THE NEXUS BETWEEN HEALTH EXPENDITURES AND ECONOMIC GROWTH IN AUSTRALIA: EVIDENCE FROM TODA-YAMAMOTO APPROACH

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Abstract
Health is one of the most important factors of human life. Increasing and improving the level of health is significant for people to continue their lives in a healthy way. Within this scope, health expenditures play an important role in increasing the life expectancy and quality of life of individuals. It can be said that a healthy and educated society is a prerequisite for economic growth, welfare and development of a country. The aim of this study is to examine the nexus between health expenditures and economic growth in Australia for the period of 1973-2018 by using Toda-Yamamoto causality test. The empirical results from the Toda-Yamamoto causality test show that there is a unidirectional Granger causality running from health expenditures to economic growth.

Keywords: *Economic Growth, Health Expenditures, Australia, Toda-Yamamoto Causality Test*

JEL Classification: *H51, I1, I15*

I. INTRODUCTION

Health is a fundamental right and necessity for every human being. Health expenditures are essentially an investment and this investment is quite required and important. Because only healthy individuals can be successful, productive and can contribute to the humanity and society. Therefore, it is very significant to determine, develop and implement suitable policies for the purpose of improving health and increasing the quality of life.

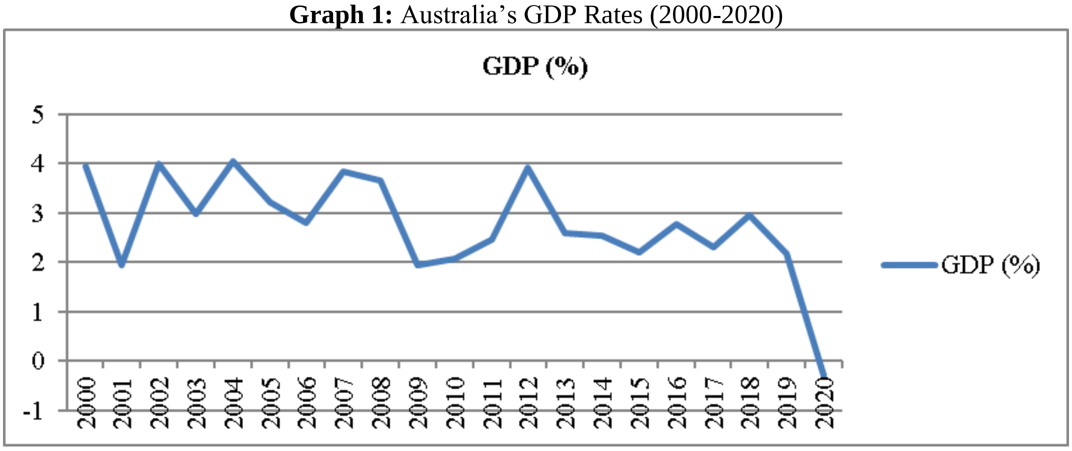
Basically, economic growth can be expressed as the increase in the production of economic goods and services, compared from one period of time to another (https://www.investopedia.com). According to the World Health Organization (WHO), "Health is a state of complete physical, mental, and social well-being and not merely the absence of disease of infirmity" (Callahan, 1973: 77). Health is a significant factor for the development and growth of the country's economies, as well as for the continuation of the society. A healthy society with qualified human resources is very important for economic growth/development. Health expenditures can be considered as all expenditures made to protect, develop and maintain health. Health expenditures not only increase the health level of the individual and society, but also affect economic growth with their contributions to human capital (Tıraş and Ağır, 2018: 14). Spending on health will enhance human development through of some channels such as economic growth, reduce mortality rates and improve the learning process (Razmi et al., 2012). Health is aimed both as a development goal and as a basic input for the creation of human capital that will increase economic efficiency. A healthy population is seen as the engine of economic growth. Besides, there is a widespread view that economic growth is a prerequisite for improving people's health. For policy makers, the analysis of the nexus between economic growth and health is guiding for appropriate policy development and planning health reforms (Şimşir et al., 2015: 44).

According to the general opinion, the high level of health of the countries affects the development of the country positively. Health has a direct impact on countries' income and welfare, labor productivity, demographic and human capital factors. Because according to the human capital theory, improving knowledge and skills increases one's productivity in economic activities. However, the level of health is also important in terms of getting an education and participating in economic activities. Today, in order to improve the quality of health due to the investment of labor force, developed countries and countries that have reached a certain level of welfare allocate resources to health spending at an increasing rate every year (Aydemir and Baylan, 2015: 418; Yumuşak and Yıldırım, 2009: 60).

It can be said that there is a close connection between a person's health to the conditions where they live and work. Elements such as socioeconomic position, educational attainment, employment opportunities, disability status, access to health services, social supports, and the built and natural environments can strengthen or undermine the health of individuals and communities (Australian Institute of Health and Welfare, 2020: 48).

As the world's largest island and smallest continent, Australia is the sixth largest country in area in the world, which covering an area of approximately 7.69 million km^2. Australia is located between the Pacific Ocean and the Indian Ocean and has a population of approximately 25.69 million in 2020. Australia has no land borders with other nations. Its neighbors are New Zealand, Papua New Guinea, Indonesia, the Solomon Islands, East Timor, Vanatu and New Caledonia and the capital is Canberra. Australia is one of the world's leading advanced economies. Besides, it is also among the leading countries in the world in terms of welfare and per capita income. Australia became the 13th largest economy in the world with a 2.9% growth in GDP. Since 1992, economic growth has been stable, but annual growth rates have fluctated during this period (European Parliament, 2020: 2; https://data.worldbank.org; https://www.avusturalyakonsoloslugu.com; https://thecommonwealth.org; https://www.dw.com/tr). Australia's most important imports are materials, natural gas and wheat. Although Australia is a net oil exporter, it is among the countries that export a significant amount of coal export. The country is in an advantageous position with the abundance of energy and mineral mines. With a GDP of US $ 1.3 trillion, Australia is the world's 23rd largest export economy with annual exports of $195 billion (Yayman, 2020: 822-823). It is also in the world's top 10 for solar energy production and top 16 for wind energy generation (Australian Trade and Investment Commission, 2019: 12). The human development index includes being knowledge and have a decent standard of living as well as a long and healthy life (http://hdr.undp.org/). In this context, in 2019, Australia ranked 8th along with the Netherlands with an index value of 0.944 and showed very high human development (http://hdr.undp.org/en/data). Australia also performs well in health and education, high quality of life, low employment, low public debt, controlled inflation, a highly skilled workforce and a balanced financial system (The Department of Foreign Affairs and Trade, 2016: 7; Yayman, 2020: 822). Australia's healthcare system is one of the pioneers in effectiveness and efficiency, and is among the World Health Organization's top-performing countries in terms of healthy life expectancy and per capita health expenditure (The Department of Foreign Affairs and Trade, 2016: 66). The Australian health care system is financially driven by a mixed system of Medicare insurance and private insurance, created by taxes from the federal government. Healthcare in Australia is financed by both government and non-government sources. In other words, responsibilities for health care are divided between the Federal and State governments, and both the public and the private sectors play a role. This situation brings about differences between states and inequalities in health (Özyurda, 2021: 412-423; Gibson and Covvey, 2011; 220).

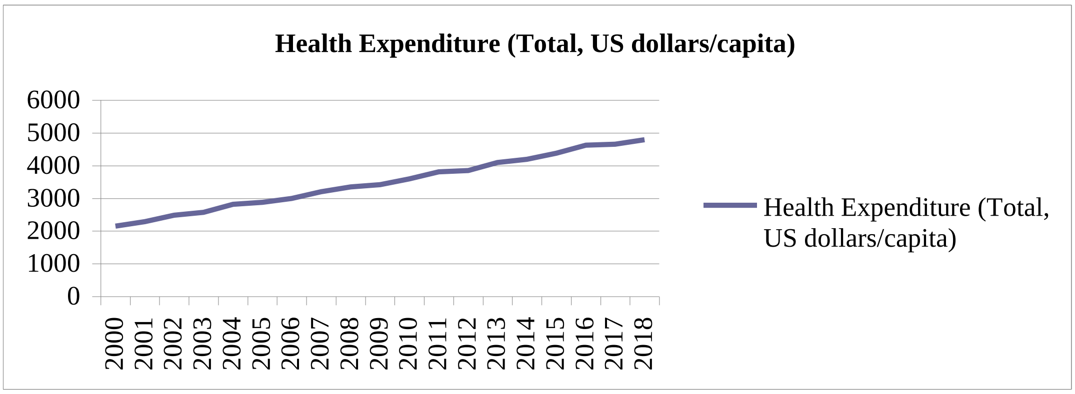
Graph 1: Australia's GDP Rates (2000-2020)



Source: https://data.worldbank.org

Economic growth rates of Australia between 2000 and 2020 are shown in graph 1. It can be seen from the graph that the growth rates between the period in question vary between -0.28% and %4 on average. The graph shows that the growth rates decreased in 2001 and 2008-2009. Again, it is seen that the growth rates decreased in 2019 and 2020. It can be said that this decrease is due to the COVID-19 global pandemic that emerged in 2019.

Graph 2: Australia's Health Expenditures (2000-2018)



Source: https://data.oecd.org

In graph 2, Australia's health expenditures per capita between 2000 and 2018 is shown. Per capita health expenditures in Australia have increased continuously from 2000 to 2018 and have followed an increasing trend. Especially in 2001 and 2008-2009 crisis years, while GDP of Australia decreased significantly, it is seen that health expenditures continued to increase. Throughout the period of 2000 and 2016, Australia's health spending to GDP ratio was higher than the OECD median. Growth in health spending appears to be relatively higher than GDP growth rates (Australian Institute of Health and Welfare, 2019: 2-5).

The aim of this study is to examine whether there is a causal relationship between health expenditures and economic growth in Australia and determine the direction of the causality by using Toda-Yamamoto causality approach. The study covers the period of 1973-2018. The remaining part of the study is organized as follows: Section 2 desribes the relationship between health and economic growth. Section 3 summarises the empirical literature of the nexus between health expenditures and economic growth. Section 4 introduces the data set and econometric method used in the study. Section 5 describes the empirical results of the research. Last section is the conclusion of the study.

II. THE RELATIONSHIP BETWEEN HEALTH AND ECONOMIC GROWTH

It can be said that economic growth and health are interrelated. There are two plausible explanations for the existence of the relationship between health and economic growth. Firstly, increased income will lead to better health conditions. Secondly, healthy workers will be more productive, thus earning higher incomes (Şahin and Yalçınkaya, 2020: 53). In addition, a healthy person will maintain both the social and business life in order (Tutar and Ekici, 2020: 1336).

Improving health conditions and positive contributions to economic growth can occur in different ways. It is assumed that long-term life expectancy will increase the rate of savings, capital accumulation and investment, thereby increasing growth rates (Şahin and Yalçınkaya, 2020: 53). At the same time, since healthy people are more energetic physically and mentally, general and significant improvements in public health will affect labor productivity positively. Positive developments in health can affect economic growth through education. Quality and positive improvements in health can cause an increase in life expectancy and help reduce infant and child mortality rates. Raising healthy people can contribute positively to the increase in the number of the working-age population and its qualitative improvement (Doğan, 2016: 30). Therefore, it is not possible to consider the health separately from economic and social structure (Erol and Özdemir, 2018: 120).

In 1962, Mushkin showed that simultaneous investments in health and education had positive impacts on the economic development process. In this framework, it was determined that healthy and educated people act more effectively as consumers and producers in the society. Another point is that healthy individuals are better educated and the workforce that grows from these people is a factor that increases production. At the same time, if healthy people are educated, since these people will live longer, it will be possible to benefit from education investments for a longer period of time. At this point, it is clear that education and health are two complementary factors. The fact that health expenditures increase economic growth is explained by the health-led growth hypothesis. According to the health-led growth hypothesis, health expenditures are productive capital. In other words, investments made in the health sector have positive impact on total economic growth. However, the existence of a weak health sector in countries can have a negative effect on the productivity of capital (Kamacı and Yazıcı, 2017: 55-56). Since the health-led growth hypothesis implies an increase in the total factor productivity of a healthier population, a healthier population can work longer, be more productive, earn higher earnings, have higher learning abilities, and states that the economy in general can increase the productivity of human capital (Atilgan et al., 2016: 567). Bloom and Canning who states that health is of paramount importance as both a source of human welfare and a determinant of overall economic growth, describe due to their greater physical energy and mental clearness, healthy populations tend to have higher productivity. According to them, healthier individuals can effect the economy in four ways: 1) they might be more productive at work and therefore earn higher incomes, 2) they may spend more time in the labor force, as less healthy people take sickness absence or retire early, 3) they may invest more in their own education, which will increase their productivity, and 4) they may save more in expectation of a longer life – for instance, for retirement – increasing the funds available for investment in the economy (Oni, 2014: 78). Cole and Neumayer emphasized that poor health has a negative effect on productivity (Tang, 2011: 199). Akın stated that there is a close relationship between health services, education level and population structure in a society and economic and social development. Investments in health services cause the health level of the society to increase, which makes it more successful and brings a healthy production structure for education. This will accelerate the increase in productivity and production. Allocating more resources for a healthy society and the effective use of these resources contribute to both economic and social development. Societies with higher education levels take part in development as a qualified workforce, with improvements in health indicators. Increase in efficiency and production will increase income, and an increase in income will increase economic and social development. Generally, developed societies aim to raise the health and welfare level of the society and to maintain this level by allocating more resources for health services compared to other countries (Deniz and Sümer, 2016: 473). According to Wang, with the development of a country's economy, people tend to place more value on quality of life. For this reason, there is more demand for medical services, especially in developed countries with higher national income (Wang, 2011: 1536). World Health Organization and European Commission reports reveal that increasing health expenditures contribute to the economic growth of both developed and developing countries (Kutlu, 2021: 1810). Good health is a very important part of well-being. As noted by the World Bank, good health can influence economic growth in several ways: good health can reduce production losses caused by worker illness, it can permit the use of natural resources that had been totally or nearly inaccessible because of disease, it can increase children's school enrollment and enables them to learn better, and it can frees for alternative uses of resources that would otherwise have to be spent on treating illness (World Bank, 1993: 17).

III. LITERATURE REVIEW

The relationship between economic growth and health expenditures has been a topic of empirical research that has received widespread attention, and this issue is still current and continues to be important. As a result of the spread of the COVID-19 pandemic, which emerged in December 2019, reminded how important health is both in the continuation of social life and in development (Beceren et al., 2021: 2). Within this scope, when literature is analyzed, it is seen that there are many empirical studies examining the relationship between economic growth and health expenditures. Table 1 presents some studies examining the relationship between the variables in question.

Table 1: Literature Summary on the Relationship between Economic Growth and Health Expenditures

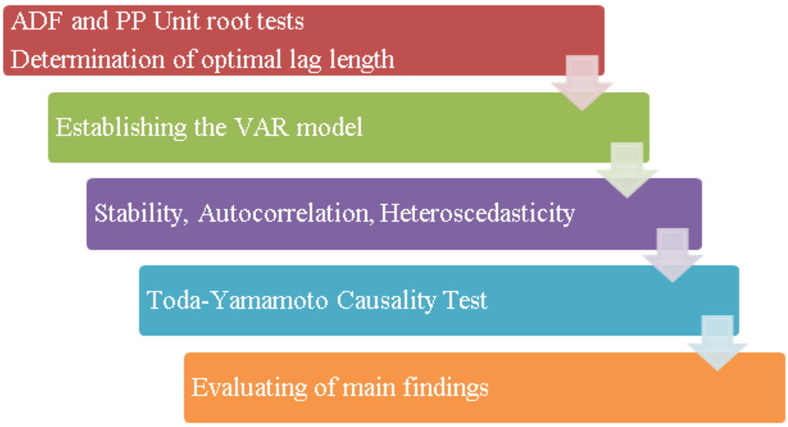
Researcher(s)	Scope	Method	Results
Aka and Dumont (2008)	1929-1997, The USA	Johansen cointegration, ECM and causality tests	There is cointegration between economic growth, health and education. According to the EC-VAR investigations, there is two-way causality between education and health. Besides, causality between health and economic growth was found
Bozkurt (2010)	1980-2005, Turkey	Two Step Engle-Granger, Johansen Cointegration and Stock-Watson methods	There is causal relation from the health and education to economic growth, if education and health being analysed seperately. But there is causal relation from health to growth if the variables have been analysed together. The health is dominant factor
Rahman (2011)	1990-2009, Bangladesh	Cointegration and Granger causality tests	There is a bilateral causality from education expenditure to GDP and from education expenditure to health expenditure and a one-way causality from health expenditure to GDP
Alhowaish (2014)	1981-2013, Saudi Arabia	Granger causality test	A one-way causal relationship from economic growth to healthcare spending was found
Yakışık and Çetin (2014)	1980-2012, Turkey	ARDL bounds test method	There are significant and positive effects of patent, average life of expectancy, and secondary schooling ratio on growth while there is no effect of higher education schooling ratio
Onisanwa (2014)	1995-2009, Nigeria	Cointegration and Granger causality tests	Health indicators have a positively impact on GDP in the long run and health indicators cause the per capita GDP
Öztürk and Topcu (2014)	1995-2012, G8 countries	Kao panel cointegration and panel causality tests	There is a long-run equilibrium between the variables. According to the causality test findings, there is a unidirectional causality from health expenditure to economic growth in the short run. Besides, there is a causality from economic growth to health expenditures in the long run
Akıncı and Tuncer (2016)	2006:Q1-2016:Q2, Turkey	Johansen cointegration test, VECM, Granger causality analysis, Impulse-Response Functions based on VAR model and Variance Decomposition methods	There is a long run two-way link between health expenditures and economic growth
Arslan et al. (2016)	1975-2012, Turkey	Hatemi-J asymmetric causality test	A positive link between health indicators and development was found
Badri and Badri (2016)	2006-2013, 24 selected countries of	GMM method	Health spending has an important and positive impact on economic growth. Besides, physical capital and the working population have a significant positive impact on economic

	OECD		growth. However, inflation has a negative affect on economic growth
Cebeci and Ay (2016)	2000-2014, BRICS countries and Turkey	Panel data analysis	Health expenditure has significantly positive effect on economic growth
Fazaeli et al. (2016)	1995-2012, 12 countries of the OPEC	Panel cointegration analysis and ECM model	Health expenditures and GDP are cointegrated and have Engle and Granger causality
Ghorashi and Rad (2017)	1972-2012, Iran	Dynamic simultaneous equation models	There is a two-way relationship of causality between CO_2 emissions and economic growth. Besides, there is a one-way relationship of causality from health expenditures to economic growth
Boachie (2017)	1982-2012, Ghana	ARDL bounds test approach to cointegration	A good health significantly promotes economic growth both in the short and in the long run
Sahnoun (2018)	1970-2014, Tunisia	Johansen cointegration test	A positive relationship between health spending and economic growth was found
Bektaş and Akman (2018)	1975-2014, Turkey	Johansen cointegration and Granger causality tests	There is a long run relationship between economic growth and health expenditures. Moreover, there is a one-way Granger causality relationship from health expenditure to economic growth
Çelik (2020)	2000-2016, G20 countries	Durbin-Hausman panel cointegration and Dumitrescu-Hurlin panel causality tests	There is a unidirectional causality relationship from economic growth to health expenditure. Besides, increases in health expenditure per capita has a positive and statistically significant impact on economic growth
Tutar and Ekici (2020)	1999-2018, Turkey	Johansen cointegration and Granger causality tests	There is a one-way relationship from health spending to gross domestic product per capita

IV. DATA SET AND METHODOLOGY

With the object of investigate the causality relationship between health expenditures and economic growth in Australia, annual data from 1973 to 2018 was employed depending on data availability. In the study, the economic growth rate and total health expenditures as a percentage of GDP was used. The growth rate is shown as GDP and health expenditures is shown as HEALTH in the analysis. The growth rate variable was obtained from the World Bank database. The health expenditures variable was accessed from the OECD database. Eviews program was used for the econometric analysis. In the first stage of the study, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were conducted and then, causality test was applied within the framework of Toda-Yamamoto approach. Thus, it has been tried to examine whether there is a causality between the variables and to determine the the direction of the relationship if there is causality. Figure 1 shows the methodological order applied which is used in the study.

Figure 1: The Framework for the Research



A. ADF AND PP UNIT ROOT TESTS

Dickey and Fuller developed an analysis for unit root inclusion status of a time series in 1979. The series are not stationary if it contains unit root. If the series contains unit root, the difference is taken to remove the unit root. The Dickey-Fuller test is applied to the following regressions (Sert and Doğan: 2020: 6; Tarı et al., 2019: 389):

None $\Delta Y_t = \delta Y_{t-1} + u_t$

Intercept $\Delta Y_t = b_0 + \delta Y_{t-1} + u_t$

Trend and Intercept $\Delta Y_t = b_0 + b_1 t + \delta Y_{t-1} + u_t$

Later, ADF unit root test was developed and used. Accordingly, the lagged value of the dependent variable (ΔY_{t-1}) was added to the model in order to eliminate the autocorrelation in the error term. According to the ADF unit root test, the equations created with none, intercept and trend and intercept, respectively are as follows (Sert and Doğan: 2020: 6):

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-1} + \varepsilon_t$$

$$\Delta Y_t = \mu + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-1} + \varepsilon_t$$

$$\Delta Y_t = \mu + \beta T + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-1} + \varepsilon_t$$

In 1988, Phillips and Perron developed an alternative test for unit root. The PP unit root test builds on the DF test (Mert and Çağlar, 2019: 101). This test differs from ADF unit root test because an advantage of the PP unit root test compared to ADF unit root test is that PP test is robust to general forms of heteroscedasticity in the error term ε_t (Afriyie et al., 2020: 657). The hypothesis of the PP unit root test are similar to ADF and are expressed with the following equations (Phillips and Perron, 1988: 338):

$$y_t = \hat{\mu} + \hat{\alpha} y_{t-1} + \hat{u}_t$$

$$y_t = \tilde{\mu} + \tilde{\beta}\left(t - \frac{1}{2}T\right) + \tilde{\alpha} y_{t-1} + \tilde{u}_t$$

For both tests, the fact that the test statistic is greater than the critical values means that the null hypothesis of the unit root, which means the existence of a unit root is rejected (Gögül, 2020: 243). The hypothesis of the ADF and PP unit root tests are as follows:

H_0: The series is not stationary, there is a unit root.
H_1: The series is stationary, there is no unit root.

B. TODA-YAMAMOTO CAUSALITY TEST

The causality test developed by Toda and Yamamoto (1995) was used as the method of the study. Toda-Yamamoto is a causality test based on the estimation of augmented VAR ($k+d_{max}$) model, in which the level values of the examined variables are included regardless of whether they contain unit root or not. In other words, when applying Toda-Yamamoto causality test, the analysis is made with the level values of the variables, thus eliminating the loss of information in the series in question. Accordingly, while performing the Toda-Yamamoto causality test, the lag length (k) is determined by establishing the VAR model, and the highest degree of integration (d_{max}) is added to the found lag length (Süsay and Ünal, 2020: 91-93; Dritsaki, 2017: 123). Knowing these two values allows the model to be predicted correctly, preventing data loss and allowing more successful results at the level (Meçik and Koyuncu, 2020: 9). The equations of Toda-Yamamoto causality analysis are given below (Mert and Çağlar, 2019: 345):

$$y_t = \delta + \sum_{i=1}^{k+d_{max}} a_i y_{t-i} + \sum_{i=1}^{k+d_{max}} \theta_i x_{t-i} + e_{1t} \qquad (1)$$

$$x_t = \delta + \sum_{i=1}^{k+d_{max}} \gamma_i x_{t-i} + \sum_{i=1}^{k+d_{max}} \theta_i y_{t-i} + e_{2t} \qquad (2)$$

In the equations, k stand for the optimal lag length, d_{max} represents the largest of the integration degrees and e_{1t} and e_{2t} represents the error terms. It is assumed that error terms have a zero mean and a fixed covariance matrix (Gazel, 2017: 292).

V. EMPIRICAL FINDINGS

Stationarity analysis were performed for the variables used in the study. Because in analysis using econometric time series techniques, it is important to test the stationarity properties of the series before examine the relationship between the variables (Songur and Yüksel, 2018: 57). Therefore, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were used in the analysis.

The unit root analysis results of the series for the period 1973-2018 is given in table 2. When the table is examined, it is seen that the GDP is stationary at level. On the other hand, the HEALTH is stationary at the trended level only in the PP unit root test. It is seen that HEALTH is not stationary at level, but becomes stationary after the first difference of the series is taken. In this context, since the variables are not stationary at the same level Toda-Yamamoto causality test was used.

Table 2: ADF and PP Unit Root Tests

Intercept					
Variables	**ADF Test Statistic**		**Test Critical Values**		
	t-Statistic	**Prob.**	**1%**	**5%**	**10%**
GDP	-6.205978	0.0000	-3.584743	-2.928142	-2.602225
D(GDP)	-6.359071	0.0000	-3.596616	-2.933158	-2.604867
HEALTH	-1.601631	0.4735	-3.584743	-2.928142	-2.602225
D(HEALTH)	-5.813183	0.0000	-3.588509	-2.929734	-2.603064
Variables	**PP Test Statistic**		**Test Critical Values**		
	Adj. t-Stat	**Prob.**	**1%**	**5%**	**10%**
GDP	-6.192333	0.0000	-3.584743	-2.928142	-2.602225
D(GDP)	-26.59337	0.0001	-3.588509	-2.929734	-2.603064
HEALTH	-1.601631	0.4735	-3.584743	-2.928142	-2.602225
D(HEALTH)	-7.652435	0.0000	-3.588509	-2.929734	-2.603064
Trend and Intercept					
Variables	**ADF Test Statistic**		**Test Critical Values**		
	t-Statistic	**Prob.**	**1%**	**5%**	**10%**
GDP	-6.132892	0.0000	-4.175640	-3.513075	-3.186854
D(GDP)	-4.288632	0.0086	-4.226815	-3.536601	-3.200320
HEALTH	-3.442869	0.0587	-4.180911	-3.515523	-3.188259
D(HEALTH)	-5.730301	0.0001	-4.180911	-3.515523	-3.188259
Variables	**PP Test Statistic**		**Test Critical Values**		
	Adj. t-Stat	**Prob.**	**1%**	**5%**	**10%**
GDP	-6.109943	0.0000	-4.175640	-3.513075	-3.186854
D(GDP)	-25.61739	0.0000	-4.180911	-3.515523	-3.188259
HEALTH	-3.940706	0.0182	-4.175640	-3.513075	-3.186854
D(HEALTH)	-7.090101	0.0000	-4.180911	-3.515523	-3.188259

While applying the Toda-Yamamoto causality test, the level values of the series were used. Therefore, it does not matter whether the variables are stationary or not. Unit root test results are applied to determine the maximum degree of integration of the variables (d_{max}) (Contuk, 2020: 625). In other words, it is important to determine which degree the series are stationary at the stage of establishing the VAR(k+d_{max}) model. The first step of the Toda-Yamamoto causality test is to determine the maximum degree of integration (d_{max}). As a result of the applied ADF and PP unit root tests, it was concluded that the GDP is stationary at the level and the HEALTH is stationary at the first difference. Therefore, the maximum degree of integration (d_{max}) is determined as 1. After this stage, it is necessary to determine the optimal lag length (k). Accordingly, LR, FPE, AIC, SC and

HQ statistics were used to decide the optimal lag length. In this context, the optimal lag length is selected as 2 according to the information criteria. Table 3 shows the results of the optimal lag length selection.

Table 3: Optimal Lag Length

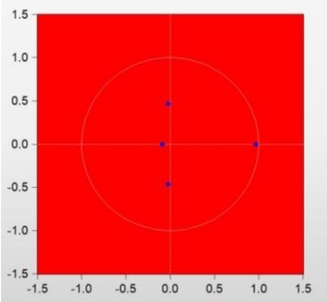
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-140.0847	NA	2.974872	6.765937	6.848683	6.796267
1	-51.37012	164.7556	0.052689	2.731910	2.980149	2.822900
2	-40.34848	19.41909*	0.037781*	2.397546*	2.811277*	2.549195*
3	-39.33507	1.689016	0.043730	2.539765	3.118988	2.752073
4	-37.68859	2.587317	0.049271	2.651838	3.396553	2.924805

In order for the VAR model to be stable all the inverse roots of the AR characteristic polynomial must lie inside the unit circle and all the roots must have modulus less than one. When table 4 is examined, it is seen that no modulus value is outside the reference range. Besides, it is seen that the inverse roots of the AR characteristic polynomial, which allows to interpret the same analysis graphically, are also located within the unit circle (figure 2). Hence, the model estimated is stable and does not have any stationarity problem because it fulfills the stationarity conditions.

Table 4: Roots of AR Characteristic Polynomial

Root	Modulus
0.969138	0.969138
-0.025981 – 0.466088i	0.466812
-0.025981 + 0.466088i	0.466812
-0.089867	0.089867

Figure 2: Inverse Roots of AR Characteristic Polynomial



Diagnostics test were performed and the test results are reported in tables below. Table 5 shows the autocorrelation test results. Because the probability value is greater than 0.05, there is no autocorrelation problem in the model.

Table 5: Autocorrelation Test

Autocorrelation Test		
Lags	**LM-Stat**	**Prob.**
1	4.892192	0.2985
2	5.455554	0.2437
3	8.647259	0.0705
4	5.183333	0.2690

The heteroscedasticity test results are shown in table 6. Accordingly, it is seen that the probability value is greater than 0.05. It can be concluded that there is no heteroscedasticity problem in the model. These results supports that there is no structural problem in the model.

Table 6: Heteroscedasticity Test

Heteroscedasticity Test		
Chi-sq	**df**	**Prob.**
43.31868	42	0.4149

Toda-Yamamoto approach was applied to determine the causality relationship between the variables. The highest degree of integration of the variables was found to be $d_{max} = 1$ and the optimal lag length was determined as k = 2. It is concluded that $d_{max} + k = 3$ is required for the Toda-Yamamoto causality test. Table 7 shows the findings of the Toda-Yamamoto causality test. Hereunder, there is a unidirectional Granger causality relationship from health expenditures to economic growth. Accordingly, H_0 is rejected while H alternative is accepted.

Table 7: Toda-Yamamoto Test Results

Dependent Variable: GDP					
Variables	**D_{max} = 1, k = 2** **D_{max} + k = 3**	**Chi-sq**	**Prob.**	**Direction of Causality**	**Hypothesis**
HEALTH	3	19.70572	0.0001	There is a Granger Causality HEALTH → GDP	H_0 rejected
Dependent Variable: HEALTH					
Variables	**D_{max} = 1, k = 2** **D_{max} + k = 3**	**Chi-sq**	**Prob.**	**Direction of Causality**	**Hypothesis**
GDP	3	1.600861	0.4491	There is no Granger Causality	H_0 accepted

CONCLUSION

Economic growth is one of the main indicators showing the economic performance of a country in macroeconomics. Health investments are essential to society and is one of the main dynamics of economic growth and development. Because poor health can negatively affect a person's social life as well as reduce their work ability. Therefore, it is significant for the individual to be physically and mentally healthy in order to create a strong society. In this context, there is a positive relationship between economic growth and health expenditures. Because a healthy society will contribute to economic growth and development. And as economic growth increases, financing will be available to improve health conditions. Every investment made to improve the health conditions can contribute positively to economic growth, and an increase in economic growth will generally help to improve health conditions and to realize health investments for the whole society.

Investments in health conditions also contribute to promoting sustainable development. Besides, economic development strongly influences per capita health expenditure (Faruk et al., 2021: 2). It is important for policy makers to know the relationship between economic growth and health expenditures in order to develop appropriate health policies. From this point of view, in this study, the relationship between economic growth and health expenditures was empirically examined for Australia. Annual data for the period between 1973 and 2018 were used in the study. First of all, ADF and PP unit root tests were conducted. Afterwards, Toda-Yamamoto causality test was performed. According to the empirical findings of the study, there is a unidirectional Granger causality relationship from health expenditures to economic growth. The one-way Granger causality relationship obtained supports the studies of Rahman (2011), Ghorashi and Rad (2017), Bektaş and Akman (2018) and Tutar and Ekici (2020) in the literature. Investment in health and improving the quality of health services can contribute to the improvement of the health level of the society. In this context, it can be said that health expenditures can be a driving force for Australia's economic growth and can positively affects people's quality of life and life expectancy. By increasing the quantity and quality of health spending, Australia can use it as a stimulus tool to influence economic growth.

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