1996; Cylus et. al., 2012; Khoshnevis Yazdi and Khanalizadeh, 2017).

In emerging economies, government health expenditure is greater than private health expenditure and this difference is growing especially in recent years. Therefore, according to these results, it can be recommended that the role of private sector in health should be increased. This study aims to make contribution to the literature by focusing on this important topic for emerging economies. However, it is thought that a new study that also covers developed economies is also very beneficial.

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