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Health Expenditures-Economic Growth Nexus: The EU 28 And Panel Feder-Ram Model

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ÖZ

This study uses the dynamic panel data Feder-Ram model to analyze possible direct and indirect (external or productivity enhancer) effects of the health expenditures on economic growth for 28 European Union Countries period of 2006-2015. The main findings obtained from the study; The Feder-Ram equations show that the direct effect of healthcare expenditures on economic growth is negative and statistically significant. However, the indirect effect of healthcare expenditures on other sectors are positive and significant. The healthcare expenditures increase the productivity of labour factor and thus, the efficiency on other sectors and consequently, healthcare expenditures provide a positive contribution to production. Results obtained from the equations have shown that indirect effect is higher than direct effect. As a result, it can be smoothly said that the net effect of healthcare expenditures is positive.

Keywords: Direct and Indirect Effects, Health Expenditures, Economic Growth, The Feder–Ram Model.

JEL Classifications: H23, I15, O11, O41

Sağlık Harcamaları - Ekonomik Büyüme İlişkisi: 28 AB Ülkesi ve Panel FEDER-RAM Modeli

ABSTRACT

Bu çalışma, 2006-2015 yılları arasında 28 Avrupa Birliği ülkesi için sağlık harcamalarının ekonomik büyüme üzerindeki olası doğrudan ve dolaylı (dışsal veya üretkenliği arttırıcı) etkilerini analiz etmek için dinamik panel veri Feder-Ram modelini kullanmaktadır. Feder-Ram modelinden elde edilen sonuçlar sağlık harcamalarının ekonomik büyüme üzerindeki doğrudan etkisinin negatif ve istatistiksel olarak anlamlı olduğunu göstermektedir. Sağlık harcamalarının diğer sektörler üzerindeki dolaylı etkisi ise pozitif ve istatistiksel olarak anlamlı bulunmuştur. Sağlık harcamalarının işgücü verimliliğini, dolayısıyla sağlık harcamaları dışındaki diğer sektörlerin verimliliğini arttırmakta olduğu sonucuna ulaşılmıştır. Sağlık harcamalarının diğer sektörlerin üretimine olumlu katkı sağlaması toplam üretimi arttırıcı bir etki olarak değerlendirilmektedir. Denklemlerden elde edilen sonuçlar, dolaylı etkinin doğrudan etkiden daha yüksek olduğunu göstermiştir. Sonuç olarak, sağlık harcamalarının net etkisinin olumlu olduğu ve üretime arttırıcı bir etkiye sahip olduğu söylenebilir.

Anahtar Kelimeler: Doğrudan ve Dolaylı Etkiler, Sağlık Harcamaları, Ekonomik Büyüme, Feder–Ram Modeli.

JEL Sınıflandırması: H23, I15, O11, O41.

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1. INTRODUCTION

Healthcare expenditures provide a direct contribution to economic growth because it provides an increase in work efficiency of individuals, healthy individuals generate more income and are much more willing to spend. Studies addressing the effect of health policies on economic growth began after the 1960s. (Schultz 1961) has stated that incurring healthcare expenditures will increase the opportunities for individuals to find a better job and allow them to earn more money. (Schultz, 1961:1) Mushkin (1962) has argued that costs incurred for the health of human capital are an investment.

Thus, individuals maintain their productive powers, become sick less and later than usual. Consequently, the loss of labour is prevented. Healthcare services towards controlling of diseases that may become more severe in the future prevent healthcare expenditures that will need to be incurred more in the future. Healthy individuals are better educated.

Having an educated workforce is a factor increasing production. Healthy people live longer. Thus, investments in education provide longer term individual and social benefits. (Mushkin,1962:156) in addition, incurring preventive healthcare expenditures will also avoid healthcare expenditures that will need to be incurred in the future at higher rates due to diseases that would emerge in the future. Healthy individuals produce better quality goods and services. in his book titled "Economics of Health" published in 1965, Klarman examined decisions taken in health policy and studies conducted by economists on the contribution of healthcare services to economy. (Klarman,1965) Disability of an individual engaged in production in business life or ill health of any of his/her relatives will affect his/her labour productivity. His/her psychology affected negatively by the current situation and time period he/she spends in taking care of his/her such ill health relative will create a loss of labour. As a result, the quality of goods and services produced will decrease even if personal income does not reduce. Similarly, an infectious virus will also have a negative effect on the social production. for example, preventing reduced supply of labour by avoiding untimely death through vaccination will increase production levels. Increased production will bring in an increase both in individual and social income.

Economic benefits derived from the utilization of health services by individuals affect the economy towards production as well as consumption as mentioned above. Healthcare expenditures contributes to economic growth in the form of healthy individuals in business life and individuals generating higher income and spending more money in their everyday life. Such contributions are monetary contributions. It can be argued that there is a correlation between investments made in order to create a community where healthy people live and economic growth and moreover, development of healthcare services accelerates economic growth.

2. LITERATURE REVIEW

The exogenous growth theory has basically evaluated economic growth process from the neo-classical perspective. It was developed by Ramsey (1928), Solow (1956), Swan (1965), Cass (1965) and Koopmans (1965). A feature of this model is that it has adopted the convergence property hypothesis at international level. So, it is assumed that developing countries with the same conditions will grow faster than developed countries and close the prosperity gap in between in the long term.

According to the neoclassical exogenous growth theory, economic growth particularly depends on productivity. Productivity depends on technological progress. Technological progress was considered to be an exogenously given factor. It is claimed that no continuous and sustainable growth can be achieved without technological progress especially in economic growth. The fact that growth theorists explained the growth only with technological improvement in the 1950s and 1960s and ignored other factors that may affect the growth has paved the way for new quests in the economic growth theory. Economic growth theories have been developed based on the endogenous growth theory with the studies carried out by Romer (1986), Lucas (1988), Barro (1991), Barro and Sala-i-Martin (1995).

One of the common starting points of endogenous growth models is that the importance attached to physical capital for many years is exaggerated. According to this approach, the important factor of production in terms of long-term growth is human capital. Any activity that increases the efficiency, quality and productivity of workforce, such as health (creation of conditions that will allow individuals to be healthy in the country where they live) is important in terms of human capital.

While increases in healthcare expenditures improve the quality of life of individuals, they also provide social benefits to the entire community. The increase in production occurring due to higher consumption by healthy individuals contributes to both the individual and the community. The reduction of social production with unhealthy individuals also means a reduction in national income at macro level and downsizing of the economy. Therefore, expenditures incurred for healthcare is important among public expenditures. Any increase in resources allocated to healthcare services will ensure individuals to live longer, improve their productivity and make them remain productive in working life longer. These individuals will contribute to the improvement of economic growth. As a result, it can be argued that economies with budgetary possibilities expanding will allocate more resources to health. To summarize, healthcare services have also indirect effects on the economic growth, in addition to their direct effects which we have briefly addressed above. These indirect effects can be represented as the correlation between increase in healthcare expenditures, increase in trainable labour force and growth increase and as increase

in healthcare expenditures, increase in healthy population and growth increase.

There are various studies in the empirical literature which support the theoretical literature and investigate the relationship between healthcare expenditures and economic growth by addressing a single country with time series analysis as well as multiple countries with panel data analysis. Summary of the empirical literature on healthcare expenditures and economic growth is given below.

Table 1. The Literature between Health Expenditures and Economic Growth.

Study	Countries	Empirical results
Newhouse (1977)	13 Countries	Positive and from GDP to Health
Jones (1990)	USA	Negative
Barro (1991)	98 Countries	Negative and from Health to GDP
Fogel (1994)	United Kingdom	Positive and from GDP to Health
Atkinson (1995)	Europe	Positive and from Health to GDP
Hansen and King (1996)	20 OECD Countries	Positive
Barro (1996)	100 Countries	Positive
Hitiris (1997)	EC Countries	Positive
Blomqvist and Carter (1997)	24 OECD Countries	Non-significant
McCoskey and Selden (1998)	20 OECD Countries	Non-significant
Barros (1998)	24 OECD Countries.	Non-significiant
Rivera and Currais (1999a)	OECD Countries	Positive
Rivera and Currais (1999b)	OECD Countries	Positive
Schieber ve Maeda (1999)	Developing Countries	Positive
Arora (2001)	10 Industrialised Count.	Positive
Brinkley (2001)	USA	Positive
Fielding and Shields (2001)	3 Scandinavia Countries	Negative
Bhargava etc.(2001)	92 Countries	Positive
Heshmati (2001)	OECD Countries	Positive and from Health to GDP
Bloom et al.(2001)	104 Countries	Positive and from Health to GDP
Kar and Taban (2003)	Turkey	Negative
Javadipour (2004)	33 Developing countries	Positive
Erdil and Yetkiner (2004)	75 Countries	Low and middle income: From GDP to Health High income: From Health to GDP
Beraldo et al. (2005)	OECD Countries	Positive
Dreger and Reimers (2005)	21 OECD Countries	Long Run: Positive Short Run: Low and middle income: From GDP to Health High income: From Health to GDP
Chang and Ying (2006)	15 OECD Countries	Positive
Bokhari et al. (2007).	189 Countries	Positive and from GDP to Health
Akram (2009)	Pakistan	Long Run: Positive and from Health to GDP Short Run: Non-significant
Yumuşak and Yıldırım (2009)	Turkey	Negative
Hartwig (2010)	21 OECD Countries	Non-significiant
Narayan et al. (2010)	5 Asian Countries	Long Run: Positive and from Health to GDP
Çetin and Ecevit (2010)	15 OECD Countries	Non-significiant
Pradhan (2011)	11 OECD Countries	Long and Short Run: Both from Health to GDP and from GDP to Health
Eryiğit et al. (2012)	Turkey	Positive
Lago-Peñas et al.(2013)	31 OECD Countries	Long Run: Positive and from Health to GDP
Kurt (2015)	Turkey	From Health to GDP. The direct impact: Positive Indirect impact: Negative

3. FEDER-RAM MODEL

Feder (1983, 1986) examined the direct and indirect effect of export on economic growth. in Feder's (1983, 1986) model, economy is divided into two parts, being export industries and other non-export industries. Feder (1983, 1986) developed a model to examine the direct and indirect effects of the export industry on other industries. Consequently, he concluded that there was a positive exogeneity from the export industry to other industries. Later, Ram (1986) and Biswas and Rati (1986) developed different approaches based on this approach of Feder (1983, 1986) and investigated effects of various sectors in the economy. Accordingly, the export industry output in the model shows E and the rest of the non-export industry output shows NE. represents labour employed in the export industry, capital used for the export industry, labour employed in the non-export industry and capital used for the non-export industry with the assumption that labour (L) and capital (K) are homogeneous in both the industries.

$$E = F(L_E, K_E), NE = F(L_{NE}, K_{NE}, E) \quad (1)$$

$$L = L_E + L_{NE}, K = K_E + K_{NE} \quad (2)$$

Y being the amount of total output,

$$Y = E + NE \quad (3)$$

Biswas and Rati(1986) the growth model equation as,

$$\acute{Y} = NE_K \frac{\Delta K}{Y} + NE_L \frac{L}{Y} \acute{L} + \delta \frac{E}{Y} \acute{E} + \theta \acute{E} \quad (4)$$

$$\acute{Y} = NE_K \frac{I}{Y} + NE_L \frac{L}{Y} \acute{L} + \left(\frac{\gamma}{1+\gamma} - \theta\right) \frac{E}{Y} \acute{E} + \theta \acute{E} \quad (5)$$

Double points appearing on the variables show growth rates of the variables and shows the difference operator. 'I' is the coefficient representing investments, direct effect of export on the output, 'θ' indirect effect or exogeneity effect. shows the difference in productivity between the export industry and non-export industry. If is positive, it means that the export industry is more productive than non-export industries; and if it is negative, then it means that other industries are more productive than the healthcare industry. Zero value of indicates that there is no productivity difference in the two industries.

In this study, the Feder (1983, 1986) and Ram (1986) model and the Biswas and Rati (1986) model was used as the basis to investigate direct and indirect effects of the healthcare industry on economy. The variable 'Labour (L)' was not included in the model because the variable 'GDP per person employed (2011=100, PPP $)' was used for the calculation of dependent variable and economic growth in the study. The reason for this is to analyse direct and indirect effects of the healthcare industry on economy more precisely for the calculation of the output taking into account both PPP and GDP per employed person. This study assumes that there are two industries as the key industries, being the healthcare industry (H) and non-healthcare (NH) industry. capital used for the healthcare industry, and capital used for the non-healthcare industry with the assumption capital (K) are homogeneous in both the industries.

$$\acute{Y} = NE_K \frac{I}{Y} + NE_L \frac{L}{Y} \acute{L} + \left(\frac{\gamma}{1+\gamma} - \theta\right) \frac{E}{Y} \acute{E} + \theta \acute{E} \quad (6)$$

$$K = K_H + K_{NH} \quad (7)$$

Y is total output,

$$Y = NH + H \quad (8)$$

Biswas and Rati (1986) the growth model for health equation as,

$$\acute{Y} = NH_K \frac{\Delta K}{Y} + \delta \frac{H}{Y} \acute{H} + \theta \acute{H} \quad (9)$$

$$\acute{Y} = NH_K \frac{I}{Y} + \left(\frac{\gamma}{1+\gamma} - \theta\right) \frac{H}{Y} \acute{H} + \theta \acute{H} \quad (10)$$

We can use these equations to investigate direct and indirect effects of healthcare expenditures on economic growth.

4. ECONOMETRIC ANALYSIS AND DATA

The stationarity of the variables used in this study was investigated by Pesaran (2007) test unit root tests. Feder-Ram model was used to search the relationships between the variables.

4.1. Data

Data is covering the 2006-2015 period for 28 Europian Union countries, the study used GDPGR11 as growth rate of gross domestic product per person employed (2011=100, PPP $), HPCGR11 as growth rate of total health expenditure per capita (2011=100, US$), HPCGDP11 ratio of different of total health expenditure per capita (2011=100, US$) to GDP per capita (2011=100, PPP $), HPCGR05 as growth rate of total health expenditure per capita (2005=100, US$), HPCGDP05 ratio of different of total health expenditure per capita (2005=100, US$) to GDP per capita (2005=100, PPP $) and INVESTGDP11 as ratio of different of the gross fixed capital formation (2011=100, US$) to gross domestic product per person employed (2011=100, PPP $). All data used in the study were taken from the World Bank World Development Indicators.

4.2. Panel Unit Root (Stationarity) Analysis

Stationarity or unit root tests are divided into two, being the first generation stationarity tests and the second-generation stationarity tests. The first generation tests do not take into account cross-section dependence between cross-sections, but the second-generation tests are the tests taking into account cross-sections. in this study, Pesaran (2007) tests, a second generation test, were used instead of the first generation tests of Levin, Lin and Chu (LLC) (2002) and Im, Peseran and Shin (IPS) (2003) in order to determine the stationarity of the variables. However, in the event that there is a cross-section dependence in the variables, the Pesaran (2007) test which takes into account cross-section dependence must be used to test the stationarity of the variables. First, it should be investigated using different tests, such as Breusch-Pagan LM Test, Pesaran Scaled LM Test, Bias-Corrected Scaled LM Test, whether or not there is any cross-section dependence problem in the variables to be used for the equations.

Table 2. Cross-Section Dependence Tests.

Variables	Breusch-Pagan LM Test	Pesaran Scaled LM Test	Bias-Corrected Scaled LM Test
GDPGR11	1672 [a]	46.04 [a]	44.64 [a]
INVESTGDP11	516 [a]	3.99 [a]	2.24 [b]
HPCGDP11	905 [a]	18.14 [a]	16.39 [a]
HPCGR11	1206 [a]	29.10 [a]	27.35 [a]
HPCGDP05	610 [a]	7.42 [a]	5.67 [a]
HPCGR05	638 [a]	8.44 [a]	6.69 [a]

a and b respectively significant at %1 and %5.

As a result of the tests conducted on the variables, it has been concluded that there is a cross-section dependence in the variables as shown in Table 2. for this reason, the Pesaran (2007) test taking into account cross-section dependence was used to test the stationarity of the variables in this study.

Table 3. Pesaran (2007) Panel Unit Root test (CIPS).

Variables	Intercept	Intercept-Trend
GDPGR11	-2.99 (0) [a]	-2.19 (0) [b]
INVESTGDP11	-2.90 (0) [a]	-1.06 (0)
HPCGDP11	-4.66 (0) [a]	-1.09 (0)
HPCGR11	-3.26 (0) [a]	-0.38 (0)
HPCGDP05	-5.15 (0) [a]	-1.51 (0) [c]
HPCGR05	-5.90 (0) [a]	-2.51 (0)

a and b respectively significant at %1 and %5. The values in parentheses are the optimal lag length by Modified Akaike Information Criteria. Null for CIPS tests: series is I(1). CIPS test assumes cross-section dependence is in form of a single unobserved common factor.

Stationarity of the variables used for equations was tested using the Pesaran (2007) Panel Unit Root test, and all of the relevant variables have been found to be stationary for constant and constant-trend models as they were used in the Feder-Ram model and can be used for the equation in their current forms.

In order to determine direct and indirect effects of healthcare expenditures on economy and output using the Feder-Ram model, we can use the following equations econometrically.

$$\acute{Y} = \alpha + \beta \frac{I}{Y_{-1}} + \delta \frac{\acute{H}}{Y_{-1}} + \theta \acute{H} + e \quad (11)$$

$$\acute{Y} = \alpha + \beta \frac{I}{Y_{-1}} + \left(\frac{\gamma}{1+\gamma} - \theta\right) \frac{\acute{H}}{Y_{-1}} + \theta \acute{H} + e \quad (12)$$

In the equation, show coefficients of the variables. The variable represents GDPGR11, the variable INVESTGDP11, the variable HPCGDP11 or HPCGDP05, the variable HPCGR11 or HPCGR05 and e random error terms. The results obtained are given in Table 3 below.

(Model A) $GDPGR11_{it} = \alpha + \beta INVESTGDP11_{it} + \left(\frac{\gamma}{1+\gamma} - \theta\right) HPCGDP11_{it} + \theta HPCGR11_{it} + e_{it}$ (13)

(Model B) $GDPGR11_{it} = \alpha + \beta INVESTGDP11_{it} + \left(\frac{\gamma}{1+\gamma} - \theta\right) HPCGDP05_{it} + \theta HPCGR05_{it} + e_{it}$ (14)

Results of the redundant fixed effect test show that we should prefer the fixed effect model. for potential autocorrelation and heteroscedasticity problems in the models, the White diagonal pattern standard errors and covariance (degree of freedom corrected) correction are used. in addition, the Cross Section Dependence linear estimation after one-step weighting matrix using cross section weights and Swamy and Arora estimator of component variances is used.

Table 4. The Feder-Ram Model (Dependent Variable: GDPGR).

Variables	Model A[1]	Model B[1]
α	0.0022 (1.29)	0.007[a] (5.97)
β	36.62[a] (3.49)	61.91[a] (6.30)
δ_{11}	-0.00004[b] (-2.20)	------
θ_{11}	0.1509[a] (5.09)	------
δ_{05}	------	-0.0629[a] (-2.84)
θ_{05}	------	0.1726[b] (2.52)
γ	0.18	0.12
R^2	0.36	0.31
F	45.63[a]	36.95[a]
N	248	248
DW	2.13	1.99
RFE	0.70	0.79

a, b, c denote significant at 1%, 5% and 10%, respectively. Values in parenthesis are t statistics. RFE: Redundant fixed effect test stats. 1: Pooled OLS. White diagonal standard errors and covariance (degree of fredom corrected) are used. Linear estimation after one-step weighting matrix using cross section weights.

According to the results both from the Model A and Model B, the effect of investments on economic growth was found to be positive and statistically significant. The Model A shows that the direct effect of healthcare expenditures on economic growth is negative and statistically significant. However, the Table 4 shows that the direct effect in the Model B is negative and statistically significant and a greater coefficient comparing to the Model A. The negative direct effect can be explained by the import of medicines and health supplies from other countries in healthcare expenditures. It is seen that the indirect effect or the exogeneity effect is positive and statistically significant in both equations. in other words, increased healthcare expenditures have a positive effect on other industries. Given that healthcare expenditures are incurred for the treatment of patients, it can be easily said that healthcare expenditures will increase the productivity of patient workers and entrepreneurs, in short, of the labour factor; will increase productivity in other industries and provide positive contributions to production. Indirect effect which increases productivity and is positive is greater than direct effect. It is seen in the Model A that the proportion of the coefficients to each other is much higher, while the indirect effect is approximately 3 times of the direct effect in Model B. Consequently, based on the table, it can be smoothly said that the net effect of healthcare expenditures is positive. Another indicator to this is that it is . That this coefficient is positive indicates that productivity of the healthcare industry is higher than other industries. Coefficients are calculated to be 0.18 for the Model A and 0.12 for the Model B. These coefficients are such values close to each other and such results supporting each other on the productivity of the healthcare industry to be higher than other industries.

5. CONCLUSIONS

The effect of healthcare expenditures on economic growth is an important issue requiring to investigate whether or not expenditures incurred are productive, whether or not expenditures are incurred for productive areas and whether or not they increase welfare level and labour productivity of individuals and community. in this study, the investigation of the direct and indirect effects of healthcare expenditures on economy and the productivity of the healthcare industry comparing to other industries was examined using the Feder-Ram model. in the study, macroeconomic variables per worker and per person were used differently from the Feder-Ram model.

In the study, it was first investigated whether or not there was any cross-section dependence problem using different tests, such as Breusch-Pagan LM Test, Pesaran Scaled LM Test, Bias-Corrected Scaled LM Test, and it was observed that there was cross-section dependence in the variables. Therefore, the Pesaran (2007) test taking into cross-section dependence was used to test stationarity of the variables and it was seen that all the variables were stationary, i.e. I (0), as they were used in the Feder-Ram model. The redundant fixed effect was used to decide which model out of the Pooled OLS, fixed effect models would be used. It was decided to use the Pooled OLS model for the Model A and B. for potential autocorrelation and heteroscedasticity problems in the models, the White diagonal pattern standard errors and covariance (degree of freedom corrected) correction are used. in addition, the Cross Section Dependence linear estimation after one-step weighting matrix using cross section weights and Swamy and Arora estimator of component variances is used.

The contribution of this paper to the literature on, according to the results from the equations, the effect of investments on economic growth was found to be positive and statistically significant. Both the Equations shows that the effect of healthcare expenditures on economic growth is negative and statistically significant. Products in the portfolio of European multinational pharmaceutical companies are out-dated comparing to US firms introducing new chemical compounds into the market. R&D activities in the pharmaceutical industry concentrate in North America. The share of the US market in sales of new drugs is gradually increasing. Most of the competition which threatens the EU in the pharmaceutical market comes from the US, Sweden and Switzerland. EU countries are both pharmaceutical exporters and importers in the pharmaceutical market. The negative direct effect can be explained by the import of medicines and health supplies from other countries in healthcare expenditures. It is seen that the indirect effect or the exogeneity effect is positive and statistically significant in both equations. in other words, increased healthcare expenditures have a positive effect on other industries. Given that healthcare expenditures are incurred for the treatment of patients, it can be easily said that healthcare expenditures will increase the productivity of patient workers and entrepreneurs, in short, of the labour factor; will increase productivity in other industries and provide positive contributions to production. Indirect effect which increases productivity and is positive is greater than direct effect. As a result, it can be smoothly said that the net effect of healthcare expenditures is positive. Another indicator to this is that it is . That this coefficient is positive indicates that productivity of the

healthcare industry is higher than other industries. Coefficients are calculated to be 0.18 for the Model A and 0.12 for the Model B. These coefficients are such values close to each other and such results supporting each other on the productivity of the healthcare industry to be higher than other industries.

A policy proposal to be concluded from this study is that domestic production of pharmaceutical products and medical equipment should be encouraged. However, it can be said that investments and quality in the healthcare industry and the number of people accessing healthcare services should be increased because healthcare expenditures increased to eliminate health problems of individuals and society increase labour productivity.

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