Journal of Statistics & Applied Science, Volume - 1, Issue – 1
İstatistik ve uygulamalı bilimler dergisi, Cilt - 1 sayı - 1

The Relationship between Health Expenditures and Economic Growth in G7 Countries

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Abstract

The Present study endeavors to examine the relationship between health expenditure and economic growth for the case of G7 countries over the period of 1970 to 2017 except France and Italy which is over the period of 1987 to 2017 due to lack of data from 1970 to 1986. The paper uses modern time – series econometric techniques to test the propositions. Johansen Co-integration, Granger and Toda Yamamoto causality test has been applied to test the existence of long run co-integration and the causality between health expenditure and economic growth. Finding of this study endeavors a positive and statistically significant co-integration for all countries, no causality for the France and Italy, bi-directional causality for Germany and unidirectional causality for other countries from health expenditure to economic growth.

Keywords: Health Expenditures, Economic Growth, G7 countries

Özet

Bu çalışma, 1970'den 1986'a kadar veri eksikliği nedeniyle Fransa ve İtalya için 1987-2017 yılları arasında diğer G7 ülkeleri için ise 1970-2017 yılları arasındaki sağlık harcamaları ile ekonomik büyüme arasındaki ilişkiyi incelemeye çalışmaktadır. Makalede önerileri test etmek için modern zaman serisi ekonometrik teknikler kullanmaktadır. Johansen Koentegrasyon, Granger ve Toda Yamamoto nedensellik testi, uzun dönem koentegrasyonun varlığını ve sağlık harcamaları ile ekonomik büyüme arasındaki nedenselliğin test edilmesi için uygulanmıştır. Bu çalışmanın sonuçları, tüm ülkeler için pozitif ve istatistiksel olarak anlamlı bir bütünleşme, sağlık harcamalarından ekonomik büyümeye kadar Fransa ve İtalya için nedenselliğin olmaması, Almanya için iki yönlü nedensellik diğer ülkeler için ise tek yönlü nedensellik üzerinde çalışmaktadır.

Anahtar Kelimeler: Sağlık Harcamaları, Ekonomik Büyüme, G7 Ülkeler

1 INTRODUCTION

Economists a long time ago have recognized that human capital plays an important role in the process of economic growth (see for, Schultz, 1961; Becker, 1964; Uzawa, 1965; Rosen, 1976). The main components of human capital are education and health, as Schultz argues that investment in human capital accounts for the bulk of real income growth per worker. According to Becker (1964), any investment on human capital (education, health), increases productivity and income of human capital which contribute to the economic growth. In short, due to the fact that effective labor (healthy individuals) is one of the main elements of economic growth. Within a healthier society, production growth will increase so the production growth will cause economic growth. (Chetin, Ecevit 2010, Tirasoglu, Yildirim 2012).

For the first time Harrod-Domar mentioned that capital accumulation is an important determinant of the economic growth, in their model. They suggested that economic growth rate is proportionally related to capital accumulation at a given technology level, the model has been extended by Solow and Swan by adding Labor as a factor of production, further Romer and Lucas developed an endogenous growth theory in which investigation of different factors of economic growth has been suggested and after the arguments of how the growth rate can be changed though human capital began (Bedir 2016).

The human capital become in the central of argument in the last dictates, special when the concept of human capital in economic growth defined widely by including health education, training, migration and other factors which enhance individual's productivity.

There are two concepts of health and economic growth relationship, or we can say that there are two ways of relationship between this phenomena, either health could affect economic growth by increasing productivity of human capital, and the economic growth could help health, by providing more facilities infrastructural (hospital), products (medicine), and education (health education) and … etc. (Akram, Pada, khan, 2008).

This study consists of 5 different sections. After this section, a Literary Review will be presented in the second section and in section 3 will introduces the empirical methodology. Section 4 provides an overview of empirical research on the interaction between health expenditures and economic growth by using G7 Countries data. The last part of the study contains conclusions, i.e. analysis results and offers recommendations.

2 LITERATURE

There are numerous studies which investigated the relationship between health expenditure and economic growth, health expenditure divided into two groups of direct and indirect expenditure that indirect health expenditures includes environmental pollution expenditure (Keskin, 2020) but this paper has investigated direct health expenditures relationship with economic growth.

And the main conclusion of previous studies strongly supports the existence of a positive relationship between health and economic growth. The empirical nexus between health and economic growth has been certainly well known in the literature of growth theory. This literature includes numbers of empirical studies on this topic. Specially, papers of Kleiman (1974) and Newhouse (1977) has expanded rapidly. Newhouse (1977) suggests that gross domestic product of a country is one of the most influential factor on health which is investigated and supported by Kleiman (1974).

Serap Bendir (2016) investigated health care expenditure and economic growth in developing countries for the period of 1995 to 2013, using modified version of the Granger (1969) and causality test proposed by TodaYamamoto. Her finding reveals bi-directional and uni-directional causality between health expenditure and economic growths. Babatunde (2014) had investigated the relationship between health and economic growth in Nigeria for the period of 1970– 2010, that his finding become the same as Serap Bendir, bi-directional relationship between health expenditure and economic growth for Nigeria.

Seema Narayan, Paresh Kumar Narayan and Sagarika Mishra (2010) by using Residual LM test show that between per capita income, health, investment, exports, imports and education there is long-run relationship in 5 Asian countries during the 1974–2007 period.

Chor Foon Tang (2010), by performing the Johansen-Juselius cointegration test for Malaysia over the period 1967–2007, has found that health and its determinants (income, health care price) are co-integrated.

The investigation of Juste Some, Selsah Pasali and Martin Kaboine (2019) about the relationship between economic growth and health in a panel data growth regression framework using aggregate data from 48 African countries over the period 2000-2015 brought a finding that the health expenditures have a positive and economically meaningful direct and indirect effects on economic growth.

The article of Alexei Balaev (2019) by using SVAR model (Corsetti et al., 2012) examines how Russia's GDP growth responds to changes in the structure of government spending during the period 2000-2017. The results show a positive impact on GDP growth rate by the increasing the share of productive expenditures (national economy, education, healthcare).

Çiğdem Börke Tunalı and Naci Tolga Saruç (2018) analyze relationships between health care expenditures and economic growth in the European Union Countries from the 1995s to the 2014s. The authors by performing cointegration tests and Granger causality tests found a unidirectional relationship from GDP per capita to the health expenditure per capita. Moreover, in the short- and long-run, GDP per capita has positive impact on health expenditure.

Ayhan Kuloglu and Ebru Topcu (2016) have examined causality between health expenditure and economic growth in Eurasian Economic Union over the period 1995-2014. They found bidirectional causality relationship in both short run and long run between these variables.

A Feder-Ram approach paper by Serdar Kurt (2015), investigated government health expenditures and economic growth for the case of Turkey for the period of 2006 to 2013 monthly data, the finding of the paper shows direct, positive and significant effect of government health expenditures on economic growth.

3 ECONOMETRIC METHODOLOGY

The of LRPCHEXP (Natural logarithmic form of Per Capital Real total health expenditure), GDP (Gross Domestic Product), POP(population) and GDP deflator for this paper collected from World Bank and OECD websites, that have been used as the per capital, real and logarithmic form to achieve the most reliable results.

To test or investigate the relationship between health expenditure and economic growth for G7 countries in which the total health expenditure and gross domestic product have used as variables which formulated as follows:

$$LN(PCRGDP) = \beta_1 + \beta_2 LN(PCR\text{HEXP}) + u \qquad (1)$$

Where β_1 stands for constant term, LN (PCRHEXP) stands for logarithmic form of per capital real health expenditure, LN (PCRGDP) stands for logarithmic form of per capital real gross domestic products and u stands for classical regression error terms. For validity of this relationship, β_1 is expected to be greater than zero. In order to prevent any spurious relationship, the time-series properties of the variables have been analyzed before any estimation.

In order to test the relationship between total health expenditure and gross domestic product, the Granger co-integration has been utilized. The most important condition in order to test Granger co-integration is the stationarity, which means for investigation of co-integration the variables should be stationary in their level or differenced forms (in the level I(0) or in the first difference I(1)). To check the stationarity of variable a general from of ADF form of regression formulated as follows:

$$\Delta LN(PCRGDP)_t = \beta_1 + \beta_2 LN(PCR\text{HEXP}) + \beta_3 LN(PCRGDP)_{t-1} \sum \alpha_i\, \Delta LN(PCRGDP)_{t-i} + \varepsilon_i \qquad (2)$$

Where ΔLN(PCRGDP)_t stands for first differenced deries of LN(PCRGDP), LN(PCRHEXP) stands for trend and ε_i is a white noise residual.

The hypothesis of unit root (non-stationary) is tasted by setting the null (H_0) hypothesis (H_0:β_2=β_3=0). Mostly variables are not stationary at their level, then we should investigate the stationarity of the variables in the some order (in their level of first difference are prefer), but if the data don't become stationary at the first difference I(1). Once the data founded to be stationary in the first difference, we can run a co-integration test.

Basically there are 2 approaches to test the long run relationship between time series: first one is Egle & Granger (1987) and the other one is Johansen & Juselius (1990, 1992). The general VAR model with a lag length (p) for Johansen approach formulated as follow:

$$\Delta x_t = \Pi_0 + \Pi_1 \Delta x_{t-1} + \Pi_2 \Delta x_{t-2} + \ \dots + \Pi_{n-1} \Delta x_{t-n+1} + \pi x_{t-n} + BZ_t + v_t \qquad (3)$$

Where $\Delta LN(PCRGDP)_t$ stands for first differenced deries of LN(PCRGDP), LN(PCRHEXP) stands for trend and ε_i is a white noise residual.

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Where x_t stands for (mx1) vector of first difference stationarity I(1),), Z_t stands for (Sx1) vector of level stationarity I(0), $\Pi's$ stands for unknown parameters and v_t stands for error term. The hypothesis that π has a reduced rank (r<m) is tested using the trace and λ-MAX (maximum eigenvalues) test statistic. Once co-integration is found in time series-data, there must be an existence of a bi-directional or uni-directional causality between variables.

A general Granger causality approach based on VAR model formulated as follow:

$$x_{1t} = \alpha + \sum \beta_1 \Delta x_{1t-i} + \sum \gamma_i x_{2t-i} + u_i \tag{5}$$

VAR system model in Impulse Response Function formulated as follow:

$$LN(PCRGDP) = \beta_1 + \beta_2 LN(PCRHEXP)_{t-i} + \beta_3 LN(PCRGDP)_{t-i} + u_1 \tag{6}$$

$$LN(PCRHEXP) = \beta_3 + \beta_4 LN(PCRGDP)_{t-i} + \beta_5 LN(PCRHEXP)_{t-i} + u_2 \tag{7}$$

Where ''u'' means impulse, innovation, or we can also say to it, the shock of standard deviation.

4 EMPIRICAL RESULTS

In order to prevent any spurious relationship, the time-series properties of the variables have been analyzed before any estimation.

4.1 Jarque bera Normality Test

Jargue-Bera Normality Test has been applied to examine the normal distribution of error terms. As it reveals in the table (1); the residuals are normally distributed.

In order to avoid Heteroscedasticity and serial correlation problem, farther estimations has been applied under HAC methods.

Null; Residuals are normally distributed						
Country	**obs**	**mean**	**median**	**Std.Dev**	**J-Bera value**	**prob**
Canada	48	2.35e-15	0.025352	0.128177	3.071352	0.215310
Germany	48	3.60e-15	0.020064	0.166677	1.620107	0.444834
UK	48	3.16e-15	-0.006364	0.149904	0.946685	0.622917
USA	48	3.70e-16	-0.002898	0.026212	1.383993	0.500576
France	31	2.09e-15	0.027258	0.111214	1.542252	0.462492
Italy	31	5.55e-15	0.002859	0.130183	1.087201	0.580654
Japan	48	9.62e-16	-0.011128	0.271293	1.714625	0.424301

Table (1). Jarque bera Normality test

4.2 Unit Root Tests

The ADF and ERS-Point Optimal unit root has been applied to examine the stationarity order of variables, for time series and the equation in logarithmic form of data in order of level and first difference, stationarity.

	Augmented Dickey-Fuller Test Equation				
	Lag Length: (Automatic - based on AIC)				
		LEVELS I(*0*)		**FIRST DIFFERENCE I(*1*)**	
COUNTRY	**VARIABLE**	**t-Statistic**	**Prob.**	**t-Statistic**	**Prob.***
CANADA	LPCRHEXP	-0.429764	0.8953	-6.089748	0.0000***
	LPCRGDP	-2.150295	0.2268	-4.757955	0.0003***
GERMANY	LPCRHEXP	-4.548068	0.0006	-4.245449	0.0016
	LPCRGDP	-2.513311	0.1188	-4.919592	0.0002
UK	LPCRHEXP	0.797829	0.9930	-5.631403	0.0000
	LPCRGDP	-2.614963	0.0973	-4.355790	0.0011
USA	LPCRHEXP	-2.628130	0.0948	-2.719229	0.0785
	LPCRGDP	-1.723637	0.4131	-5.050479	0.0001
FRANCE	LPCRHEXP	-1.466107	0.5338	-5.287645	0.0002
	LPCRGDP	-1.961799	0.3011	-5.129740	0.0003
ITALY	LPCRHEXP	-0.343604	0.9066	-4.215629	0.0027
	LPCRGDP	-1.750813	0.3966	-4.846861	0.0005
JAPAN	LPCRHEXP	0.158335	0.9668	-5.280144	0.0001***
	LPCRGDP	-2.123720	0.2366	-5.071580	0.0001***

- ✓ ***,** Rejection of unit root hypothesis, based on McKinnon's critical value, at 1% & 5%
- ✓ The lag selection based on AIC value.
- ✓ The unit root hypothesis for united stat variables tested under equation of ERS-Piont Optimal unit root test.
- ✓ I(*0*) stationary at the level
- ✓ I(*1*) stationary at the firs difference

Table (2). Unit Root Test

According to the table (2) all variables are appear to be stationary in their first difference I(1) for all countries except USA and Germany . The lag lengths have been selected on the basis of AIC.

4.3 Johansen and Juselius co-integration test

For the further process of Johnsen maximum likelihood co-integration test (Johansen & Juselius 1990), the table (3) revealed the result for Johansen and Juselius co-integration. According to the empirical results the Null Hypothesis (there is no co-integration) have been rejected based on the λ-MAX value and Trace value. Which revealed there is long run co-integration between total health expenditure and economic growth.

	NULL	ATRER-NATIVE	λ-MAX STATISTIC	95% CRITICAL VALUE	Prob**	TRACE STATISTIC	95% CRITICAL VALUE	Prob**
CANADA	r = 0	r = 1	29.38652	14.26460	0.0001	30.30302	15.49471	0.0002
	r ≤ 1	r = 2						
UK	r = 0	r = 1	15.26318	14.26460	0.0347	15.26548	15.49471	0.0541
	r ≤ 1	r = 2						
FRANCE	r = 0	r = 1	14.33016	14.26460	0.0488	19.35120	15.49471	0.0124
	r ≤ 1	r = 2						
ITALY	r = 0	r = 1	22.13000	14.26460	0.0024	22.47220	15.49471	0.0038
	r ≤ 1	r = 2						
JAPAN	r = 0	r = 1	18.07494	14.26460	0.0119	18.43274	15.49471	0.0175
	r ≤ 1	r = 2						

- ✓ Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
- ✓ Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
- ✓ * denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table (3). Johansen and Juselius co-integration test and results

The hypothesis of unit root (non-stationary) is tasted by setting the null (H_0) hypothesis ($H_0: \beta_2 = \beta_3 = 0$). Mostly variables are not stationary at their level, then we should investigate the stationarity of the variables in the some order (in their level of first difference are prefer), but if the data don't become stationary at the first difference I(1). Once the data founded to be stationary in the first difference, we can run a co-integration test.

All results are statistically significant and also here we can interpret the normalized cointegrating coefficients as follows:

For Canada a 1% increase in the LPCRHEXP leads to a 3.94% increase in the LPCRGDP in the long run.

LPCRGDP = 3.949*LPCRHEXP

For UK a 1% increase in the LPCRHEXP leads to a 0.33% increase in the LPCRGDP in the long run.

LPCRGDP = 0.333*LPCRHEXP

For France a 1% increase in the LPCRHEXP leads to a 1.64% increase in the LPCRGDP in the long run.

LPCRGDP = 1.643*LPCRHEXP

For Italy a 1% increase in the LPCRHEXP leads to a 0.06% increase in the LPCRGDP in the long run.

LPCRGDP = 0.069*LPCRHEXP

For Japan a 1% increase in the LPCRHEXP leads to a 1.37% increase in the LPCRGDP in the long run.

LPCRGDP = 1.373*LPCRHEXP

4.4 Granger Causality Test

Country	Null Hypothesis:	Obs	F-Statistic	Prob.
CANADA	LPCRGDP does not Granger Cause LPCRHEXP	42	1.56167	0.1940
	LPCRHEXP does not Granger Cause LPCRGDP		2.84378**	0.0256
UK	LPCRGDP does not Granger Cause LPCRHEXP	41	1.34136	0.2713
	LPCRHEXP does not Granger Cause LPCRGDP		2.54553	0.0389
FRANCE	LPCRGDP does not Granger Cause LPCRHEXP	29	0.47819	0.6257
	LPCRHEXP does not Granger Cause LPCRGDP		0.95481	0.3990
ITALY	LPCRGDP does not Granger Cause LPCRHEXP	24	0.64033	0.7151
	LPCRHEXP does not Granger Cause LPCRGDP		0.80911	0.6012
JAPAN	LPCRGDP does not Granger Cause LPCRHEXP	41	0.46201	0.8528
	LPCRHEXP does not Granger Cause LPCRGDP	41	2.80879**	0.0256

- ✓ ***, ** Revealed rejection of the null hypothesis in the level 1%, 5%
- ✓ Lag Length: (Automatic - based on AIC)

Table (4). Pairwise Granger Causality Test

Table(4). Revealed investigation of pairwise Granger Causality. It revealed existence of uni-directional causality from total health expenditure to economic growth for Japan, UK, and Canada, and no causality between this variable's for France and Italy.

4.5 Toda Yamamoto Causality Test

Country	Null Hypothesis:	Chi-sq	df	Prob.
USA	LPCRGDP does not Granger Cause LPCRHEXP	17.61747	14	0.2248
	LPCRHEXP does not Granger Cause LPCRGDP	441.8732	14	0.0000
GERMANY	LPCRGDP does not Granger Cause LPCRHEXP	25.27762	14	0.0319
	LPCRHEXP does not Granger Cause LPCRGDP	1414.483	14	0.0000

Table (5). Toda Yamamoto Causality Test

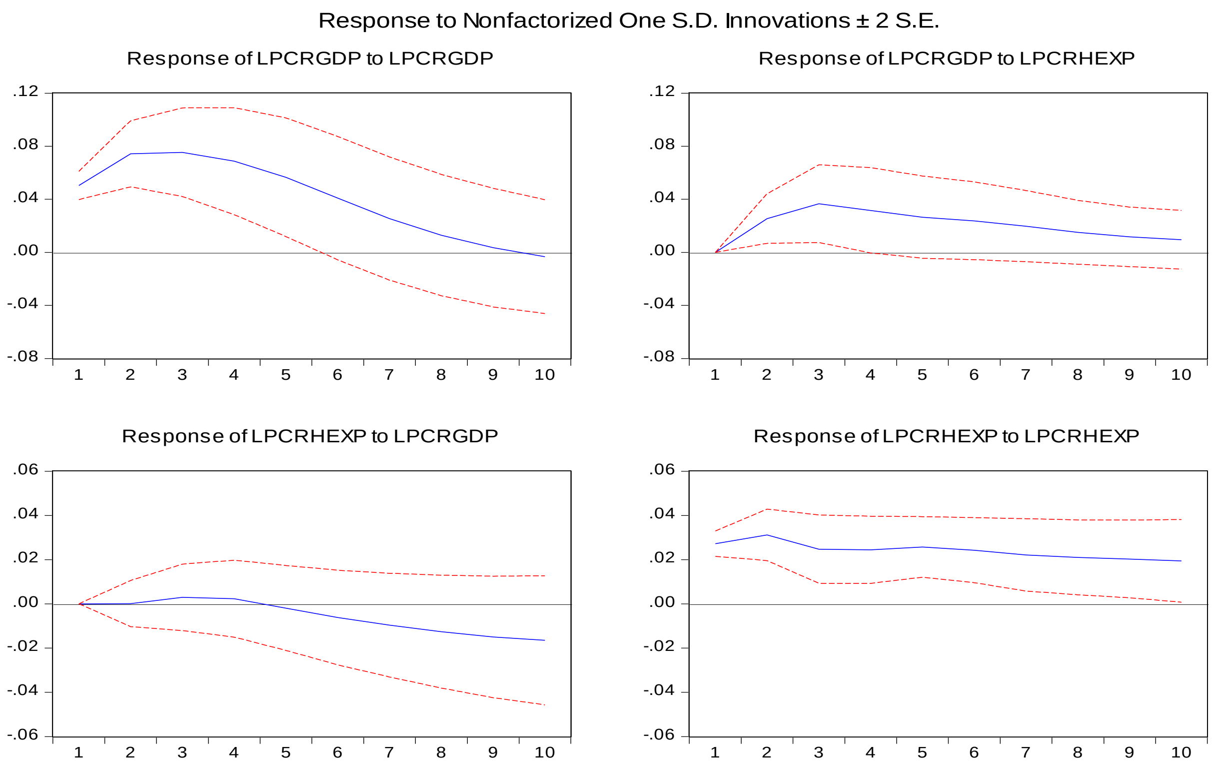
In order to investigate the causality between variables which are not stationer with the same level the Toda Yamamoto causality test has been applied for USA and Germany. According to the table (5) a unidirectional causality exists for USA from health expenditure to economic growth and it also reveals the existence of bi-directional causality for Germany.

4.6 Impulse Response Analysis

Impulse responses identify the responsiveness of the dependent variables in the VAR when the shock is put to the error term. A unit shock is applied to each variable to see its effects on the VAR system. Figure(1) analyzes Impulse response test where one standard deviation positive shock is given to one variable to check how other variable react.

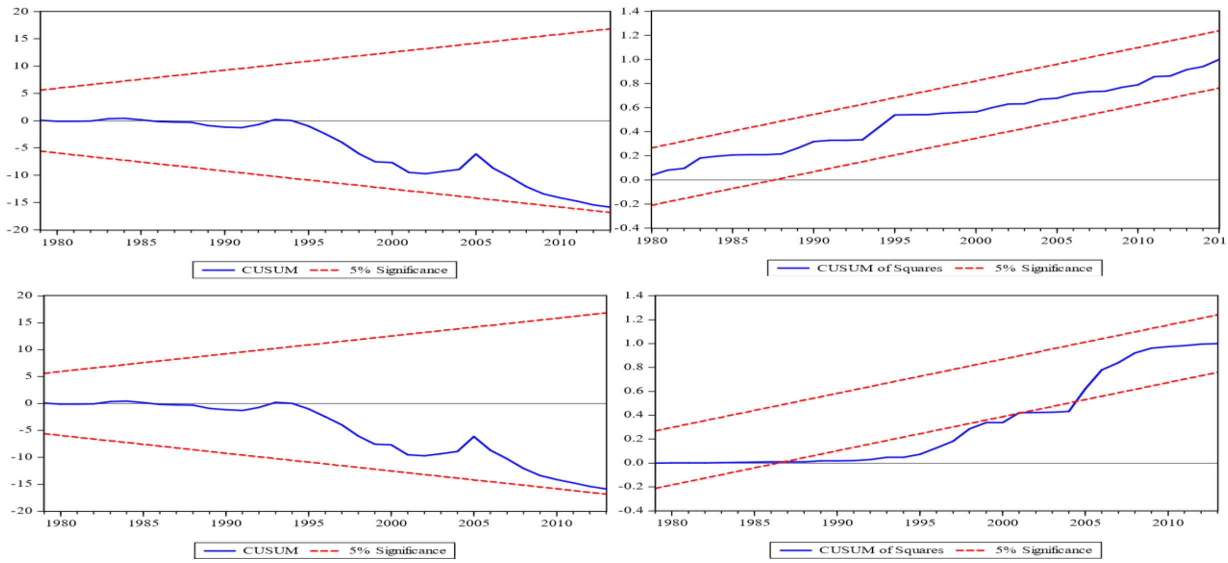
Fıgure (1). Impulse Response Tests

A. Canada



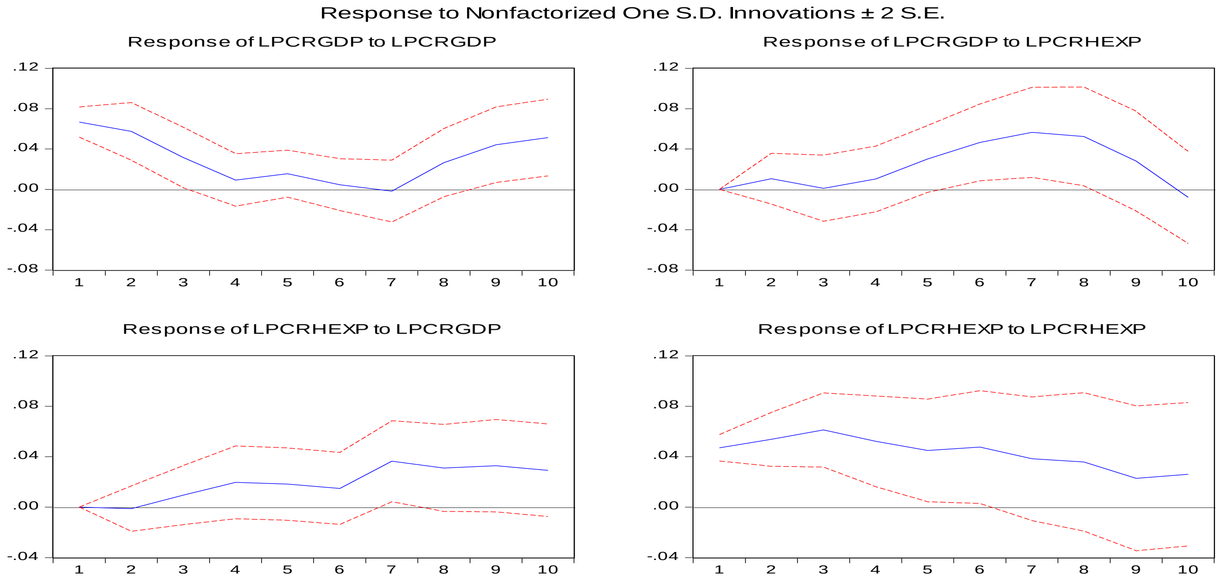
İn graph Response of LPCRGDP to LPCRGDP meaning that LPCRGDP is effecting to LPCRGDP in ten period. So when there is a shock LPCRGDP slowly going up, after 3 period it going down and become negative in last period. The meaning of the second graph is that, when one standart deviation shock is given to the LPCRHEXP how LPCRGDP is responding. Here when LPCRHEXP has positive shock LPCRGDP become positive. It has not been negative, it is always positive. In third graph, where a shock is giving then how LPCRHEXP is responding to LPCRGGDP. This is seen in the movement of blue line. Initially it is positive, but it becomes negative after the fourth period. On the last graph, where LPCRHEXP is affecting to LPCRHEXP has always positive reaction.

B. Germany



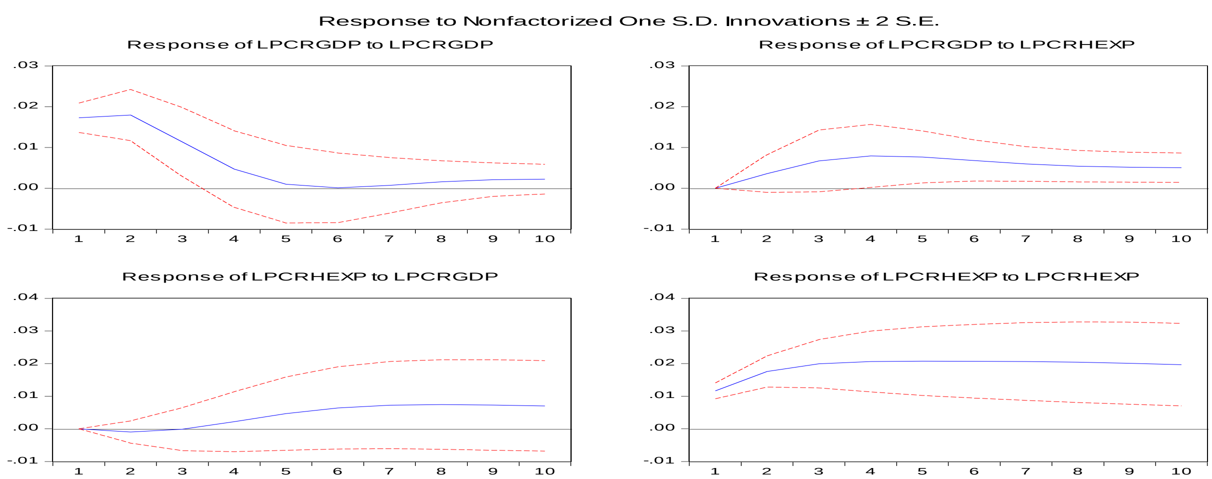
In first graph where LPCRGDP responding to LPCRGDP initially, before the second period it going up then reaction is gradually going down and after 6 periods became negative. The meaning of the second graph, if one standard deviation shock is given to LPCRHEXP, how LPCRGDP shall be responding. Response is going down by being negative and after the 4 period it rising and become positively stable. The next graph means, when 1 standart deviation shock is given to the LPCRGDP how LPCRHEXP is responding. With positive shock in LPCRGDP, LPCRHEXP initially become positive then after 5th period response become negative. 4th graph mean that, LPCRHEXP is always affecting to LPCRHEXP positively.

C. UK



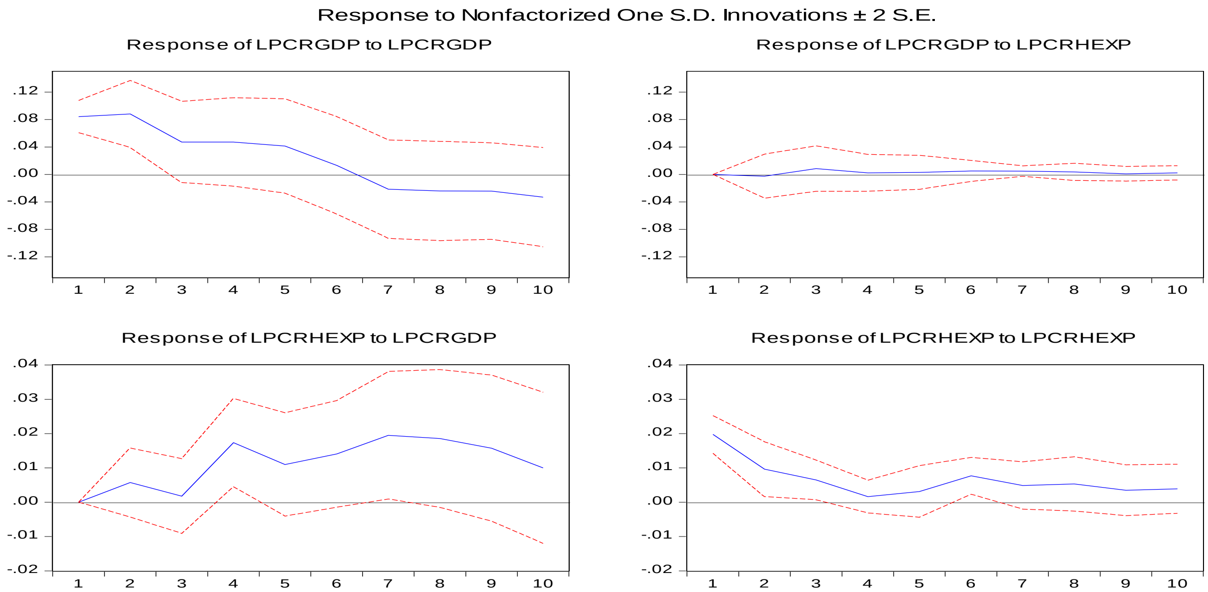
Response of LPCRGDP to LPCRGDP meaning that when there is a shock LPCRGDP is responding to LPCRGDP it going down. After 4 periods, it slowly rises to 5 periods and then also going down and becomes negative on 7 periods. Finally after 7 periods response will be positive. In the second graph when LPCRHEXP has positive shock, LPCRGDP become positive but at the end in 10 periods it becomes negative. When 1 standart deviation shock is given to the LPCRGDP, LPCRHEXP is responding positively after 2 periods. Finally LPCRHEXP affecting to LPCRHEXP positively in 4thgraph.

D. USA



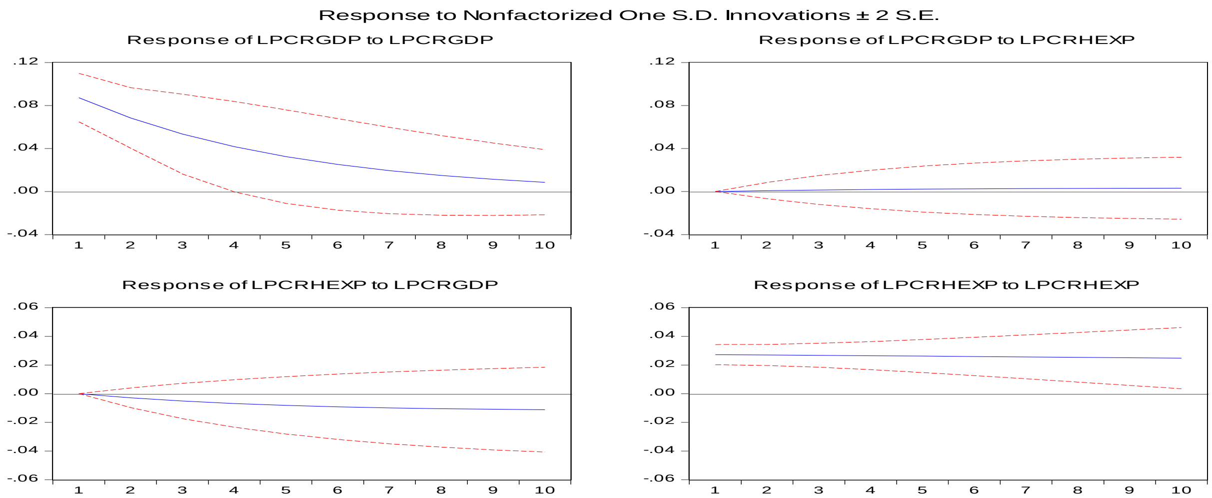
Here in USA charts show a positive response to shock. However in 1st graph where LPCRGDP affecting LPCRGDP, the response after the second period decreases to the 5th period, but not becomes negative. Also when LPCRGDP has positive shock in 3rd graph, LPCRHEXP initially up to the 3rd period it is negative then it rise and will have positive response.

E. France



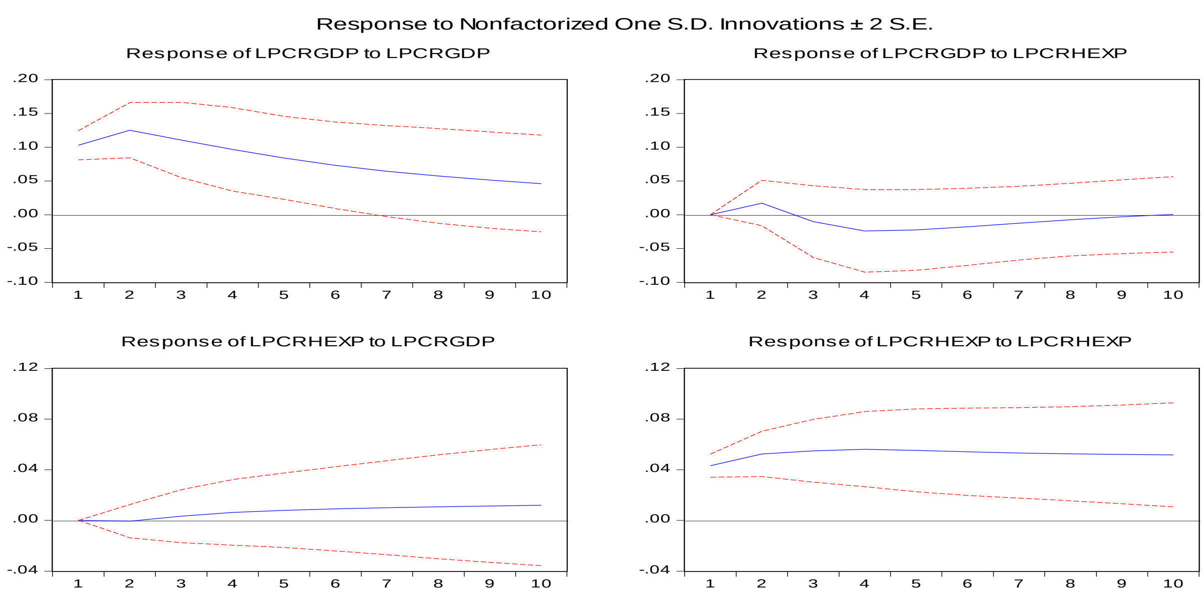
İn first graph when there is a shock how LPCRGDP is responding to LPCRGDP. Initially there is positive response then it going down and after 6th period it becomes negative. İn 2nd graph if 1 standart deviation shock is given to LPCRHEXP, LPCRGDP except the second period shall be responding positively. Also when LPCRGDP has positive shock LPCRHEXP become positive, goes up. And with LPCRHEXP affecting to LPCRHEXP initially it is going down until 4th period but always has positive response.

F. Italy



In Italy when LPCRGDP is affecting to LPCRGDP the blue line gradually going down but response has not been negative it is always positive. In 2nd graph when 1 standart deviation shock is given to the LPCRHEXP, LPCRGDP is responding positively stable. The response of LPCRHEXP on LPCRGDP's positive shock will be negative. Finally, in last graph when there is a shock is heaving then LPCRHEXP is responding to LPCRHEXP always positively.

G. Japan



Response of LPCRGDP to LPCRGDP meaning that LPCRGDP is affecting to LPCRGDP positively. İnitially it rise but after the period 2 it is gradually going down but LPCRGDPs reaction has not been negative. In second graph, with the 1 standart deviation shock is given to LPCRHEXP, LPCRGDP shall be reacting negativelly after the 3th period. When LPCRGDP has positive shock LPCRHEXP become positive, goes up. Also with the LPCRHEXP affecting to LPCRHEXP there is positive reaction.

5 CONCLUSION

The nexus between health expenditure and economic growth (GDP) has been tested in this paper using time series data and econometric modern techniques for the period of 1970-2017. Data has been collected from World Bank data bank and The Organization for Economic Co-operation and Development (OECD).

A simple regression model has been built to investigate the relationship between health expenditure and economic growth and sum necessary assumption has been described in the methodology section of this paper. Furthermore, to prevent the spurious regression and misspecification of the model Jarque Bera Normality Test has been applied to examine the normal distribution of error terms. In order to avoid serial correlation and heteroscedasticity HAC has been applied.

To examine the existence of long run co-integration nexus health expenditure and economic growth the ADF optimal unit root has been adopted to test the level of stationarity for variables which indicates variables are stationer in their first difference I(1) for all countries except USA and Germany which are not stationer with the same level, lag lengths have been selected based on AIC value for Johansen maximum likelihood co-integration test, the finding of Johansen Co-integration test indicates a long run co-integration exist between health expenditure and economic growth for Japan, Italy, France, UK and Canada in the period of 1970-2017.

Finally, the Pairwise Granger Causality Test (for Japan, Italy, France, UK and Canada) and Toda Yamamoto Causality Test (for USA and Germany) adopted which revealed a uni-directional causality from health expenditure to economic growth of Canada, UK, Japan and USA, bi-directional causality of Germany and no causality has been founded for France and Italy.

It's necessary to recommend for all researchers who want to research in this field to examine nexus between direct (treatment, surgery, medicine) and indirect (health education …) health expenditure and economic growth. I would like to add that one of the reasons that we can't find the causality for France and Italy is that the data is insufficient. My advice to those who would like to work on this subject is to use monthly or at least quarterly data series. So by increase the number of data they can find a positive causality.

REFERENCES

Akram,N., Padda, I.U.H., Khan, M., "The Long Term Impact of Health on Economic Growth in Pakistan," Pakistan development review 47(4):487-500, 2008. https://www.researchgate.net/publication/46532484_The_Long_Term_Impact_of_Health_on_Economic_Growth_in_Pakistan

Balayev, A., "The structure of public spending and economic growth in Russia," Russian Journal of Economics, 2019. www.rujec.org

Bedir, S., "Healthcare Expenditure and Economic Growth in Developing Countries,"2016. http://www.hrpub.org/download/20160229/AEB2-11805616.pdf

Bloom, D.E., Canning, D., "Population Health and Economic Growth," 2008. https://siteresources.worldbank.org/EXTPREMNET/Resources/489960133899724l035/Growth_Commission_Working_Paper_24_Population_Health_Economic_Growth.pdf

Chetin M., Ecevit, E., "Sağlık Harcamalarının Ekonomik Büyüme Üzerindeki Etkisi: OECD Ülkeleri Üzerine Bir Panel Regresyon Analizi," Doğuş Üniversitesi Dergisi, 11 (2) 2010, 166-182, 2010. https://openaccess.dogus.edu.tr/xmlui/bitstream/handle/11376/298/cetin.pdf?sequence=1

Engle, R. F., Granger. C.W.J., "Integration and Error Correction: Representation, Estimation, and Testing," 1987. http://www.ntuzov.com/Nik_Site/Niks_files/Research/papers/stat_arb/EG_1987.pdf

Johansen, S., & Juselius, K.," Maximum likelihood estimation and inference on cointegration with applications to the demand for money," Oxford Bulletin of Economics and statistics, 52(2), 169-210, 1990.

Keskin, A., "G20 Ülkelerinin CO2 Emisyonları ve Kişi Başına Düşen Milli Gelirin 1960-2012 Dönemi Arasındaki Ampirik Analizi," 2020. https://dergipark.org.tr/en/download/article-file/1180623

Kuloglu, A., Topcu, E., "The Relationship between Health and Growth in Eurasian Economic Union," Eurasian Journal of Economics and Finance, 2016. http://eurasianpublications.com/Eurasian-Journal-of-Economics-and-Finance/Vol.4-No.4-2016/EJEF-5.pdf

Kurt, S., "Government Health Expenditures and Economic Growth: A Feder–Ram Approach for the Case of Turkey," 2015. http://dergipark.gov.tr/download/article-file/363012

MacKinnon, J. G., Haug, A. A. & Michelis, L.," Numerical distribution functions of likelihood ratio tests for cointegration," Journal of Applied Econometrics, 14, pp. 563- 577, 1999.

Narayan, S., Narayan, P. K., Mishra, S., "Investigating the relationship between health and economic growth: Empirical evidence from a panel of 5 Asian countries," Journal of Asian Economics, 2010. https://ideas.repec.org/a/eee/asieco/v21y2010i4p404-411.html

Rosen, S., "A theory of life earning," Journal of Political Economy, 84, S45-S67, 1976. https://www.jstor.org/stable/pdf/1831102.pdf

Schultz, T. W. "Investment in human capital," American Economic Review, pp. 1-17, 1961. https://www.jstor.org/stable/pdf/1818907.pdf

Sghari, M.B.A., Hammami, S., "Relationship between Health Expenditure and GDP in Developed Countries," IOSR Journal Of Pharmacy, 2013. http://www.iosrphr.org/papers/v3i4/Part.3/G0343041045.pdf

Some, J., Pasali, S., Kaboine, M., "Exploring the Impact of Healthcare on Economic Growth in Africa," Redfame Publishing, 2019. http://www.redfame.com/journal/index.php/aef/article/viewFile/4110/4385

Tang, C. F., "Multivariate Granger causality and the dynamic relationship between health spending, income, and health price in Malaysia," MPRA Paper No. 27298, 2010. https://mpra.ub.uni-muenchen.de/27298/1/MPRA_paper_27298.pdf

Tirasoglu, M., Yildirim B., "Yapısal Kırılma Durumunda Sağlık Harcamaları ve Ekonomik Büyüme İlişkisi: Türkiye Üzerine Bir Uygulama," Electronic Journal of Vocational Colleges, 2012. https://dergipark.org.tr/download/article-file/62604

Tunali, C.B., Saruç, N.T., "An Empirical Analysis on the Relationship between Health Care Expenditures and Economic Growth in the European Union Countries," European Journal of Medicine and Natural Sciences, 2018. http://journals.euser.org/index.php/ejmn/article/view/4371

Uzawa, H., "Optimal technical change in an aggregate model of economic growth," International Economic Review, pp. 18-31, 1965. https://www.jstor.org/stable/pdf/2525621.pdf