

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN HEALTH CARE
EXPENDITURES AND ECONOMIC GROWTH

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BY

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PLAGIARISM

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

MURAT BİNAY

21.10.2022

ABSTRACT

In the 1960s, endogenous growth theories revealed that human capital as much effect as as physical capital in economic growth. Then, it was focused on how to increase human capital accumulation, and it was determined that first of all, education and then health were two main components.

There are a lot of studies in the literature trying to assess the relationship between health expenditures and economic growth. In the studies on the relationship between economic growth and health expenditures, which is the subject of this thesis, it has been observed that economic growth is increased by health expenditures generally, but there are some studies that show that it does not affect economic growth even decrease.

In this thesis, the relationship between health expenditures and economic growth has been examined for OECD countries, including Turkey, with five different methods: panel data analysis, structural break panel data analysis, panel causality test, dynamic panel data analysis and non-linear panel data analysis. In these methods, firstly, the relationship between health expenditures and economic growth is examined, then the other components of economic growth that are generally accepted in the literature, such as capital accumulation, total factor productivity and the democracy index, whose effects on economic growth are discussed, are included in the model to determine the effect of health expenditures on economic growth. has been studied.

In addition, although there are studies on the optimal level of public expenditures in the literature, it has been observed that there is no study on the optimal level of health expenditures in OECD countries, and it has been tried to calculate at which health expenditure level the economic growth will be maximum.

Key words: Economic Growth, Health Expenditures, Armey Curve, Dynamic Panel

Data Analysis



ÖZET

Beşerî sermaye birikiminin ekonomik büyüme üzerinde en az fiziki sermaye birikimi kadar önemli olduğu 1960’larda içsel büyüme teorileri ile ortaya konmuştur. Ardından beşerî sermaye birikiminin nasıl artırılacağı üzerine odaklanılmış, öncelikle eğitim ardından da sağlığın iki ana bileşen olduğu tespit edilmiştir.

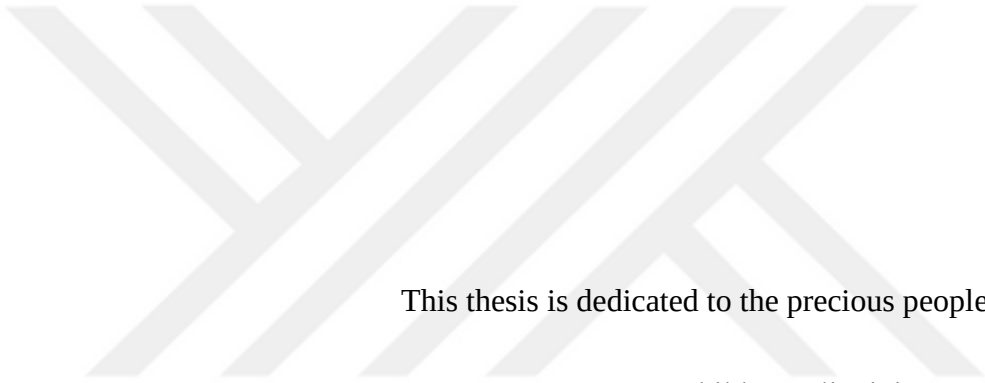
Literatürde ekonomik büyüme ile sağlık harcamalarının ilişkisi üzerine birçok çalışma mevcuttur. Bu tezin konusu olan sağlık harcamaları ile ekonomik büyüme arasındaki ilişki üzerine yapılan çalışmalarda genellikle sağlık harcamalarının ekonomik büyümeyi artırdığı görülmüş olsa da, hiç etkilemediği ya da ekonomik büyümeyi düşürdüğüne dair çalışmalar da mevcuttur.

Bu çalışmada sağlık harcamaları ve ekonomik büyüme ilişkisi Türkiye’nin de içinde bulunduğu OECD ülkeleri için panel veri analizi, yapısal kırılmalı panel veri analizi, panel nedensellik testi, dinamik panel veri analizi ve non lineer panel veri analizi olmak üzere beş ayrı yöntemle incelenmiştir. Bu yöntemlerde öncelikle ekonomik büyüme ve sağlık harcamaları arasındaki ilişki incelenirken, ardından ekonomik büyümenin literatürde genel kabul gören diğer bileşenleri olan sermaye birikimi, toplam faktör verimliliği ve ekonomik büyüme üzerinde etkisi tartışılan demokrasi endeksi gibi bileşenler de modele dahil edilerek sağlık harcamalarının ekonomik büyüme üzerindeki etkisi tespit edilmeye çalışılmıştır.

Ayrıca literatürde kamu harcamalarının optimal düzeyi üzerine çalışmalar bulunmakla beraber OECD ülkelerinde sağlık harcamalarının optimal düzeyi üzerine çalışma bulunmadığı görülmüştür ve sağlık harcamalarının milli gelire oranı ne olduğunda ekonomik büyümenin maksimum olacağı hesaplanmaya çalışılmıştır.

Anahtar Kelimeler: Sağlık Harcamaları, Ekonomik Büyüme, Armey Eğrisi, Dinamik

Panel Veri Analizi



This thesis is dedicated to the precious people in my life;

My children Ali Yiğit, Ateş and Demir

To my beloved wife Songül Binay and my beloved mother Cemile Binay

And my beloved father Ali Hikmet Binay

My beloved brother Aziz Binay

My beloved sisters Sevgi Alper and Neslihan Şebin...

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INTRODUCTION:

In this thesis, the relation between health expenditures and economic growth has been examined for OECD countries, including Turkey, with five different methods: panel data analysis, structural break panel data analysis, panel causality test, dynamic panel data analysis and non-linear panel data analysis. In these methods, firstly, the relation between health expenditures and economic growth is examined, then the other components of economic growth that are generally accepted in the literature, such as total factor productivity, capital accumulation and the democracy index, whose effects on economic growth are discussed, are included in the model to determine the effect of health expenditures on economic growth. has been studied.

In addition, although there are studies on the optimal level of public expenditures in the literature, it has been observed that there is no study on the optimal level of health expenditures in OECD countries, and it has been tried to calculate at which health expenditure level the economic growth will be maximum. In addition, while it is almost agreed in the literature that physical capital accumulation, total factor productivity positively affects economic growth.

It is thought that democracy's effect and health expenditures increase growth by increasing human capital accumulation and reducing income inequality, as well as increasing the ratio of public consumption expenditures to GDP and preventing physical capital accumulation and reducing growth.

Therefore, in this study, although their effect on economic growth is controversial in the literature, these two variables, which are thought to increase economic growth by increasing human capital, will be added to the model and how much they contribute to economic growth besides total factor productivity and accumulation of physical capital which are agreed as the main elements of economic growth, are analysed.

CHAPTER 1

GENERAL FRAMEWORK OF ECONOMIC GROWTH MODELS

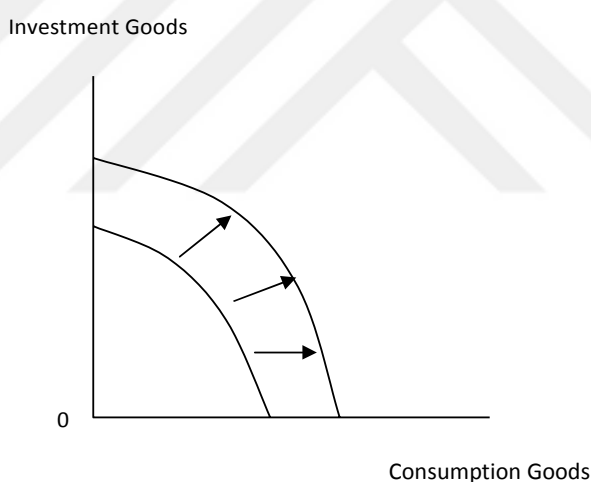
1.1. Economic Growth Concept

According to another definition, economic growth is defined as the increase in real output per capita (Economic, 2005: p. 55, Karluk, 2005, p. 55), as the economy grows and the production capacity of the economy increases, more goods and services are produced.

Economic growth can be explained as the expansion of goods and services production capacity. In other words, if the production possibilities of the country are shifted to the right in a production possibility frontier, it can be said in economic growth, as seen in Figure 1.

Figure 1

Production Opportunities Curve



Economic growth is measured as an increase in real per capita income. These increases arise only in the long run due to the fact that potential of the country or the production scale is widening or more productive. Therefore, the concept of economic growth is often thought as a long-term problem and is determined more in the macroeconomic sense than supply. In other words, the factors that cause an economy's production opportunity curve to slide outward or to the right of the long-run aggregate supply curve are theories of economic growth theory. Behind these shifts, it is pointed out that governments are three important sources of economic growth that can be measured in terms of real GDP and percentage of increase in real

GDP, as well as the effects of infrastructure investments that increase technology policies and education and physical capital stock to increase the production factors' productivity (Parasız, 1997, p. 5; Kibritçioğlu, 1998, pp. 207-208).

1.2. History of Economic Growth Models

Scientifically, economic growth has been started to be studied from the middle of the 20th century, while economic economics has been interested in economic growth and Adam Smith's study since the 18th century "The Wealth of Nations". Simplifications are needed to ensure that the economic growth process to be understandable, and these simplifications are done with the help of models.

Growth models may be separated as Solow-Swan neoclassical model, Neo-Keynesian Harrod-Domar model, inner growth models and models of modern economic politics. (Snowdon, 2006, p. 84).

In the Internal Growth Model; The quality, productivity and creative ideas of the workforce are of great importance. The new ideas produced; It is predicted that with the transformation of new products, functional designs and scientific inventions, the amount of technology-intensive products in the country's exports and the country's export competitiveness will increase, the added value obtained from exports will increase and the economic growth of the country will increase forever (UNCTAD, 2008, p. 17).

According to the Intrinsic Growth Model; As people improve their knowledge and skill level, their productivity in economic activities will naturally increase. However, in order for individuals to be productive in economic activities, besides receiving a good education, they must also be healthy. Educational studies/expenditures, which usually attract attention in terms of human capital. However, no matter how well educated the individual is, he will not be productive enough if he is not healthy. For this reason, countries that want to increase their economic growth continuously and steadily need to increase their human capital stocks by investing more in the fields of health and education (Yılmaz, 2018, p. 72).

Good growth, put forward by the endogenous growth theorists, does not contain any worrying factors and takes human welfare, in other words, human development as a goal (Mızrak, 1997, p. 29).

Good growth according to this approach;

- Encouraging employment,
- Giving the individual the chance to decide and control his own destiny,
- Distributing the welfare increase fairly,
- Ensuring social cooperation and harmony,
- It has the characteristics that will protect the future of human development.

These elements listed above under certain conditions can be differentiated and increased according to the situation of the countries. The most important thing here is that it cannot be ignored that each of these conditions is a goal or a target.

In the Romer model, he explains the concept of economic growth with the help of creative ideas. In this model; It is emphasized that technology does not have the characteristics of traditional goods or public goods. It is emphasized that technology can reflect outside, albeit to a limited extent, without being dependent on competition. According to the Romer model, the main feature of technology is that it does not create a competitive environment of its own. In the model, there has been an increasing return to scale, and for this reason, it has come to the fore to conduct research on this subject (Romer, 1986, pp. 1002-1037).

According to Lucas; Continuous and growth takes place due to the constant return of inputs as a result of accumulation. Apart from the Rebelo model, there must be an additional input other than capital and labor in order to create a solution by creating an environment where competition exists. The common feature of the Lucas and Romer model is that they see additional input as a factor of capital. The point where he differs is that Lucas sees the additional input as human capital. Romer, on the other hand, sees the additional input in the fixedness that can be embodied in the form of human capital and physical capital. As a result, physical capital, which is defined as fixed capital, has the effect of increasing investments and human capital (İnce, 2006, p. 53).

Barro's model assumes that the goods and services or infrastructure provided to individuals through the public sector are of equal importance when compared to factors of production. In the model, production includes the capital factor in a broad definition and the ratio of the labor factor in the production process has been reduced in order to facilitate the model relatively. The only source of income of the state is stated as tax. It is stated that the only source of expenditure of the state is the supply

of public goods. He argues that the budget is always balanced in the Barro model (Sala-i Martin & Barro, 1995, p. 95).

1.3. Internal Growth Concept

In the economic literature there is a consensus on the principles of the theory of internal growth based on the work of Romer (1986) and Lucas (1988) (Grossman & Helpman, 1994, p. 27; Pack, 1994, p. 55, Solow, 1994) The studies in this area are significantly different from the neoclassical growth approach which links growth to the defined model to factors outside the economic system, since growth suggests that the economic system takes place internally through interaction of a number of factors within its own dynamics (Ercan, 2000, p. 129).

The theory of internal growth is set on internal factors that grow and internal development based on technological development. In this context, it attaches particular importance to the human capital consisting of the knowledge, skills and experience of the labor force and labor. Lucas model explains the economic growth as the result of the accumulation of human capital (Ay & Yardımcı, 2008, p. 40). The Neo-classical theory concedes that the capital is composed of physical capital. An important distinction between the theories arises from the understanding of these two different types of capital and the incomes of the capital. In this framework Neo Classic model mentions the increasing output of capital, including the decline of capital, internal growth models, including human capital (Taban & Kar, 2006, p. 161).

If a firm employ educated, healthy and qualified labor during their investments, the labor force will not only become productive but will also be able to use capital and technology more effectively. Thus, the increasing return on the scale will be valid (Şimşek & Kadılar, 2010, p. 118). By the way, it is seen that the basic tenets of internal growth theories are concepts of knowledge and human capital.

The neoclassical approach, which began with Solow in the 1950s and lasted until the 1980s, considered economic growth as a concept determined by external factors. However, in the 1980s education, research and development, technological innovations and the rediscovery of the state necessitated reconsideration of the concept of economic growth and its determinants. The works of Romer (1986) and Lucas (1988), which are accepted as the starting points of the researches in this subject, use the idea of learning by doing of Arrow (1962). Romer and Lucas'

preliminary work on human capital and knowledge accumulation in their work is far from physical capital accumulation.

The main starting point of new or endogenous growth models has been inadequate in explaining differences in the practical development of the neoclassical growth theory and in the rates of growth among countries. Internal growth theorems are divided into the following points from neoclassical growth theory:

- Contrary to neoclassicism, it is argued that economic growth is the product of intra-economic factors, not the forces that affect the system from the outside.
- Technological development occurs within the economic system and is influenced by economic decisions. The basic of this assumption is the internalization of technological development within the framework of internal growth theories.
- Instead of a neoclassical production function based on decreasing returns, a production function based on increasing efficiencies is used. On the basis of this assumption lies the view of Romer in the process of investment and production not only of physical product but also of new production knowledge. According to Romer, information emerging as a product in the investment and production process will provide productivity gains not just for that company but also for the whole economy (Barro & Martin, 1995, p. 227).
- The full convergence hypothesis is rejected in the theory of internal growth. If developing countries do not take the necessary measures, the income gap between developed countries will increase. Finally, in the theory of internal growth, state intervention is emerging as a necessary element in order to achieve an optimal growth rate.

1.4. Endogenous Economic Growth Determiners

As stated by Romer (1986 and 1990), the technological inventions of human capital in the research and development sector are the driving force of growth. Moreover, the contribution of the increase in information production to the whole economy through "spillover" effect and "learning by doing" will be much more than companies' specific gains. As a result of all these achievements

Schumpeterian innovation means that; in other words, economic growth is achieved through the discovery of new products, new production techniques, or the discovery of different designs and processes of a reputation.

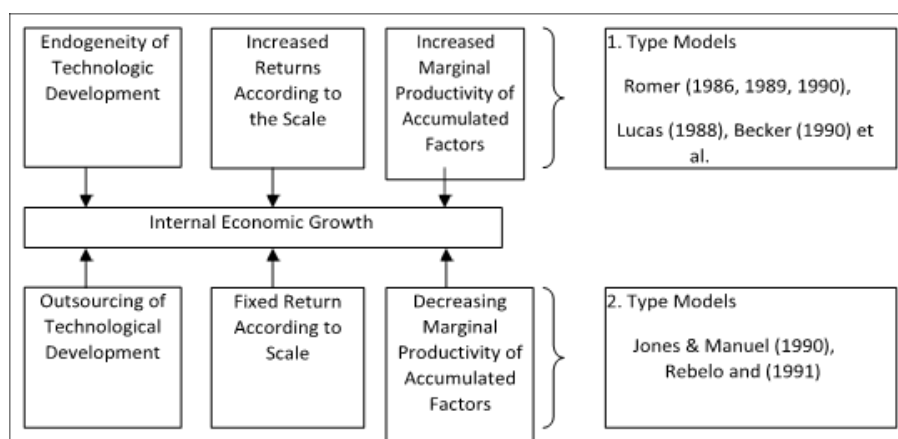
1.5. Endogenous Economic Growth Theories

Inner growth theories are based on a small mathematical detail and have a very wide range of manufactures. Theory implies, firstly, that technological development is contrary to the neoclassical theory of the economic system, and therefore influenced by economic decisions. Second, the theory of convergence is rejected. If developing countries do not take the necessary precautions, the income gap between developing countries and the developed countries may become more and more open. Third, in these theories, state interventions are necessary to achieve optimal growth rates (Yülek, 1997, p. 2).

Convergence is a critical precaution for countries that are developing emerging in the theory of endogenous growth. The new theory suggests that developing countries should implement active policies to close this gap. Therefore, sectors with high learning potential and suitable for human capital gain importance. The types and assumptions of the inner growth models are shown in Figure 2.

Figure 2

Types and Assumptions of Internal Growth Models



These countries should attach importance to the creation of dynamic comparative advantages over static Ricardian comparative advantages. As a country invests in certain sectors, it will learn about it, so it will reduce unit costs, increase quality and create a comparative advantage in that respect. In this

respect, theories of internal growth are used in the literature to explain the development of Far East countries

The advocates of the theory of internal growth put forward different subjects to the foreground. For this reason, it is actually difficult to talk about one theory. One of the common points that groups them is the idea of long-term internal determination of the growth, which is to be explained with different economic elements. Models that ensure that growth rates of real revenues are not zero in the long run, so the economic growth is not blocked and self-sustaining models are given in Figure 2, together with their assumptions. In the first type of models, it is seen that three of the basic assumptions in the neoclassical growth model are completely abandoned. In these models, subtypes of which are shown in Figure 2, there are various suggestions that will lead to increased returns. In particular, Lucas (1998) argues that the public capital of the human capital Barro (1990) will provide increased returns to Romer's (1986, 1990) R & D work. In this sense, first type internal growth theories can be classified under three main headings as "human capital models", "research & development model" and "public policy model". In a few second-generation models, only the accumulation of production factors (cumulative capital) does not diminish marginal productivity (ie, it remains constant or increases), while the internalization of technological development is not required for internalization of the growth process and neoclassical assumptions are made that the technological development is fixed, it is proven institutionally that even an internal growth process can occur.

1.6. Human Capital Model (Lucas)

In the context of intrinsic growth, the positive and continuous growth rates are due to the constant return of deposits subject to accumulation. According to Lucas, the level of education of the workforce defines the level of human capital. The active labor force (hL) included in the production function is obtained by multiplying the individual skill level (h) and the worker's size (L). Since wages are determined by marginal productivity, which is raised by education, the accumulation of work skills is carried out by

training and weighted production. Besides the "active workforce", the average level of h also enters the production function and creates externalities at the individual level. This variable (hw) represents the average quality of the human capital. To motivate this, Lucas assumes that the average productivity of the population will increase as the overall quality of the population increases.

The Cobb-Douglas-type production function proposed in Lucas (1988) can be written as follows;

$$Y = K^\alpha H^{1-\alpha}$$

If $H = uhL$ defined then $Y = AK^\alpha (u.h.L)^{1-\alpha}$

Here h is the capital per capita.

h enters into the production function of this economy, similar to the labor-saving technological development. The model works as a human capital of A and a Solow Model of $g = 1-u$. Accordingly, a policy of the Lucas model, which constantly increases the time that individuals devote to acquiring skills, leads to a steady increase in per capita output growth. That is, the most important explanatory of internal growth is not an externally determined technological development, but rather the rate of human capital accumulation ($\dot{h} / h$) and the degree of externality in the relevant economy (Lucas, 1988, p. 22).

Lucas' s approach to learning by doing is used to explain the productivity gains of human capital in physical capital and labor. The increase in human capital in the model allows a product that cannot be competing and cannot be excluded in a manner similar to Arrow's "learning by doing" approach and increases in production occur due to the disintegration effect in the economy. However, the research activities in the R&D sector will not reach a sufficient level in such a structure that accepts knowledge as public goods. At this point, the question arises as to how the R & D sectors will be identified and by which tools the public sector will play an important role in promoting research activities. Today, agreements for the liberalization of

international trade on the one hand, and agreements aimed at economic integration on the other, provide a framework and binding provisions on the policies to be implemented by the countries. However, it is clear that each country needs to take into account its own level of development and industrial structure in its policy preferences, as well as country conditions in a more general way.



CHAPTER 2

THE ROLE OF HUMAN CAPITAL IN ECONOMIC DEVELOPMENT

2.1. Definition of Human Capital

There is not a common definition of human capital. Human capital is the level of information that individuals in society perceive in relation to the production process the attitudes, behaviors and values of their knowledge, skills, abilities, emotional attachment to their work, on the other side is a concept that expresses mental and physical well-being or stability. M. Husz (1998, p. 9) expresses as experience, knowledge, skill, time and that a household or a generation of people can use in the production process, with the concept of human capital. (Keskin, A., p.128)

Schultz (1992) expresses human capital investments as the number of enrolled students multiplied by the cost of education per student. Classical economists, with the industrial revolution, did not see labor capital goods or production goods differently. As long as it is a solid contribution, the value of your work has been mentioned, otherwise labor is deemed worthless. Thus, classical economists have reduced people to the level of mediators that serve more production purposes. It is argued, however, that in the North and South since ancient times, man is not the vehicle of development, but that it is for man to develop, and that his ultimate goal should be man. Aristo, A. Smith, K. Marx, J.S. Political economists such as Mill and A. Marshall have acknowledged that development is for man, and they have not seen man as a means of production. (UNHDR, 1996, p. 45).

2.2. Human Development Index

The Human Development Index (HDI), which is able to measure the degree of welfare and development of the countries by converting the notion of human development into numerical values with its contemporary expression, has been developed by the United Nations Development Program (UNDP), taking into account both economic and social development, directional scale (Han & Kaya, 2006, pp. 274-275). The Human Development

Index measures the relative socio-economic development of countries over time and helps to determine the policy priorities of individuals and governments by creating an alternative to GNP in cross-country comparison of welfare, enabling comparison of different country experiences (UNHDR, 1994, p. 91). All countries are grouped into three groups according to the value of Human Development Index. Countries with a Human Development Index value of 0,800 or higher have a high human development group; Countries with between 0,500 and 0,799 constitute the middle human development group and countries below 0,500 constitute the low human development group (UNHDR, 2006, p. 275). In the UNHDR 2009 (204), the United Nations classifies countries in four groups. According to this classification, countries with a Human Development Index value of 0,900 and above have a very high human development group; Countries with a population of between 0,800 and 0,899 have a high human development group; Countries with between 0,500 and 0,799 are the middle human development group; and countries under 0,500 constitute a low human development group. In the related report, the countries in the first group are developed and the countries in the other three groups are mentioned as developing countries.

2.3. Social Capital

Social capital is a multidimensional concept in terms of economic, social and political aspects, and abstract relations are the whole. The relationship culture that allows people to do business together; There is the capacity and the ability to provide benefits and advantages through membership among the members of the public, the public and the civilian institutions of the society. On the one hand, it is a capital that creates bonds between individuals, families and neighbors, and communities on the other. This concept includes mutual respect, trust and mutual trust between norms, social networks and people that affect the productivity and well-being of the community. Social capital is not monopolized by a person or group, but rather by a network of contacts and / or institutions. As the relations continue, social capital increases. Social capital disappears when relations are broken. It cannot be bought and sold like physical capital. The main source of social capital

mixed with financial capital is 'skill in human relations' (Keskin, 2011, p. 6).

The rational use of human capital in an economy requires the existence of social capital. Because there is a strong positive relationship between social capital and human capital (Karagül & Dündar, 2006, p. 70). Fukayama (2000) defines social capital as "the whole of common, informal values and norms spontaneously shared among members of a group and enabling them to cooperate with each other ...". Therefore, social capital is perceived as a whole of social networks, norms, trust, and cultural values that help people, institutions and organizations that make up society to achieve common goals and objectives.

One of the preconditions for the formation of a high social capital is the "trust" that must be between individuals and institutions in society. Trust in social communication is one of the preconditions for the emergence of a healthy democracy and an open society. Communication is the most important element of discussion culture. Communication channels that are open to citizens and managers are crucial to the development of participatory democracy. Social capital from the other side, the creation of material capital; are also closely related to their use for productive, correct purposes and for collecting plus value. As a result, individuals who are educated, sensitive to the social issues, who are close to the world, who are participating, who are aware of their rights and responsibilities, are individual reflections of social capital.

Classical factors of production [labor, capital, nature and entrepreneur] are being revised by adding technology and capital factor is expanded to include financial capital, physical capital as well as human capital and social capital. Because, in addition to classical production factors, social capital, which expresses the level of communication based on human capital and social trust, which expresses the knowledge, skill and experience of the working person, has now entered economic theories as new production factors (Callois & Aubert, 2005, p. 3).

2.4. The Development of Human Capital in the World

Economic development is parallel to the development of human capital. Statistics and criteria for these variables are developing over time. At this point, the relationship between the two cases becomes more testable. Four tables from Table 1 to Table 4 below were prepared to monitor the development of human capital in the world. These tables are prepared according to criteria which are accepted as criteria of human capital. Table 1 and Table 2 are prepared with the average national income figures per person, and Table 3 and Table 4 are prepared with the index of human development index.

Table 1

Growth in Human Development in Country Groups by Category in the Period of 1990-2021 (%)

Country	Human Development Index (HDI) 1990	2000	2010	2015	2018	2019	2020	2021
Human development groups								
Very high human development	0,784	0,826	0,868	0,889	0,898	0,902	0,895	0,896
High human development	0,557	0,625	0,700	0,734	0,751	0,756	0,753	0,754
Medium human development	0,453	0,506	0,582	0,627	0,643	0,645	0,642	0,636
Low human development	0,356	0,399	0,477	0,506	0,518	0,522	0,519	0,518

Table 1 shows the average annual per capita real growth rates. While the growth rates of the high and low human development groups generally declined, the growth rate of the middle human development group in the post-1990 period is remarkable.

A similar development can be observed in Table 2 for the regions in the world. According to this, while the average per capita real growth in industrialized countries is decreasing, it is observed that the rate is growing in East Asia.

Table 2

Average Human Development Index Growth in the World by Region in the Period of 1990-2021 (%)

Country	Human Development Index (HDI) 1990	2000	2010	2015	2018	2019	2020	2021
Regions								
Arab States	0,555	0,618	0,676	0,697	0,711	0,715	0,708	0,708
East Asia and the Pacific	0,507	0,592	0,684	0,722	0,741	0,748	0,748	0,749
Europe and Central Asia	0,664	0,681	0,746	0,783	0,798	0,802	0,793	0,796
Latin America and the Caribbean	0,633	0,689	0,733	0,758	0,766	0,768	0,755	0,754
South Asia	0,442	0,500	0,576	0,623	0,640	0,641	0,638	0,632
Sub-Saharan Africa	0,407	0,430	0,503	0,534	0,547	0,552	0,549	0,547
Least developed countries	0,357	0,408	0,487	0,520	0,537	0,542	0,542	0,540
Small island developing states	0,601	0,649	0,693	0,723	0,734	0,738	0,732	0,730
Organisation for Economic Co-operation and Development	0,795	0,840	0,875	0,893	0,901	0,905	0,897	0,899
World	0,601	0,645	0,697	0,724	0,736	0,739	0,735	0,732

Table 3 and Table 4 are prepared according to human development index data. Table 3 presents the average human development indices of the country groups according to three human development categories.

Table 3

Changes in HDI According to the Human Development Categories in the 1990-2021 Period

Human development groups	1990	2000	2010	2015	2018	2019	2020	2021
Very high human development	0,784	0,826	0,868	0,889	0,898	0,902	0,895	0,896
High human development	0,557	0,625	0,700	0,734	0,751	0,756	0,753	0,754
Medium human development	0,453	0,506	0,582	0,627	0,643	0,645	0,642	0,636
Low human development	0,356	0,399	0,477	0,506	0,518	0,522	0,519	0,518

Note. From Human Development Report Office, UNHDR 2021

In Table 4, the information in Table 3 is given for the regions in the world. According to this, while industrialized OECD countries have the highest human development index values, developing countries have improved over time but still have the lowest human development index values

Table 4

Global and Regional Improvements in HDI in the 1960-2003 Period

Regions	1990	2000	2010	2015	2018	2019	2020	2021
Arab States	0,555	0,618	0,676	0,697	0,711	0,715	0,708	0,708
East Asia and the Pacific	0,507	0,592	0,684	0,722	0,741	0,748	0,748	0,749
Europe and Central Asia	0,664	0,681	0,746	0,783	0,798	0,802	0,793	0,796
Latin America and the Caribbean	0,633	0,689	0,733	0,758	0,766	0,768	0,755	0,754
South Asia	0,442	0,500	0,576	0,623	0,640	0,641	0,638	0,632
Sub-Saharan Africa	0,407	0,430	0,503	0,534	0,547	0,552	0,549	0,547

2.5. Human Capital and Economic Development in Turkey

2.5.1. Economic development issues in Turkey

Since the day the Republic was founded, Turkey has been making great efforts towards economic development. But Turkey, lagged well behind many countries which has the same level of development in the 1960s such as Greece, South Korea, Japan, Singapore, Italy, Spain. Turkey's most important deficit is education in order to take up less than the rate of economic growth. Growth and development economists are united by the fact that education and human capital play a very important role in the economic growth process. A workforce with greater skills to move to a higher added value structure that uses more advanced technologies than a muscle-based production, is emerging as an important condition.

2.5.2. The human capital in Turkey and international comparisons

According to the criteria used in preparing the Human Development Index prepared by United Nations, the value of Turkey's 1990-2021 period related to these criteria is presented in Table 5. According to Table 5, to say that Turkey's human capital index and stable over time and between countries in the ranking do not show a significant improvement. Turkey is at the 48th number according to the Human Development Report Office, UNHDR 2021 among 191 countries.

Table 5

Annual Change of Turkey's Human Development Index (1990-2021)

Year	Country
1990	0,600
2000	0,670
2010	0,749
2015	0,817
2018	0,839
2019	0,842
2020	0,833
2021	0,838

Table 6 shows the progress of the development in both 1990-2021 period as well as whole world and OECD countries. Turkey's human capital level was at medium human development level before 2007 and has an increasing trend.

Table 6*International Comparison According to the Human Development Index*

Country	1990	2000	2010	2015	2018	2019	2020	2021
OECD	0,795	0,840	0,875	0,893	0,901	0,905	0,897	0,899
World	0,601	0,645	0,697	0,724	0,736	0,739	0,735	0,732

According to Table Turkey's cross-country comparison shows that in the 1992-2007 period, the rank changed between 66th and 96th. In addition, although Turkey has located in the middle human development group, after 2007 has entered high human development group at UNHD 2009 report.

2.6. Human Capital - Economic Development Relation in the Theory and Practice

2.6.1. Human capital - economic development relation in the theory and practice

Human capital, unlike physical capital, is subject to increased productivity, not diminishing in production (Sala-i Martin, 1990). For this reason, there is no steady-state growth in Neo-Classical theory for an economy in inner growth models; the economy can continuously grow as the welfare increase continues.

The developments and empirical findings indicate that the income gap between developed and underdeveloped countries is increasing day by day [contrary to the convergence hypothesis proposed by Neo-Classical growth theory].

2.6.2. Relation of human capital and economic development in practice: empirical findings

The role of human capital in economic development is still being studied intensively in the literature both theoretically and empirically. The results of these studies reveal that the causality relationship between human capital and economic development is sensitive to selected human capital. As a measure of human capital, variables such as education expenditures, health expenditures, literacy rate, schooling rate are mostly used.

In western societies, human capital, especially the rapid development in the post-World War II era and the increasing use of knowledge in production have

resulted in increased economic development and prosperity. H. W. Singer argues that educational investments are subject to the law of increasing yields, not to law of diminishing marginal returns; It also indicates that the investment in education and research in different fields is tightly linked and interacted with each other. Educational investments are leading to the emergence of innovations that have never been anticipated.

Table 7 summarizes the studies on the relationship between human capital and economic development.

Table 7

Empirical Studies on the Relationship between Human Capital and Economic Development

Researcher	Country/ Period	Variables	Method	Results
Denison (1962)	USA 1929-1959	Human capital (education) and economic growth	Endogenous Economic Growth	In the period examined, 0.93% part of the annual growth rate 2.92% is accounted for by labour and capital inflows, and a significant portion of the remaining 2% is explained by the increase in productivity through education.
Romer (1989)	International 1960-1985	Human capital (education) and economic growth	Endogenous Economic Growth	Education representing human capital, has a positive effect on economic growth.
Barro ve Lee (1993)	Internatioanl 1960-1985	Economic growth and Human capital (education)	Panel study	Education representing human capital, has a positive effect on economic growth.
Mulligan ve Sala-i Martin (1992)		Human capital, physical capital and economic growth	Endogenous Economic Growth	The return rate of the human capital is higher than the physical capital, increasing the economic growth
Mankiw, Romer ve Weil (1992)	International 1960-1985	Per Capita National Income, Physical Capital Investment (I / GDP) and Human Capital Investment (Education)	Endogenous Economic Growth	Physical capital and human capital investments make the same contribution to the increase in per capita income
Lau vd. (1993)	Brazil 1970 and 1980	Increase in physical capital, labour, human capital, technological development and industrial production	Endogenous Economic Growth	The share of physical capital as a source of growth in industrial production is 2% (19% of the growth), 1.8% of the labour share (17%), the share of human capital is 2.6% (24%) and the share of technological development is 4% (40%) respectively.
Freire-Serén (2001)	International 1960-1990	Human capital (education) and economic growth	Two-step nonlinear least squares method with cause-effect relationship analysis, Panel	Human capital affects economic growth, and economic growth also contributes to human capital accumulation

Researcher	Country/ Period	Variables	Method	Results
Kar and Ağır (2006)	Turkey 1926- 1994, Annual	Human Capital (Ratios of Education and Health Expenditures to GNP), Income (GNP per Capita)	The logarithm of the variables was taken; Granger Causality Test, VECM, Unit Root Test; Cointegration Test applied.	It is determined that there is cointegration between LPY and LED and between LPY and LHE, and that LED → LPY and LPY → LHE are correct. LPY: log GNP per capita LED: log Educational Expenditure LHE: log Health Expenditure

As seen in Table 8 below; in developing countries rate of return for human capital decreased in the 1960s.

Table 8

Expenditures of Physical and Human Capital (%)

	1960's	1970's
	Human Physical	Human Physical
Developing Countries	20 > 15	15 > 13
Developed Countries	8 < 10	9 < 11

Note. From Dursun, H. (1998). İnsan sermayesi ve ekonomik büyüme. Hazine Dergisi, 10, 97.

At micro level, the productivity of labour falls in proportion to the health of individual labour. At macro level, the aggregate and individual productivity will decrease in proportion to the decrease in average health in the population (Yetkiner, 2006, p. 83). The efficiency of labour is increasing in proportion to the quality of health services provided to the people in society. Societies that allocate more resources to health spending and prefer to take advantage of modern medical techniques in case of illness appear to have better health indicators. On the other hand, it is possible to produce more with a healthier society. Thus, there is a mutual interaction in which the economic situation affects health and the health affects the economic situation.

CHAPTER 3

HEALTH AND ECONOMIC GROWTH RELATIONSHIP

3.1. Health Expenditure

In order to obtain health and to ensure its sustainability, all expenditures on the health sector and the health sector, which are formed by all the organizations and institutions that produce health related services and goods, are called health spending (Ersöz, 2008, p. 95). In 2010, Member States of the European Union increased their health spending by 7.3% compared to 2000 and allocated an average of 9% of GDP.

Table 9

Share of Total Health Expenditures in GDP in OECD Countries%

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Australia	8,423	8,54	8,675	8,751	9,848	10,18	10,09	10,12	10,07	10,23	10,64	..
Austria	10,22	10,02	10,19	10,28	10,36	10,36	10,35	10,38	10,34	10,47	11,47	12,15
Belgium	10,20	10,36	10,48	10,54	10,57	10,77	10,76	10,75	10,78	10,66	10,79	..
Canada	10,70	10,40	10,51	10,41	10,25	10,74	11,03	10,86	10,84	10,95	12,94	11,66
Chile	6,775	6,772	7,021	7,445	7,807	8,303	8,519	9,069	9,159	9,333	9,753	9,054
Colombia	7,071	6,781	6,746	7,017	7,186	7,523	7,531	7,679	7,625	8,117	8,993	..
Costa Rica	8,029	8,112	7,782	7,679	7,662	7,592	7,315	7,045	7,286	7,221	7,877	..
Czech Republic	6,875	6,928	6,979	7,722	7,597	7,196	7,107	7,381	7,472	7,605	9,24	..
Denmark	10,60	10,40	10,52	10,32	10,30	10,34	10,25	10,09	10,09	10,12	10,52	10,84
Estonia	6,323	5,819	5,833	6,017	6,362	6,641	6,702	6,597	6,721	6,823	7,752	7,466
Finland	9,142	9,223	9,586	9,805	9,781	9,645	9,378	9,127	9,042	9,169	9,532	..
France	11,22	11,18	11,29	11,40	11,53	11,44	11,48	11,35	11,21	11,09	12,20	..
Germany	11,09	10,77	10,85	10,99	11,02	11,18	11,23	11,32	11,45	11,69	12,82	12,80
Greece	9,597	9,193	8,924	8,438	7,891	8,22	8,449	8,135	8,12	8,203	9,508	..
Hungary	7,445	7,478	7,408	7,232	7,044	6,852	6,986	6,738	6,575	6,297	7,25	..
Iceland	8,362	8,203	8,181	8,176	8,229	8,07	8,097	8,261	8,376	8,513	9,517	9,653
Ireland	10,52	10,63	10,62	10,30	9,545	7,318	7,446	7,146	6,88	6,673	7,101	6,728
Israel	6,997	6,956	7,081	7,042	7,122	7,1	7,164	7,236	7,287	7,473	8,32	..
Italy	8,916	8,774	8,784	8,775	8,868	8,857	8,725	8,678	8,682	8,656	9,634	9,454
Japan	9,063	10,48	10,67	10,67	10,72	10,75	10,65	10,65	10,74	10,95	11,13	..
Korea	5,917	6,008	6,133	6,249	6,479	6,658	6,92	7,086	7,52	8,141	8,364	8,778
Latvia	6,097	5,724	5,41	5,409	5,463	5,652	6,133	5,965	6,189	6,53	7,36	..
Lithuania	6,815	6,488	6,276	6,126	6,193	6,49	6,638	6,464	6,53	6,999	7,538	7,852
Luxembourg	6,662	5,952	5,294	5,236	5,23	5,081	5,071	5,135	5,259	5,421	5,735	..
Mexico	5,737	5,519	5,665	5,809	5,553	5,723	5,553	5,458	5,383	5,446	6,242	..
Netherlands	10,15	10,23	10,53	10,58	10,56	10,32	10,29	10,10	10,03	10,15	11,15	..
New Zealand	9,593	9,52	9,652	9,36	9,402	9,283	9,244	8,967	9,035	9,049	9,719	..
Norway	8,906	8,789	8,778	8,93	9,345	10,13	10,59	10,31	10,02	10,53	11,33	10,08
						1	1	6	4	6	9	1

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Poland	6,412	6,24	6,224	6,415	6,28	6,395	6,535	6,56	6,328	6,447	6,493	6,593
Portugal	10,033	9,731	9,654	9,405	9,343	9,316	9,394	9,306	9,413	9,514	10,549	11,211
Slovak Republic	7,697	7,33	7,565	7,523	6,908	6,782	6,994	6,775	6,7	6,948	7,262	..
Slovenia	8,565	8,536	8,715	8,74	8,502	8,517	8,478	8,185	8,279	8,523	9,517	..
Spain	9,119	9,168	9,154	9,067	9,089	9,126	8,952	8,95	9,001	9,139	10,714	..
Sweden	8,32	10,416	10,735	10,905	10,948	10,804	10,852	10,785	10,941	10,832	11,497	11,439
Switzerland	9,942	10,019	10,249	10,462	10,616	11,008	11,3	11,481	11,156	11,287	11,796	..
Türkiye	5,021	4,653	4,444	4,371	4,325	4,117	4,285	4,18	4,124	4,36	4,618	..
United Kingdom	9,952	9,916	9,932	9,842	9,827	9,755	9,695	9,588	9,658	9,875	11,978	11,939
United States	16,196	16,138	16,117	15,987	16,192	16,481	16,793	16,768	16,641	16,676	18,816	17,778

Note. Updated with OECD Health Data 2021 data.

Health expenditure in public expenditures continued in 2009, as GDP in many countries dropped strongly. The Netherlands has the largest share of health (12%) in GDP in 2010. However, this share is well below the US. The US share of health spending in GDP is 17.6%. This sharing, countries that have the lowest health expenditures in GDP is about 6% with Turkey and Romania. (Table 9). On the other hand, there are large differences in the proportion and level of health expenditures among European countries (Table 10). Per capita health expenditure tends to be related to total per capita income. For this reason, it is not surprising that two European countries, such as Norway and Switzerland, are the countries that spend the most money on health with about \$ 5,000 per capita.

Table 10

Total Health Expenditures per Capita in 2019 (US \$)

Countries	Health expenditure Per Capita
<u>Australia</u>	5.187,4
<u>Austria</u>	5.851,1
<u>Belgium</u>	5.428,0
<u>Canada</u>	5.418,4
<u>Chile</u>	2.159,4
<u>Colombia</u>	1.212,6
<u>Czech Republic</u>	3.426,0
<u>Denmark</u>	5.567,9
<u>Estonia</u>	2.578,8
<u>Finland</u>	4.578,4
<u>France</u>	5.375,7
<u>Germany</u>	6.645,8
<u>Greece</u>	2.383,6
<u>Hungary</u>	2.222,4
<u>Iceland</u>	4.811,4
<u>Ireland</u>	5.275,5

<u>Israel</u>	2.932,5
<u>Italy</u>	3.649,2
<u>Japan</u>	4.822,8
<u>Korea</u>	3.384,2
<u>Latvia</u>	1.972,6
<u>Lithuania</u>	2.638,1
<u>Luxembourg</u>	5.558,3
<u>Mexico</u>	1.153,6
<u>Netherlands</u>	5.765,1
<u>New Zealand</u>	4.204,0
<u>Norway</u>	6.646,7
<u>Poland</u>	2.292,1
<u>Portugal</u>	3.378,6
Slovak Republic	2.353,6
Slovenia	3.224,0
Spain	3.616,5
Sweden	5.782,3
Switzerland	7.732,4
Turkey	1.339,5
United Kingdom	4.653,1
United States	11.071,7
OECD AVERAGE	4.223,5

Romania and Bulgaria were the countries with the lowest per capita health expenditure among member states of the European Union. In addition, the first Yugoslav Republic of Macedonia and Turkey is among the lowest in the list. The reason is that while the state has maintained health spending at the outset of the economic crisis, there has been a need to cut down on major deficits and debts, and to cut expenditures on the responsibilities of budget pressures (OECD, 2021, 120).

3.2. Turkey's Health System and Health Spending

Health expenditure in Turkey is located in the central government budget expenditures. Health expenditures; general treatment and health care costs, general drug costs, treatment and health care costs of green card holders, and drug costs of green card holders.

Table 11 shows the share of total health expenditures in GDP in selected OECD countries. Turkey expenditure on health as can be seen from Table 11 lags behind other countries. Especially in developed countries like France, Germany and USA, health spending is high.

Table 11*Proportion of Health Expenditures to GDP in Selected OECD Countries*

Countries	2019	2020
United States	16,767	
Germany	11,697	12,53
Switzerland	11,291	
France	11,112	12,377
Japan ¹	11,037	
Sweden	10,921	11,447
Canada	10,844	11,557
Belgium	10,659	
Norway	10,521	11,344
Austria	10,434	11,498
Netherlands	10,165	11,218
United Kingdom	10,154	12,754
Denmark ²	9,956	10,612
Brazil	9,591	
Portugal	9,531	10,116
Australia ¹	9,418	
Chile	9,333	9,365
Finland	9,159	9,55
Spain	9,132	
New Zealand ¹	9,069	
OECD	8,840	
Italy	8,669	9,716
Iceland	8,566	9,813
Slovenia	8,524	9,715
South Africa	8,253	
Korea	8,164	8,405
Greece	7,838	
Czech Republic ²	7,835	9,068
Colombia	7,709	
Israel	7,461	
Costa Rica	7,274	
Lithuania	7,006	7,565
Slovak Republic ²	6,959	7,732
Estonia	6,73	8,052
Ireland	6,679	7,194
Latvia	6,578	
Poland	6,462	7,15
Hungary	6,35	
Russia	5,607	
Mexico	5,433	6,211
Luxembourg	5,371	
China	5,148	
Turkey	4,344	
India	3,567	
Indonesia	2,868	

It can be argued that the level of health spending is higher in developed countries where economic development is provided than in other countries. However, developing countries also attach importance to health spending. When looking at the share of health spending in GDP in Turkey, there is an increase in the share of health spending in 2005-2008. This rate remained constant in 2008 and 2009. The reason for

this is the occurrence of the global crisis. In 2010-2011 period, the share of health expenditures in GDP decreased.

3.3. Health Expenditures and Economic Growth Relation

Most of the economists have a common view that the high level of health of countries affects the development of the country positively (Karagul, 2002, p. 72). There is a direct impact of health, income and prosperity of the countries, labour productivity, demographic and human capital factors (Taban, 2006, p. 33).

Developed countries can allocate more from the Gross Domestic Product (GDP) for the protection, development and treatment of human health that is the main element of economic growth. In a sense, health investments are considered as "productive investment" (Tokgöz, 1981, p. 503).

Developments in health and education services affect the production function and raise the level of labour services. When the workforce is healthy, less time is wasted and more effective efforts are made. It is also a fact that healthy labour power will make a significant contribution to a rapid economic growth (Talas, 1972, p. 80).

It should not be forgotten, however, that the level of health is also important for the person to be able to receive education and economic activities. In this direction, health and education should be evaluated together in the human capital stock (Karagül, 2002, p. 70)

Theoretical discussions on economic growth literature focus on the role of human capital in the economic growth process (Çetin & Ecevit, 2010, p. 166). Because human capital is a source of economic growth and health is the most important economic component of human capital, a cause of health and economic growth is also considered as a reason for health (European Commission, 2005, p. 20).

In the literature, causality relation between health expenditures and GDP is explained by four different hypotheses. Among these are the hypothesis that health spending positively affects GDP (Mushkin, 1962, p. 129; Hansen & King, 1996, p. 135; Bloom & Canning, 2000, p. 1209; Groosman, 1972, p. 223; Newhouse, 1977, p. 5; Foo Tang, 2011, p. 199). In this hypothesis, there is a one-way causality from health expenditures to GDP. The second is the hypothesis that health spending affects not only the positive growth of growth but also the growth of the health sector (Elmi

& Sadeghi, 2012, p. 88; Mehrara & Musai, 2011, p. 103). Here, two-way causality from health expenditure to GDP and from GDP to health spending is discussed. The third hypothesis is that health expenditures do not affect GDP. In other words, there is no causal relationship between two variables in this hypothesis. The last hypothesis assumes that health expenditures negatively affect GDP (Akar, S., 2014, p. 312). There is a causal relationship between health and income. Rural health expenditures of the countries, health expenditure of the society and health of the society can affect the productivity of the country. This relationship can be bi-directional as well as health-conscious or health-conscious. Although these divergent forms differ between countries, the causality relation can be observed in both countries in different income groups (Erdil & Yetkiner, 2004, p. 702).

The province of these studies, Groosman (1972) did not work is done. According to this study, the health service expressed as fixed capital stock positively affects output growth. Spending on the health sector encourages economic growth as a type of investment. Newhouse (1977) suggests that GDP at national level is a positive influence on medical care.

Mushkin (1962) pioneered the study of health as an important catalyst for economic growth and economic growth, followed by a number of studies investigating the relationship between health spending and income in the literature. A large part of these studies [Newhouse (1977), Parkin et al. (1987), Wang & Rettenmaier (2007) and Hartwig (2008) show that both variables have a positive correlation (Tang and Ch'ng, 2011, p. 6814).

Jones (1990) dealt with public expenditure in the United States between 1964 and 1984 by means of a model of imbalance between public expenditure and economic growth variables. Other expenditures, which health and transfer spending reduce by economic growth, have reached the result, in particular expenditures incurred by local governments, to encourage growth.

Kelly (1997) reached the conclusion that between 1970 and 1980, 73 countries' health spending did not make a meaningful contribution to economic growth.

Base and Snow (2003), from 1971 to 2000 for the period between annual data using in Turkey in the distribution of public spending (education, health, social

security and infrastructure spending) was investigated using the co-integration approach, the effects of economic growth. Econometric results of the analyses showed that the effect of infrastructural expenditures is statistically insignificant and the effect of growth of health expenditures is negative, while the effect of education and social security expenditures on economic growth is positive.

Tan et al. (2010), representing a correct relationship Keynes public expenditure to national income from their work in order to test the hypothesis for Turkey's economy in 1969-2003 period; has identified the existence of a causality relationship from infrastructure spending to gross domestic product.

Nelson & Phelps (1966) and Romer (1990) defined the interdependence between per capita income and health expenditure in models of internal growth. Health spending contributes to economic growth by developing human capital, and at the same time, the growth of economic growth can be led to human capital investments to achieve a chain growth.

Ak's (2012) study that was done with health expenditure in Turkey showed there was not a short-term relationship between economic growth but has determined that a relationship in the long term.

Atılgan et al., (2016) Turkey is a person 0,434'lük% the head of the 1% increase in health spending per person by using the ARDL model to determine the relationship between private in 1975-2013 in a study conducted for the period of health care spending to economic growth identified is the cause of national income growth they have.

Uçan & Atay (2016), the study covers the period 2006Q1-2014Q4 they analyse the relationship between the growth of health expenditures in Turkey and have determined that the run relationship between variables.

Kıymaz et al. (2006), the relationship between health spending and economic growth in Turkey 1984-1998 period for their study addressed using the Johansen cointegration analysis, private health spending and Gross National Product (GNP) to include that of a cointegration relationship and per capita GDP than medical expenses one-sided relationship.

The impact of health expenditure on economic growth, which is one of the important indicators of health, is multifaceted and long-lasting (Taban, 2006, p. 35). Recent studies have also proved that the positive impact of investments on health in the economic development process. The macroeconomic and health commission (2001) and the comprehensive report published by the European Commission (2005), set up by the World Health Organization, point out that for both developed and developing countries, health spending is an incentive for GDP growth and that health spending should be done. (Karabulut, 1999, p. 139).

Sorkin (1977) has come to the conclusion that in developed countries, the society has made little positive contribution to economic growth despite improvements in health conditions.

Strauss and Thomas (1998) have shown an empirical study of the relationship between health and productivity. According to the study result, there is a relationship between some health indicators (disease types and nutrition habits) and physical efficiency.

Reinhart (1999) deals with the effects of government spending on economic growth with a life expectancy at birth. In Bloom et al. (2001) empirical analyses, they used the human capital Solow model.

For most of the empirical studies on the effect of health on economic growth, the main problem is that as a health indicator it is often necessary to take life expectancy at birth. For example, Bloom & Canning (2000) found that birth expectancy had a positive and significant effect on the economic growth process. In this study, health was measured as a life expectancy at birth; other dimensions of health did not join the account.

Erdil & Yetkiner (2004) assessed a causality relationship was found that worked towards economic growth from health in low- and middle-income countries and health expenditure in high-income countries.

When human capital on economic growth in the private economy of Turkey is examined as a factor in human capital is seen that most of the studies used in training again. However, the health issue, which is basic component of human capital, has attracted the attention of researchers and they have started to take a lead in this field.

Examples of studies done in this area are Kar and Ağır (2003), Taban (2005), Temiz & Korkmaz (2007).

Taban (2005), the relationship between health and economic growth in Turkey is another study evaluating in terms of causality. Here, GDP, total health spending and birth expectancy data for 1980-2000 period are used. According to the results of the analysis, there was a two-way causality relationship between birth expectancy and economic growth, whereas no causality relationship was found between total health expenditure and economic growth.

Temiz & Korkmaz (2007), the relationship between health and economic growth in Turkey, using the Johansen cointegration test and error correction model have been discussed in terms of causality. For this, GNP for 1965-2005 period benefited from birth expectancy and infant mortality rate data. According to empirical results; a positive and bi-directional causality relationship between birth expectancy and economic growth was observed, but a negative and one-way causality relationship was found from infant mortality to economic growth.

According to the Gyimah & Wilson (2004), an increase of 22% and 30% in per capita income in Africa and OECD countries contributed to improvements in health spending.

The role of health spending on economic growth is often encouraging (Mushkin, 1962, p. 129). This positive effect of health expenditures in the literature is explained by the "health-based growth hypothesis". According to the health-based growth hypothesis, health spending is the productive capital. In other words, investments in the health sector contribute to total economic growth. In addition, the presence of a poor healthcare sector in countries affects the efficiency of the capital in the negative direction. This effect helps explain the failure of the health sector in underdeveloped countries (Foon Tang, 2011, p. 201).

On the other hand, according to Bloom & Canning (2000), health spending has positive effects on economic prosperity and growth. The reasons for this positive effect are summarized as follows; Healthy individuals (employees) are more efficient and healthy individuals have a positive effect on human capital. The fact that the average life span is too high encourages an increase in physical investments.

However, increased health spending supports the longer average life span and, in this case, increases long term growth.

In studies dealing with countries of the Organization for Economic Co-operation and Development (OECD), a positive relationship was found between health spending and economic growth. Hansen and King (1996) conducted a unit root analysis of health spending and GDP variables in OECD countries and found that these series are not static. Nevertheless, it emphasized the importance of GDP in determining the level of total health expenditure.

Beraldo, Montolio & Turati (2009) assessed 1 percent increase in total health spending increases the per capita GDP by between 0,06 and 0,10 percent. The increase of 0.04 percent to 0.07 percent is due to public expenditures.

McCoskey & Selden (1998) used panel data differently from Hansen and King (1996) when examining GDP and per capita health expenditure in OECD countries, and this panel provided a unit root test. According to this study, the series contain unit root and the null hypothesis is rejected. However, the results of the study show that national health expenditures reduce the likelihood of misdetection in panel data analysis and misleading health policies.

Baltagi & Moscone (2010) examined the long-term relationship between health spending and economic growth in OECD countries in the period 1971-2004. According to the study results, since the elasticity of health expenditures is less than 1, these expenditures are expressed as mandatory goods from luxury goods. In addition, long term health spending and economic growth are related to each other.

The results of the study, Baltagi & Moscone (2010), Beraldo et al. (2009), there is no statistically significant relationship between economic growth and health spending.

In addition to OECD countries, there are studies in different countries that test the causality relationship between health spending and growth and achieve different outcomes. For example, Foo Tang (2011) found that there was a two-way causality between long-term health spending and growth in Malaysia in the period of 1970-2009.

Kuhn & Prettnner (2012) found that employment in the healthcare sector in the United States (USA) increased growth by about 2 percent in the 2008-2012 period. However, the study suggests that countries with health expenditures of 6-7 percent of GDP have higher growth rates.

According to Dormont et al. (2008), the potential impacts of public health spending in the US, Europe, and Japan are positively affecting potential growth and productivity. The reasons for this are shown in the developed economies to meet the health services from the public budget. The study also found that health expenditures tend to increase in the same direction as per capita income (unit income elasticity).

Akram (2009) investigated the impact of health indicators on economic growth in Pakistan between 1972-2006. The study shows that per capita GDP is positively affected by long-term health indicators. However, short-term health indicators do not have a significant impact on GDP per capita.

Mehrara & Musai (2011) examined the causality between health spending and economic growth in oil-exporting countries. According to this study, economic growth and health expenditures are related in both ways.

Wang (2011) assessed; growth in low- and high-income countries is due to the different characteristics of health spending, as it occurs at different levels. Nevertheless, in countries with similar economic conditions and moderate economic development, economic growth is positively affected, although the level of health expenditure varies.

Elmi & Sadeghi (2012), unlike Wang (2011), analysed co-integrated relationship and causality between economic growth and health expenditures in developing countries between 1990 and 2009. According to the study, there is a two-way causality between long term GDP and health expenditure variables. For this reason, it is suggested that the hypothesis of growth based on health is valid in developing countries.

Gerdtham & Jönsson (1991) in their study of twenty-two OECD countries; Contrary to Groosman (1972) and Newhouse (1977) studies, the relative price of health spending is not related to national income. The supply of health expenditures is increasing due to the national gender. Moreover, the relative price of health spending

close to price elasticity -1 creates a rationing effect 1 in the amount of health spending. Hence, the level of health expenditure is not large in countries with higher price levels. However, the difference in the amount of health spending and the amount of health expenditures among countries also changes the definition of health expenditures from country to country. Gerdtham & Jönsson (2000) analysed the relationship between international health spending and GDP for twenty-one OECD countries during the period 1960-1997. The results of this study show that, unlike the results of Gerdtham & Jönsson (1991), both variables are not static and that health expenditures and GDP are cointegrated.

Hitiris & Posnett (1992) found that health expenditures, which are close to 1 in income and price elasticities, are an important determinant of GDP.

Okunade & Karakus (2001) investigated whether health spending, the relative price of health spending and the GDP variables for the OECD countries during the period 1960-1997 were cointegrated. Study; In the UK, Ireland and Greece, health spending has been claimed to be regarded as luxury goods in the long run, since the price and income elasticity of the health expenditure is greater than 1. However, health spending, the relative price of health spending and the GDP variables coexist. For this reason, implementation of national health spending policies in OECD countries can be beneficial for growth.

According to Milne & Molana (1991), neglecting the relative price of health spending leads to income elasticity greater than 1. The fact that a relative unit of increase in income does not increase real health spending due to the compensatory role of relative price. According to the study results, the relative price of health expenditures and the GDP tend to increase together. Besides this increase tendency, health spending also increases in the same direction.

The analysis of health expenditure and GDP in Turkey generally have focused on the analysis of cointegration between public spending and GDP. For this reason, studies addressing health expenditures in public spending are relatively few. Studies that analyse the causality between health expenditures and GDP have different results using different samples.

Kar & Ağır (2002), in Turkey for the period 1926-1994, implies that there is unidirectional causality from health spending to economic growth. The reason for this is that the share allocated for health expenditures in the budget is small.

Taban (2004), with health indicators in the 1968-2003 year in Turkey, has analysed the causal relationship between economic growth. Health indicators in work; the birth expectancy at birth, the number of beds of health institutions, the number of health institutions and the number of persons per health personnel. The results of the study show that there is no causality relationship between the number of health institutions and GDP. However, there is a two-way causality relationship between other health indicators and GDP. Looking at these results, it is stated that GDP will be positively affected if health expenditures are given importance.

Öksüzler & Turhan (2005), have identified the period 1960-2000 unidirectional causality relationship from GDP per capita health spending per capita in Turkey.

Eryiğit et al. (2012), the 1950 to 2005 period, positive impact on economic growth suggests that health spending in Turkey found.

CHAPTER 4

MODEL AND ANALYSIS

4.1. Optimal Public Expenditure

What the optimal public size should be is a controversial issue, and different economics schools have different views on the subject. This section will not include such discussions, but it is important in terms of the location of studies that measure the economic impact of public expenditures on the basis of optimal volume searches. One of these studies was done by Richard Armey (1995). Armey argues that there is a quadratic relationship between public expenditure and GNP, as shown in Fig.

According to this, initially there is a positive relationship between public expenditures and GNP, but after public expenditures have increased to a certain magnitude, there is a negative effect. Positive effects in the beginning emerge as an end to avoiding the state of anarchy, chaos and insecurity that may arise in the absence of the state. The focus can be on the question of why the state must exist in order to understand it more clearly. As is known, the state is a necessity for the individual. State; ensuring the existence and protection of property rights, ensuring national security and justice, establishing an atmosphere of peace and prosperity, reducing the negativities created by market failures and ensuring justice in income distribution. In addition, the state plays a role in the financing of some investments and public goods that cannot be easily achieved through the private sector and encourages the initiatives of the economic units by providing a safe economic environment. For this reason, it is inevitable that the existence of the state, when compared to the state without the state, affects the income in the positive direction. However, as public expenditures are increased, the principle of reduced income will begin to operate. In addition to decreasing public spending, the taxes used in financing will have negative effects on the behaviour of economic units. As a result, increases in public spending after a certain level will affect the economy negatively.

In the literature conducted on the optimal public spending and direct the work done in private is not available in Turkey.

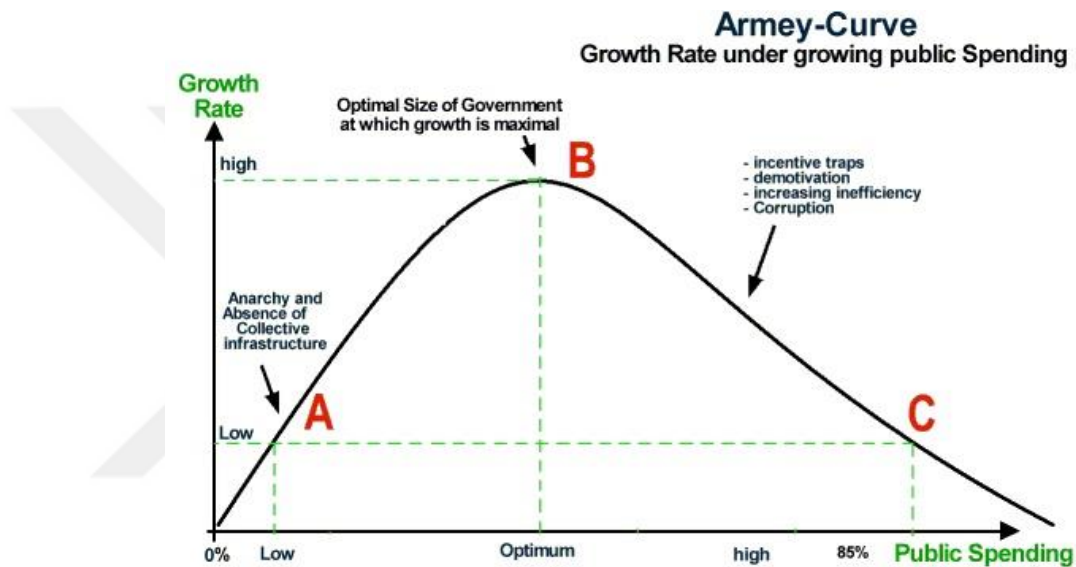
The calculation of the optimal public expenditure and in the study of which contains Turkey with 118 countries, Karras (1996), found the optimal size of the public sector average basis was 16% ($\pm 3\%$) are calculated. Turkey has found this rate

to 12%. Most of the studies performed in Turkey for the public sector updates and Wagner's law and Keynesian hypothesis is that the size of the test.

The Armeý curve shows the relationship between the public sector size in the economy (public expenditure / GDP ratio) and real GDP (or real GDP growth rate). The additional increases in public expenditures mean economic recession and downsizing.

Figure 3

Armeý Curve



There are a number of studies that test the truth of the Armeý curriculum. Pevcin (2004, pp. 10-11) tested the Armeý curriculum for 12 European Union (EU) countries from 1950 to 1996 and concluded that there was a similar relationship to the inverse u-curve. De Witte & Moesen (2010, p. 55) supported the Armeý curriculum by arguing that there was an optimal public livelihood in their work for the Organization for Economic Co-operation and Development (OECD) Facchini & Melki (2011, p. 8) similarly reached findings supporting the Armeý curriculum in their study of France for the period 1871-2008.

4.2. Panel Data Properties

Panel data method has become common in recent years. Because there are two dimensions in the panel data set, both cross-section and time. In other words, in panel data models, there are N units and T observations corresponding to each unit. Using

the two dimensions together provides more information usage and an increase in the degrees of freedom. An increase in the number of observations adds more variability to the measured relationship and eliminates the multicollinearity problem (Hsiao, 2006, p. 7).

It is possible to talk about two basic approaches used in regressions with panel data. These are: Fixed Effects Model (FEM) and Random Effects Model (REM).

It is possible to predict five different models depending on the assumptions made about them (Judge 1985, p. 515). On these models:

- i. Both constant and slope coefficients do not change with respect to both units and time, and the error term can represent differences with respect to time and units.
- ii. While the slope coefficients are constant, the constant term varies in units but may remain constant over time.
- iii. While the slope coefficients are constant, the constant term can vary with units and time.
- iv. Both constant and slope coefficients can vary by units.
- v. All coefficients can vary both in time and in units. As stated in Judge et al. (1985) and Gujarati (2003), it is possible to further classify models ii-iv depending on whether the varying coefficients are fixed or random.

The effective estimation method used to estimate the REM is the Generalized Least Squares (GLS) method. If the number of cross-section units in the panel data is large and the time period (n) (G) is short, REM provides more efficient estimations than FEM. On the other hand, if n is large and G is small, little difference is expected between the two estimation results, and as we mentioned before, FEM is more preferred. However, if n is small and G is large, significant difference is expected between the two estimation results. In this case, if it is believed that the cross-section units are randomly drawn from the large sample, REM is considered the more appropriate model, otherwise FEM (Gujarati, 2003, p. 650).

In this study, balanced panel condition is discussed in structural breakdown panel data analysis.

4.3. Econometric Analysis

4.3.1. Method and technique

The most common health indicators that are used worldwide in researching the relationship between health and growth; life expectancy at birth, infant-child mortality rate and crude death rate, the most common economic indicators are; GDP, per capita GDP and health expenditures.

This research aims to examine the relationship between health expenditures and gross domestic product levels in countries. The economic model created in this context is as follows;

$$gdpc = f(hexpc) \quad (1)$$

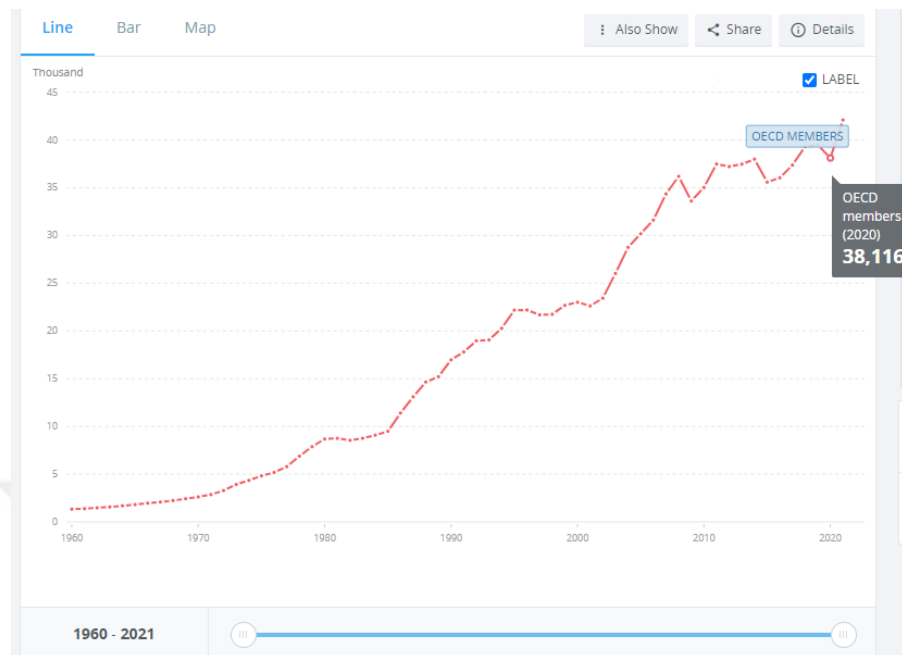
Econometric representation of economic equation 1 is as follows;

$$gdpc = \beta_0 + \beta_1 (hexpc) + \varepsilon \quad (2)$$

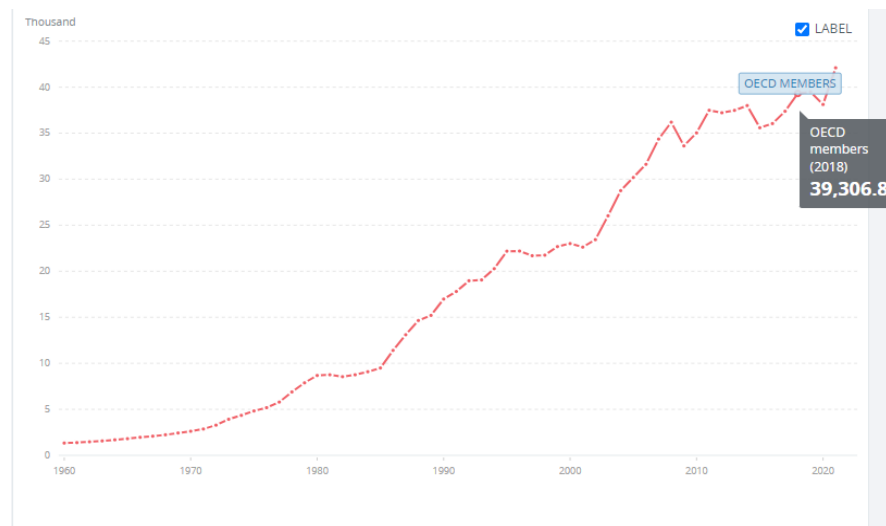
The study covers 23 OECD countries and is expected to be analysed by panel data econometrics with annual data between 1975 and 2019. The logarithmic transformation is applied first. The model to be estimated after logarithmic transformation is as follows;

$$\text{Log}(gdpc) = \beta_0 + \beta_1 (\text{Log}(hexpc)) + \varepsilon \quad (3)$$

In the study, a simple regression model was set up to examine the effects of countries' health expenditures on gross domestic product. The dependent variable is the gross domestic product while the independent variable is the health expenditure of the countries. The graph of the dependent variable gross national income after logarithmic transformation is as in Figure 4.

Figure 4*National Income Trend*

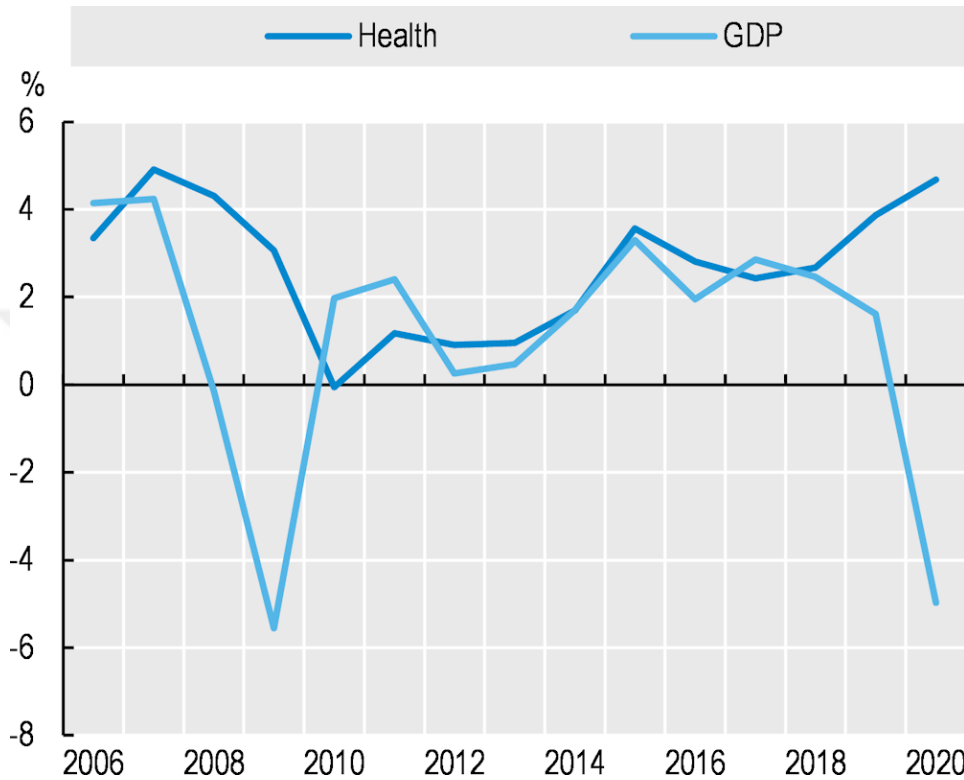
For the independent variable health expenditures, the trend graphs according to the countries are as in Figure 5.

Figure 5*Current Health Expenditure per capita*

Source: OECD Health Statistics 2021, WHO Global Health Expenditure Database.

Figure 6

Annual real growth in per capita health expenditure and GDP, OECD, 2005-20



4.3.2. Unit root analysis

The charts clearly show that the series have an increasing trend for all countries, so they are not static. Unit root tests of stationary states of variables should be examined. Before a statistical analysis of a time series is made, it is necessary to examine whether the process that creates that series is stable over time, ie whether the series is stationary. When econometric analyses are made between the non-stationary series, a misleading result is called a false regression. In other words, conventional t, F tests and R2 values can give deviating results. For this reason, stability should be tested first (Tatoğlu, 2012, p. 199). The first problem encountered in the panel unit root test is whether the horizontal sections forming the panel are independent of each other. Panel unit root tests are at this point; first- and second-generation tests. First-generation tests were conducted by Fisher Philips Perron (Choi, 2001), Fisher ADF

(Maddala & Wu, 1999), Levin, Lin and Chu (2002), Breitung (2005) & Hadri (2000), Im, Pesaran & Shin (Göçer, 2013, p. 5094).

In the panel data, both unit and time information can be analyzed. In addition to the cross-sectional dimension of the data, the path it follows over time is important. With the ineffectiveness of the time effect on the panel, it is possible to determine whether the process generating the panel data is stationary (Panel Data Models with Stata, Selahattin Güriş, p. 202) unit root test statistics are presented in Table 12.

Table 12

Panel Data Unit Root Test Statistics

Variable	Statistics	P Value	Stationarity Status
Log(gdpc)	0,5742	0,7485	Not Stationary
d(log(gdpc))	-5,9513	0,0000	Stationary
Log(hexpc))	0,6448	0,8421	Not Stationary
d(Log(hexpc))	-2,2155	0,0128	Stationary

Note. * d = symbolizes the first difference of the variable.

When panel data unit root test statistics are examined, it is observed that the natural logarithm of the gross domestic product variable and the natural logarithm of the health expenditure variable have unit root at the level value (not stable), but that they do not contain unit root at the first difference in both variables. Estimates to be made with the series integrated at the same grade should be treated with first degree differences.

4.3.3. Panel data model selection

For the selection of panel data model estimation method, Breusch Pagan test can be applied in order to make a choice between least squares method pooled and random panel data models. Zero hypothesis for Breusch Pagan test H_0 = Unit effect variance is equal to zero. The regression before the Breusch pagan test should be estimated with the fixed effects administered. Breusch pagan test statistics are as in Table 13.

Table 13*Breusch Pagan Test Statistics*

	Var	Sd= sqrt(Var)
dlog_gdc	0,00621547	0,0788382
e	0,00460203	0,0678383
u	0	0

Chibar2(01)= 0 so Prob > Chibar2=1,00

When Table 13 is examined, the Breusch pagan test, which is conducted after the regression estimation with fixed effects, gives a result of 1,000 probability values in the order of 1 sibling. According to the Breusch pagan test statistic, random effect panel data regression was adopted as the correct method among the horizontal pooled and random effect panel data models. The hausman test should be applied in order to select between random effects and fixed effects panel data models. Before the Hausman test, it is necessary to estimate and preserve the remains by panel data, random effect and constant effect models. Hausman test statistics are as in Table 14.

Table 14*Hausman Test Statistics*

	(b) (fe)	(b) re	b-B(difference)	Sqrt(diag(V_b-V_B) S.E
dlog_hexpc	0,7273849	0,6749354	0,0524494	0,0081262

$\chi^2(1)=63,12$ so $\text{prob}>\chi^2=0,00$ so H_0 : difference in coefficients are not systematic not correlated

Hausman test zero hypothesis: H_0 : The explanatory variable in the unit effective mode is uncorrelated.

When the test statistic is examined, the null hypothesis is rejected. More explicitly, the gekk (generalized least squares) estimator is unbiased and inconsistent, thus necessitating the continuation of the predictor and estimation process of the fixed effect model.

4.3.4. Model estimation

The panel data model was adopted by the fixed effect panel data model as will be remembered in the selection stages of the forecasting manager. The estimated first panel data regression output with the fixed effect model is as in Table 15.

Table 15

Fixed Impact Model Forecast Results

Dlog_gdpc	Coef	Robust std. err	T	p>t	%95 conf Interval	
Dlog_hexpc	0,6453849	0,0655167	11,63	0,000	0,05587623	0,07739969
_cons	-	0,0048094	-12,05	0,000	-0,0585042	-0,0253467
	0,0383279					
Sigma_u	0,0105567					
Sigma_e	0,0433427					
rho	0,0488132					

It is necessary to examine whether panel data assumptions and assumptions are met before analysing forecast results of the fixed effect model. There are basically assumptions that there are no horizontal cross-sectional dependence, autocorrelation and varying variance problems in the panel data econometric. Modified Wald Test can be applied to determine variance problem in fixed effect mode. Modified Wald Test Statistics are presented in Table 16.

Table 16

Modified Wald Test Statistics

Chi ² (23)	1227,06
Prob>chi2	0,000

The modified Wald test zero hypothesis tests whether the variance varies with the units by testing the null hypothesis that the variance of each unit is equal to the panel average. The Wald statistic probability value is calculated as 0,000. In this case, it can be said that there is a variance problem in the series. ($P = 0.000 < 0.001$). Regression coefficients will continue to be consistent if estimation is made by ignoring the changing variance problem, but predictions made will not be effective. In addition, standard errors obtained as a result of the prediction will be deviations. Robust standard errors should be derived to remove the problem of varying variance.

Fixed-effect panel data regression output with durable standard faults is presented in Table 17.

Table 17

Durable Standard Errors and Fixed Effect Panel Data Model Estimated Output

Dlog_gdpc	Coef	Robust std. err	T	p>t	%95 conf Interval	
Dlog_hexpc	0,7484973	0,0716755	11,57	0,000	0,05728707	0,08969839
_cons	-0,0324979	0,0039490	-	0,000	-0,0595093	-0,0346591
			12,03			
Sigma_u	0,01116044					
Sigma_e	0,04792779					
rho	0,04443554					

Another panel data assumption is autocorrelation. If the series are autocorrelated, the coefficient results for estimates made will be consistent but ineffective. The Baltagi Wu LBI test can be applied to investigate the problem of autocorrelation in fixed panel data regression. The null hypothesis for the test is that the error terms do not include autocorrelation. The Baltagi Wu LBI test statistical probability value was calculated as 2,061. In practice, this value is close to two, which means that there is no autocorrelation problem in the first order, in other words, the null hypothesis cannot be rejected.

The final assumption about panel data concerns horizontal section dependency. The Breusch Pagan Lagrange Multiplier test can be applied to the series with $T > N$ to investigate the horizontal section dependency. The null hypothesis for the test is that there is no horizontal section dependency. The Breusch Pagan Lagrange Multiplier test statistics are as in Table 18.

Table 18

Breusch Pagan Lagrange Multiplier Test Statistics

	c15	c16	c17	c18	c19	c20	c21	c22	c23
r15	1								
r16	0,1779	1							
r17	0,274	0,2023	1						
r18	-	-0,325	0,0796	1					
	0,0553								

r19	0,1982	0,2630	0,351	0,4043	1				
r20	0,2775	0,2647	0,5668	-0,042	0,4057	1			
r21	0,1956	0,1559	0,4770	0,0527	0,950	0,4835	1		
r22	0,3463	0,3881	0,3660	0,442	0,6682	0,665	0,2981	1	
r23	0,2456	0,0141	0,1982	0,0052	0,0926	-	0,138	-	1

When Table 18 is examined, it is observed that Breusch Pagan Lagrange Multiplier test statistic is 0,000. In this case, the null hypothesis cannot be rejected. More explicitly, the horizontal section dependency of panel units is concerned.

The fixed effect is met in the predicted model by standard errors based on the panel data model assumptions. The model output estimates are given in Table 19 again.

Table 19

Durable Standard Faults and Fixed Panel Data Model Estimated Output

Dlog_gdpc	Coef	Robust std. err	T	p>t	%95 conf Interval	
Dlog_hexpc	0,7484973	0,0716755	11,57	0,000	0,05728707	0,08969839
_cons	-0,0324979	0,0039490	-	0,000	-0,0595093	-0,0346591
			12,03			
Sigma_u	0,01116044					
Sigma_e	0,04792779					
rho	0,04443554					

When the forecast output is examined, it can be said that the independent variable can account for approximately 33% of the dependent variable changes. If the probability value of the f statistic for the test pattern of the model as a whole is examined, it can be said that the model is a statistically significant model with 99% confidence level as a whole. ($P < 0.01$). The estimated parameter of the independent variable in the model was statistically significant ($p < 0.001$) and the coefficient was estimated to be approximately 0,727 positive. In this case, it can be said that the health expenditure in the countries is a positive predictor of the gross domestic product of the countries.

4.3.5. Co-integration

The pedron co-integration test can be applied to determine the long-term relationship between the series that are stationary at the same level. Pedroni en integration test statistics are as in Table 20

Table 20

Pedroni Co Integration Test Statistics

Variables	Beta	t-stat
Dlog_hexpc_td	0,0003978	0,1081

When Table 20 is examined, it is observed that there is a long-term relationship between the health expenditure variable and the gross domestic product change. The long-term co-integration relation estimate is 0,0003978. In this case, the long-term positive predictive value of health expenditure variable GDP can be mentioned.

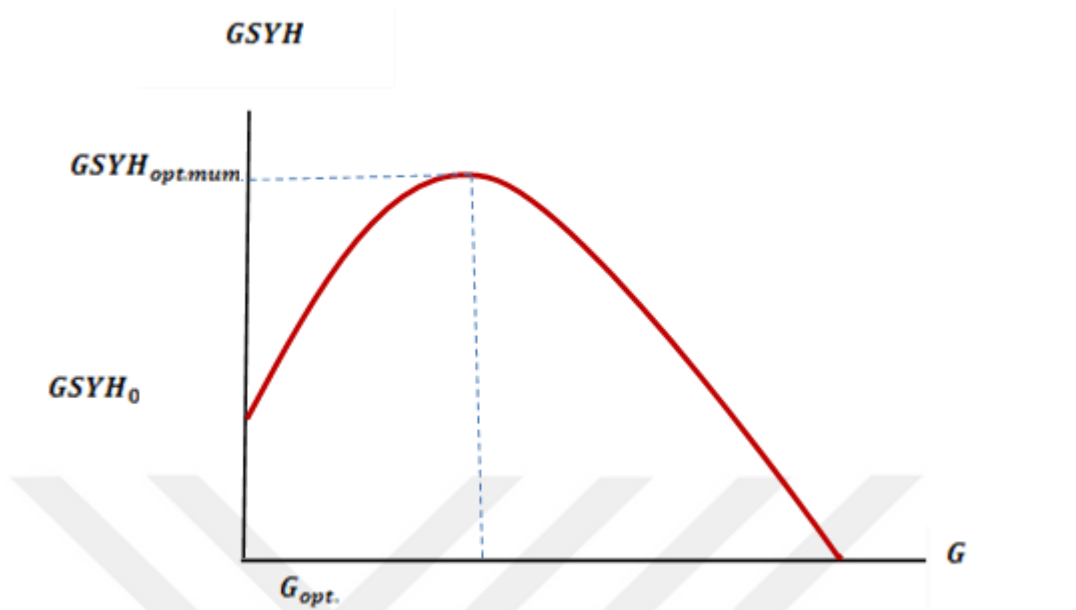
4.4.Econometric Analysis with Structural Breaks

4.4.1. Data set and model

In this part; per capita health expenditure on per capita GDP were analysed using balanced panel data analysis and 37 OECD countries using 1975-2021 annual data. Real Gross Domestic Product (GDPPC) per capita regulated by the purchasing power parity as dependent variable in the study, and per capita real health expenditure (HEXPC) by the purchasing power parity as the independent variable. Data are taken from OECD Statistics in US dollars. Descriptive statistics on the data set are presented in Appendix 1

The Armeý Curve is based on the model to be used in the study. Armeý Curve; the parabolic relationship whose arms are downward between the real public expenditure (G) in the economy and the real gross domestic product ($GSYH$) (Samuel Olasode vd. 2014). The Armeý curves are simply shown in Figure .

Figure 7
Armey Curve



In 7 the Army Curve is outlined; that a certain level of increase in public expenditures will accelerate economic activity and that the government will more effectively fulfill the functions of supervising and regulating the markets and consequently the economic growth will increase but that the public expenditures on the optimum level will meet the principle of efficient use of scarce resources in the economy, and diminishing marginal efficiency laws will come into play, which in turn will harm economic growth (Facchini & Melki, 2011; Altunc & Aydın, 2013).

In this study, the Armey Curve theory was adapted from the relationship between health expenditures and national income and the following model was obtained.

$$GDPPC_{it} = \beta_{0i} + \beta_{1i}HEXPC_{it} + \beta_{2i}HEXPC_{it}^2 + \varepsilon_{it}$$

Here, the term $HEXPC_{it}^2$; means health expenditure per capita, ε_{it} ; refers to a series of error terms with constant variance and zero mean.; β_{0i} constant terms, and it also contains the effects of other explanatory variables that are not modeled. In order for the Army Curve approach to be valid, it should be; $\beta_{1i} > 0$ and $\beta_{2i} < 0$ To find the optimal health expenditure, it is sufficient to take the first derivative of the equation according to Eq. (1) and calculate the value of this equality zero. By

substituting this obtained value in Eq. (1), the per capita GDP per capita will be reached.

4.4.2. Method

The existence of horizontal cross-section dependency between the countries forming the panel before the study; investigated by the Bias-corrected scaled (LMBC) test. Stability of series; from the second-generation unit root tests, taking into consideration the horizontal section dependency and the structural breaks in the series, Carrion-i-Silvestre et al. (Panel Kwiatkowski-Phillips-Schmidt-Shin) method developed by the Ministry of Education, Culture, Sports, Science and Technology (2005). Homogeneity of cointegration coefficients; Pesaran & Yamagata (2008). Cointegration coefficients; It was estimated by the Augmented Mean Group (AMG) method developed by Eberhardt & Bond (2009), which considers the horizontal section dependency.

4.4.3. Testing horizontal cross section dependence

In panel data analysis, it is of utmost importance to determine whether there is horizontal section dependency between the panelist countries and, if such dependency exists, to use the methods that take this into account in the analyzes to be done. Regardless of this situation, tests and coefficient estimates can produce misleading or even inconsistent parameters, if panel horizontal dependency exists (Chudik & Pesaran, 2015). For this reason, it is very important to test the existence of horizontal section dependency in series and model in panel data analysis.

Horizontal section dependency tests; a shock coming from one of the panelist countries tests whether it influences the others. Horizontal cross-section dependence is particularly likely among countries that interact with each other. Since the countries that make up the panel in this study are members of the OECD and generally have active co-operation among them, an economic shock from one of these countries is likely to affect other countries as well.

Breusch & Pagan (1980) LM test, which was followed by Pesaran (2004) LMs test and Pesaran (2004) CD test, and lastly Baltagi, Feng & Kao (2012) corrected the deviation of the previous tests to test the horizontal section dependency He developed

the LMBC test. These tests can be examined as

$$y_{it} = \beta'_{it}x_{it} + u_{it} \quad (2)$$

Here, β_i the cross-sectional feature vectors corresponding to the predicted parameters; u_{it} mean is zero, variance is constant series of error terms. The hypotheses of these tests are:

H_0 : There is no horizontal section dependency between countries

H_1 : There is horizontal section dependency between countries

To test these hypotheses, the following test statistics were developed:

Breusch and Pagan (1980) LM test statistic:

$$LM = \sum_{i=1}^{N-1} \sum_{j=i+1}^N T_i \hat{\rho}_{ij}^2 \sim \chi^2_{\frac{N(N-1)}{2}}$$

Pesaran (2004) extended the equation (3) for the case where the number of horizontal cross sections is very large in the scale LM test as follows:

$$LM_S = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (T_i \hat{\rho}_{ij}^2 - 1) \sim N(0,1)$$

He also solved the problem of possible size deformation in Pesaran (2004) and his tests and improved the CD test statistic to be used when the time dimension is greater than or equal to the horizontal section size:

$$CD = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N T_i \hat{\rho}_{ij}^2 \sim N(0,1)$$

$$LM_{BC} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (T_i \hat{\rho}_{ij}^2 - 1) - \frac{1}{2(T-1)} \sim N(0,1)$$

Horizontal section dependency tests results seen in Table 21

Table 21

Horizontal Cross Section Dependency Test Results

	LM Test Statistics	LMs Test Statistics	CD Test Statistics	LMBC Test Statistics
GDPC	8982.75 (0.00)	733.90 (0.00)	112.85 (0.00)	733.62 (0.00)

HEXPC	9280.55 (0.00)	693.75 (0.00)	110.32 (0.00)	639.47 (0.00)
Model	1964.19 (0.00)	98.64 (0.00)	17.26 (0.00)	-

Note. Parentheses are the likelihood values. ****; indicates the presence of horizontal section dependency between countries at the relevant sera level of significance of 1%. LM_{BC} test statistic cannot be produced for models.

In Table 21, the H0 hypothesis was rejected for the output of probability less than 0.05 in the tests for the series and the model, and it was decided that there was horizontal cross-section dependency among the panelist countries. In this case, an economic shock from one country can also affect others. For this reason, it is beneficial for countries to closely follow developments in other countries involved in the analysis while developing their policies. In addition, second-generation (dynamic) panel data analysis methods that take horizontal section dependency into consideration should be used in the following stages of the study.

4.4.4. Structural breaking panel unit root test

In econometric analyses, the stationarity ratings of the series must be determined before proceeding to regression analysis. Because the test methods to be used in the later stages of the analysis are determined according to the stationarity ratings of the series. If the series are not stable at the level values, analysis with the level values of these series may have a false regression problem (Engle and Granger, 1987).

Since horizontal cross-section dependency is identified among countries in the study, second generation unit root test is required. However, these tests do not consider the structural breaks in the series, taking into account the horizontal section dependency between the panelist countries. However, when there are structural breaks in the sera, tests made without considering this situation may yield deviations (Charemza & Deadman, 1997). During the period covered by this study, numerous economic crises, political and economic integration, war, terrorist attacks, etc., the use of methods that take into account structural wrinkles in the work becomes necessary. For this reason, the stability of the series in the study was evaluated by Carrion-i-Silvestre et al. (2005) developed by the PANKPSS test. In addition to taking into account the horizontal section dependency between the panelist countries, this test

permits structural breaks of up to five in each series of horizontal sections and can determine the structural break dates for each country separately and the stability of the series under the existence of these structural breaks (Gocer & Akin, 2016). Carrion-i-Silvestre et al. (2005), the PANKPSS test is based on the following models:

$$y_{i,t} = \alpha_{i,t} + \beta_{it}t + \varepsilon_{i,t}$$

$$\alpha_{i,t} = \sum_{k=1}^m \theta_{i,k} D(T_{b,k}^i)_t + \sum_{k=1}^m \gamma_{i,k} DU_{i,k,t} + \alpha_{i,t-1} + v_{i,t}$$

$v_{i,t}$ denotes zero mean, constant variance error terms series, α denotes constant terms, t denotes time trend. $i = 1, \dots, N$ and $t = 1, \dots, T$. $D(T_{b,k}^i)_t$ and $DU_{i,k,t}$ are dummy variables and defined below:

$$\begin{aligned} D(T_{b,k}^i)_t &= \begin{cases} 1, & t = T_{b,k}^i + 1 \\ 0, & \text{other situations} \end{cases} \\ DU_{i,k,t} &= \begin{cases} 1, & t > T_{b,k}^i \\ 0, & \text{other situations} \end{cases} \end{aligned} \quad (9)$$

$T_{b,k}^i$; i refers to the history of structural break of the horizontal section. Carrion-i-Silvestre, vd. (2005) hypothesis tests are below:

H_0 : Series are stationary under structural breaks

H_1 : Series are not stationary under structural breaks

The PANKPSS multi-structure fractured panel unit root test and the resulting test statistics and critical values are presented in Table 22. At this stage of the work, Gauss 9.0 program and Carrion-i-Silvestre, et al. (2005) have been used.

Table 22*Carrion-i-Silvestre vd. (2005) PANKPSS Panel Unit Root Test Results*

<i>Countries</i>	<i>GDPPC</i>		<i>HEXPC</i>		<i>ΔGDPPC ΔHEXPC</i>	
	<i>Test Statistics</i>	<i>Structural Break Dates</i>	<i>Test Statistics</i>	<i>Structural Break Dates</i>	<i>Test Statistics</i>	<i>Structural Break Dates</i>
Australia	0.095 [0.094]	1987; 1994; 2000; 2005;2020	0.115 [0.091]	1992; 1998; 2003; 2008;2020	0.033*** [0.069]	0.093*** [0.160]
Austria	0.102 [0.086]	1988; 1994; 1999; 2005;2020	0.211 [0.142]	1989; 2002; 2007;2020	0.039*** [0.086]	0.111** [0.116]
Belgium	0.095 [0.089]	1980; 1987; 1993; 1999; 2020	0.109** [0.116]	1981; 1990; 1998; 2002; 2020	0.040*** [0.116]	0.089*** [0.192]
Canada	0.093 [0.083]	1980; 1986; 1993; 1998; 2020	0.122 [0.114]	1981; 1989; 1999; 2004; 2019	0.037*** [0.060]	0.092*** [0.180]
Denmark	0.098 [0.082]	1981; 1988; 1994; 1999; 2019	0.095 [0.173]	1981; 1990; 1998; 2003; 2020	0.040*** [0.081]	0.089*** [0.157]
Finland	0.098 [0.097]	1980; 1987; 1996; 1999; 2020	0.098 [0.128]	1982; 1989; 1999; 2003; 2019	0.036*** [0.063]	0.082*** [0.190]
Germany	0.121 [0.098]	1980; 1988; 1998; 2005; 2019	0.098* [0.127]	1980; 1987; 1994; 2002; 2020	0.024*** [0.065]	0.098*** [0.147]
Iceland	0.116 [0.091]	1979; 1986; 1996; 2003; 2019	0.152 [0.110]	1980; 1986; 1997; 2019	0.046*** [0.065]	0.135*** [0.158]
Ireland	0.098 [0.091]	1981; 1989; 1996; 2000; 2019	0.217 [0.181]	1989; 1996; 2000; 2003; 2020	0.058*** [0.073]	0.163*** [0.176]
Israel	0.095 [0.086]	1980; 1987; 1993; 1999; 2019	0.086* [0.148]	1979; 1988; 1993; 1999; 2019	0.033*** [0.065]	0.070*** [0.144]
Japan	0.117 [0.083]	1981; 1988; 1995; 2003;2020	0.122 [0.088]	1981; 1991; 1999; 2004; 2009;2020	0.052*** [0.066]	0.146*** [0.187]

Korea	0.131 [0.102]	1986; 1993; 1999; 2003; 2020	0.136 [0.176]	1988; 1995; 2000; 2005; 2019	0.055*** [0.061]	0.165** [0.183]
Holland	0.099 [0.088]	1980; 1988; 1995; 1999; 2020	0.105 [0.255]	1981; 1990; 1999; 2004; 2019	0.043*** [0.082]	0.123** [0.131]
New Zealand	0.100 [0.082]	1980; 1985; 1993; 1999; 2019	0.150 [0.112]	1987; 1994; 2000; 2005; 2020	0.042*** [0.072]	0.140*** [0.162]
Norway	0.120 [0.084]	1983; 1993; 1999; 2005	0.190 [0.138]	1989; 1996; 2001; 2004; 2007	0.020*** [0.080]	0.120** [0.129]
Portugal	0.096 [0.080]	1980; 1988; 1994; 1999; 2018	0.139 [0.094]	1986; 1994; 1999; 2004; 2019	0.060*** [0.079]	0.124*** [0.194]
Spain	0.104 [0.088]	1981; 1988; 1996; 2000; 2019	0.148 [0.145]	1987; 1991; 1997; 2002; 2020	0.074*** [0.082]	0.133*** [0.158]
Switzerland	0.131 [0.070]	1980; 1988; 1999; 2019	0.094* [0.154]	1980; 1988; 1995; 2001; 2020	0.024*** [0.069]	0.094*** [0.163]
England	0.095 [0.090]	1981; 1987; 1995; 1999; 2019	0.122 [0.114]	1982; 1991; 1999; 2002; 2020	0.045*** [0.091]	0.127*** [0.281]
USA	0.093 [0.085]	1980; 1987; 1993; 1998; 2018	0.099 [0.112]	1982; 1989; 1996; 2001; 2019	0.047*** [0.076]	0.099*** [0.193]
Turkey	0.140 [0.107]	1985; 1994; 2003; 2006; 2019	0.150 [0.146]	1989; 1995; 1998; 2003; 2020	0.087*** [0.135]	0.138** [0.144]
Panel	27.94 [10.53]	-	26.27 [17.37]	-	3.79*** [9.64]	20.265*** [24.67]

Note. The figures in parentheses are the critical values produced by 1000 repetitive bootstrap. *, **, and ***; the corresponding series are stable at the level of significance of 10%, 5% and 1%, respectively. In order to reveal the actual structural break dates in the series, only the structural break dates from the test with the level values of the series are taken here.

According to the results in Table 22; it is seen that the series are generally not stationary in level values but become stationary when the first differences are received, that is, they are I (1). In this case, there is a risk of encountering false regression problems in analyses to be made with the level values of these series. For this reason, the cointegration test must be performed before the regression analysis.

When the structural breakage dates determined by the test method are examined; East and West Germany united as 1989, made from aircraft into the World Trade Organization in the United States September 11, 2001 terror attacks in 2008, the effects of the global economic crisis, the 1994 crisis in terms of Turkey and the effects of single party government period starting in November 2002 and lastly Pandemic are seen.

4.4.5. Panel causality test

A causality test should be performed to determine whether there is an interaction between the variables used together in the analyses. Otherwise, the misuse of unrelated variables in regression models comes to the foreground. The main advantages of this method are; (Dumitrescu & Hurlin, 2012). It is also possible to identify cross-sectional dependence among the panelist countries and to identify causality relations between some of the panelist countries. Dumitrescu & Hurlin (2012) panel causality test are performed using the following equations.

$$Y_{i,t} = \alpha_i + \sum_{k=1}^P \gamma_i^k Y_{i,t-k} + \sum_{k=1}^P \beta_i^k X_{i,t-k} + \varepsilon_{i,t}$$

$$X_{i,t} = \theta_i + \sum_{k=1}^P \delta_i^k X_{i,t-k} + \sum_{k=1}^P \pi_i^k Y_{i,t-k} + \epsilon_{i,t}$$

P denotes optimum delay length. Hypothesis of these tests;

$$H_0: \beta_i = 0 \quad \text{for all } i's.$$

$$H_1: \begin{cases} \beta_i = 0, & i = 1, 2, \dots, N_1 \\ \beta_i \neq 0, & i = N_1 + 1, \dots, N \end{cases}$$

In the study Dumitrescu & Hurlin (2012) panel causality test were conducted and the obtained results are presented in Table 23. This analysis was performed using the Eviews 9.0 program.

Table 23*Dumitrescu & Hurlin (2012) Panel Causality Test Results*

	<i>W</i> Statistics	<i>Z</i> Statistics	Probability Value
<i>GDPPC</i> → <i>HEXPC</i>	21.75***	22.23***	0.00
<i>HEXPC</i> → <i>GDPPC</i>	12.14***	11.00***	0.00

Note: ***; At the level of significance of 1%, the existence of causality relation is expressed. Optimum delay length; LR, FPE, AIC and HQ criteria. In Appendix 2, a graph of the inverse roots of the VAR model with 4 delay length is presented in Appendix 3.

According to the results in Table 23; the hypothesis was strongly rejected because the probability values were smaller than 0.01 and it was decided that there was a two-way causality relationship between per capita health expenditure and per capita national income. So these two variables affect one, and it would be sensible to use them together in the same regression. In addition, moving from this result, it is estimated that the health expenditure per capita increases the national income by affecting the health and productivity of the workforce positively in accordance with the Effective Wage Theory (Yıldırım, Karaman & Taşdemir, 2009) and on the other hand the increased national income increases the amount of resources allocated to health expenditures.

4.4.6. Structured fractured panel cointegration test

In this study, the existence of a cointegration relationship between the series was tested by the method developed by Basher & Westerlund (2009). This test; besides to considering horizontal section dependence, it also permits structural fracture up to five in the cointegration equation and can internally determine the structural fracture histories. Another advantage of the test method is that it can take into account the presence of structural breaks in the fixed term and / or trend separately. In this respect, the panel is superior to the cointegration tests. The test statistic developed by Basher & Westerlund (2009, p. 508) is below

$$Z(M) = \frac{1}{N} \sum_{i=1}^N \sum_{j=1}^{M_i+1} \sum_{t=T_{ij-1}+1}^{T_{ij}} \frac{S_{it}^2}{(T_{ij} - T_{ij-1})^2 \hat{\sigma}_i^2}$$

$S_{it} = \sum_{s=T_{ij-1}+1}^t \hat{W}_{st} \cdot \hat{W}_{it}$; is a vector of error terms obtained from an efficient estimator of the type of fully modified least squares. When $Z(M)$ is regulated it becomes:

$$Z(M) = \sum_{t=T_{ij-1}+1}^{T_{ij}} \frac{S_{it}^2}{(T_{ij} - T_{ij-1})^2 \hat{\sigma}_i^2} \sim N(0,1)$$

Test's hypothesis:

H_0 : The series are co-integrated under structural breaks

H_0 : H_1 : The series are not co-integrated under structural breaks

In the study Basher & Westerlund (2009) cointegration test was conducted and the results are presented in Table 24. At this stage of the work, the Gauss 9.0 program and the codes written by Basher & Westerlund (2009) are used for this program.

Table 24

Basher & Westerlund (2009) Panel Cointegration Test Results

	Test Statistics	Probability value
Non-Breaking and Trendless Model in Fixed Terms	4.728***	0.243
Unbreakable and Trendy Model in Fixed Terms	9.895	0.031
Fixed Term Break Model	4.766***	0.365
Constant Term and Trend Break Model	9.953***	0.248

Note. Probability values in parentheses are obtained with 1000 repetitive bootstrap. ***; It is stated that there is cointegration at the level of 1% significance.

When the results in Table 24 are examined, it is seen that there is a cointegration relation between the series. While no cointegration relationship was found in one of the tests that did not take structural breaks into account, the cointegration relation was determined in the tests considering structural breaks. This situation; once again reveals the superiority of structural fracture cointegration tests. Because of the cointegration relationship between the series, it has been decided that the series act together in the long run, that the long term analyses to be made with the level values will not contain false regression problems and that the results to be obtained are reliable. Interestingly, no structural fracture occurred in this test. The test was repeated with different break numbers and different bootstrap cycles, but no

structural break date was detected. It is useful to test whether the cointegration coefficients to be estimated are homogeneous without going through the regression analysis.

4.4.7. Testing homogeneity of cointegration coefficients

Pesaran & Yamagata (2008) have developed the Swamy test, starting with Swamy (1970), to determine whether the slope coefficient is homogeneous in the regression model. In this test, it is tested whether the slope coefficients in the cointegration equation are the same for different countries. In other words;

$$Y_{it} = \alpha + \beta_i X_{it} + \varepsilon_{it} \quad (15)$$

In this cointegration equation, if the β_i the slope coefficients are differentiated between horizontal sections are tested. Test hypotheses:

$H_0: \beta_i = \beta$ slope coefficients are homogeneous

$H_1: \beta_i \neq \beta$ slope coefficients are not homogeneous

Pesaran & Yamagata (2008), developed test statistics $\tilde{\Delta}$ for large samples and $\tilde{\Delta}_{adj}$ for little samples to test these hypothesis

$$\tilde{\Delta} = \sqrt{N} \left(\frac{N^{-1}S - k}{2k} \right) \sim \chi_k^2$$

$$\tilde{\Delta}_{adj} = \sqrt{N} \left(\frac{N^{-1}S - k}{v(T, k)} \right) \sim N(0, 1)$$

At these statistics N; the number of horizontal cross-sections, S; Swamy test statistics, k; number of explanatory variable, $v(T, k)$; standard error, χ_k^2 ; the corresponding test statistic has a degree of freedom chi-square distribution, $N(0, 1)$; 0 means that the mean of the relevant test statistic has a constant normal distribution of variance. Pesaran & Yamagata (2008) were tested in order to examine whether the slope coefficient for equation (1) is homogeneous and the results obtained are presented in Table 25. At this stage of the work, the Gauss 9.0 program and codes written by Pesaran & Yamagata (2008) were used for this program.

Table 25*Pesaran and Yamagata (2008) Homogeneity Test Results*

	Test Statistics	Probability Value
$\tilde{\Delta}$	112.688***	0.000
$\tilde{\Delta}_{adj}$	112.482***	0.000

Note: ***; it means that the slope coefficients at the 1% significance level of the relevant series are homogeneous.

According to the results in Table 25, the hypothesis was strongly rejected and in the cointegration equation, it was decided that the slope coefficients were not homogeneous. In this case, the individual results will be more reliable than the panel's interpretation for the general. For this reason, it has been decided to use a regression estimator that gives individual results in the study.

4.4.8. Estimation of panel cointegration coefficients

Regression analysis between stationary series in level values in panel data analysis; regression analysis between the series with non-stationary but cointegration relation at the level can be performed by using the Fully Modified Ordinary Least Squares (FMOLS) or Dynamic OLS (DOLS: DOLS) method, while the pooled least squares method can be performed with the random effects model or the fixed effect model.) methods. However, the FMOLS or DOLS methods do not consider the horizontal cross-section dependency of the model. For this reason, while estimating cointegration coefficients in panes with horizontal section dependency,

Pesaran obtained a simple arithmetic average of the cointegration coefficients obtained for countries using the CCE (Common Correlated Estimator) method when calculating the CCMGE (Common Correlated Mean Group Estimator) value of the panel as a whole. This method gives misleading results because it gives equal weight to each country in analysis. Eberhardt & Bond (2009) solved this problem by weighting individual results using variances, and developed the Panel Augmented Mean Group Estimator (AMG) method. The panel AMG method also includes; can take into account common factors in the series, produce effective results in unstable panellists, and can be used in the presence of the problem of internal stability (Eberhardt & Bond, 2009: 4). In addition, AMG produces robust estimates of

autocorrelation and variance problems. In all these aspects, AMG is a stronger and more consistent predictor than other methods. Cointegration coefficients (coefficients in Eq. (1)) were estimated by Panel AMG method in this study and the findings are presented in Table 26. Stata 11 program and Eberhardt and Bond (2009) codes were used for this program.

Table 26

Cointegration Coefficient Estimation Results

Countries	Constant Term	HEXPC's Coefficient	HEXPC2's Coefficient
Australia	-10428,8660104568***[12.70]	11,516028	-0.001[-1.14]
Austria	2152,61568722241*** [7.73]	9,1745248	-0.0007 [-0.09]
Belgium	18644,0633105873*** [6.84]	6,13364	-0.0005*** [-6.29]
Canada	42653,8145548723*** [5.29]	1,2028848	0.005** [1.98]
Chile	20753,0693850186***[25.58]	1,9348224	-0.0004* [-1.31]
Colombia	7925,9087142372***[12.31]	5,480952	-0.002** [-2.09]
Czech Republic	35685,1082932562*** [6.51]	1,5458112	-0.0002 [-0.89]
Denmark	29129,2551973745*** [9.98]	5,034654263	-0.0004*** [-3.65]
Estonia	6274,30596908443***[16.64]	11,6827008	-0.002*** [-6.91]
Finland	1005,62794094068*** [9.98]	10,39165989	-0.001 [-0.47]
France	-32848,8984578938***[16.64]	14,67105326	-0.0012*** [-5.84]
Germany	-147365,697339378***[10.63]	30,2896576	-0.002*** [-.09]
Greece	24508,669777151***[14.42]	2,177112137	-0.0004*** [-2.34]
Hungary	26903,4142835216*** [4.07]	2,5424256	- 0.0005* [1.27]
Iceland	25092,5996847418***[-3.45]	6,618286903	-0.0006 [-0.89]
Ireland	67470,5464744246*** [3.22]	3,635573143	-0.0003 [-1.02]
Israel	30729,3659266935***[13.27]	3,374888571	-0.0005** [-1.81]
Italy	21247,9274043909***[-5.16]	5,89126848	-0.0007 [-0.59]
Japan	-44300,2109743864*** [4.42]	17,83168293	-0.0016*** [-7.04]
Korea	37454,958818306*** [1.02]	1,567174674	-0.0002*** [-3.32]
Latvia	-158176,810160429*** [0.91]	96,105072	0.021*** [7.85]
Lithuania	29077,2088233219*** [4.39]	3,066225943	-0.0005 [0.46]
Luxembourg	44559,9419713995*** [7.87]	12,94607474	-0.001[-1.14]
Mexico	17501,4622633523***[-1.84]	1,88452096	-0.0007 [-0.09]
Netherlands	17926,0087359305***[12.70]	6,740225486	-0.0005*** [-6.29]
New Zealand	38969,695682517*** [7.73]	0,984937143	0.0001** [1.98]
Norway	22902,5743841333*** [6.84]	6,241061394	-0.0004* [-1.31]
Poland	8472,11292099906*** [5.29]	10,7820384	-0.002** [-2.09]
Portugal	29565,6390227624***[25.58]	1,592382446	-0.0002 [-0.89]
Slovak Republic	26695,8407566082***[12.31]	2,222874331	-0.0004*** [-3.65]

Countries	Constant Term	HEXPC's Coefficient	HEXPC2's Coefficient
Slovenia	-10231,6851673682*** [6.51]	15,25412571	-0.002*** [-6.91]
Spain	9801,49659533378*** [9.98]	8,572138286	-0.001 [-0.47]
Sweden	-42432,7782807594***[16.64]	16,47856375	-0.0012*** [-5.84]
Switzerland	-213582,344014304*** [9.98]	36,79738697	-0.002*** [-.09]
Turkey	29541,0716727459***[16.64]	1,2773472	-0.0004*** [-2.34]
United Kingdom	21510,7297017854***[10.63]	5,557130857	- 0.0005* [1.27]
United States	-113555,462654249***[14.42]	15,89769586	-0.0006 [-0.89]
OECD AVERAGE	31797,3064410066*** [4.07]	3,038023886	-0.0003 [-1.02]

*Note. Autocorrelation and changing variance problems in estimates have been eliminated by the Newey-West method. *, ** and *** respectively; 1%, 5% and 10%, respectively. Values in square brackets are standard errors, calculated using the Newey-West standard error.*

According to the results in Table 26; Canada, New Zealand and falling per capita spending on health in Turkey, Armey Curve approach in the relationship between national income per person is not valid. For these countries' health spending is on the rise in national income. Using the values obtained in Table 26, we can see that the optimal per capita health expenditure amount (HEXPC *) for each country, the per capita national income per capita (GDPPC *) when this amount is reached and the income increase values per capita income per capita and the results obtained are presented in Table 27.

Table 27

Optimum and Actual Health Expenditure for 37 OECD Countries (USD)

Country	Year	HEXP C	HEXP C*	GDPC	GDP C*	GDPC INCREASE	GDPC RATIONAL INCREASE %
Australia	2019	5.187,40	5758,014	49309,1124	55733,39	6424,27293	13,02857143
Austria	2019	5.851,10	6553,232	55833,5599	63235,49	7401,934799	13,25714286
Belgium	2019	5.428,00	6133,64	51937,42361	58941,56	7004,132555	13,48571429
Canada	2019	5.418,40	6014,424	49171,51109	55915,03	6743,52152	13,71428571
Chile	2019	2.159,40	2418,528	24931,12188	28407,23	3476,110708	13,94285714
Colombia	2019	1.212,60	1370,238	14571,99095	16637,05	2065,059288	14,17142857
Czech Republic	2019	3.426,00	3864,528	40981,05651	46882,33	5901,272137	14,4

Country	Year	HEXP C	HEXP C*	GDP C	GDP C*	GDP INCREASE	GDP RATIONAL INCREASE %
Denmark	2019	5.567,90	6293,317829	57161,68639	65523,62	8361,938123	14,62857143
Estonia	2019	2.578,80	2920,6752	36401,10885	41809,27	5408,164743	14,85714286
Finland	2019	4.578,40	5195,829943	48582,58759	55911,62	7329,030356	15,08571429
France	2019	5.375,70	6112,938857	46017,76596	53065,06	7047,292159	15,31428571
Germany	2019	6.645,80	7572,4144	53929,63929	62311,85	8382,206792	15,54285714
Greece	2019	2.383,60	2721,390171	29698,03048	34381,83	4683,803664	15,77142857
Hungary	2019	2.222,40	2542,4256	32553,69447	37762,29	5208,591116	16
Iceland	2019	4.811,40	5515,239086	56935,77273	66175,64	9239,862545	16,22857143
Ireland	2019	5.275,50	6059,288571	86650,00466	100910,1	14260,11505	16,45714286
Israel	2019	2.932,50	3374,888571	40626,21527	47404,99	6778,774205	16,68571429
Italy	2019	3.649,20	4208,048914	42746,29575	49976,53	7230,230596	16,91428571
Japan	2019	4.822,80	5572,400914	41697,41194	48845,54	7148,127761	17,14285714
Korea	2019	3.384,20	3917,936686	42758,59037	50186,37	7427,777984	17,37142857
Latvia	2019	1.972,60	2288,216	31012,1351	36470,27	5458,135778	17,6
Lithuania	2019	2.638,10	3066,225943	37166,21008	43792,41	6626,204312	17,82857143
Luxembourg	2019	5.558,30	6473,037371	116518,2768	137558,1	21039,8717	18,05714286
Mexico	2019	1.153,60	1346,0864	19675,44067	23273,24	3597,794866	18,28571429
Netherlands	2019	5.765,10	6740,225486	56784,03725	67297,2	10513,1589	18,51428571
New Zealand	2019	4.204,00	4924,685714	43110,37124	51190,49	8080,115295	18,74285714
Norway	2019	6.646,70	7801,326743	64385,00599	76599,76	12214,75542	18,97142857
Poland	2019	2.292,10	2695,5096	33185,15813	39556,71	6371,550361	19,2
Portugal	2019	3.378,60	3980,956114	34945,66134	41735,1	6789,442775	19,42857143
Slovak Republic	2019	2.353,60	2778,592914	31927,59383	38203,65	6276,05273	19,65714286
Slovenia	2019	3.224,00	3813,531429	38946,68538	46691,51	7744,826579	19,88571429
Spain	2019	3.616,50	4286,069143	40802,48774	49009,62	8207,128963	20,11428571
Sweden	2019	5.782,30	6866,068229	52850,56918	63601,88	10751,31579	20,34285714
Switzerland	2019	7.732,40	9199,346743	70944,35481	85538,62	14594,26728	20,57142857
Turkey	2019	1.339,50	1596,684	31252,07694	37752,51	6500,432004	20,8

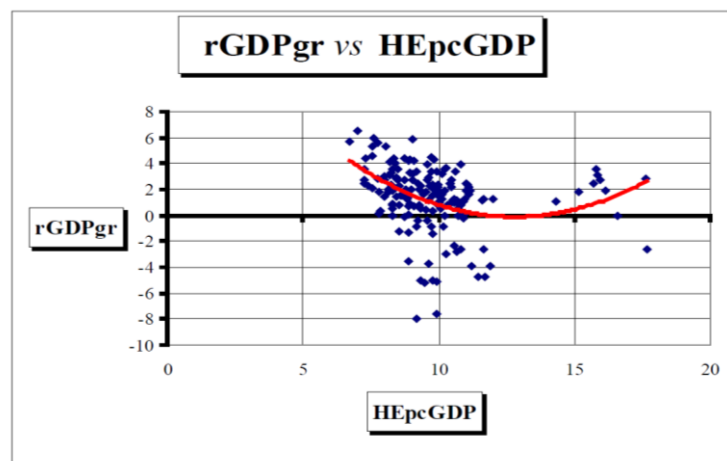
Country	Year	HEXP C	HEXP C*	GDP C	GDP C*	GDP INCREASE	GDP RATIONAL INCREASE %
United Kingdom	2019	4.653,10	5557,130857	47368,58441	57329,52	9960,936608	21,02857143
United States	2019	11.071,70	13248,07989	62458,75335	75735,7	13276,94643	21,25714286
OECD AVERAGE	2019	4.223,50	5063,373143	44628,39478	52279	7650,578775	17,14285

According to the findings in Table 27; 37 OECD countries corrected for Armeý curve and optimal health expenditure ratio. According to the calculations made for the panel's general, OECD countries included in the pension will have an average increase of \$ 7650,578775 per capita health spending, while per capita gross national income will reach \$ 52279 with an increase of 17,14285 % per capita.

Georgiou has supported the view of (Weil, 2005); (Bloom & Canning, 2008) that “health has a positive impact on economic growth”, but only if health expenditure (% GDP) exceeds a certain critical level. The critical value of $x = -\beta/2\alpha > 0 = 12,4$ (this is the critical level of %GDP). Beyond this critical value GDP starts rising (graph 1). **So, the ratio%14,15 calculated is suitable for literature.**

Figure 8

GDP Growth Rate and Health Expenditure Per Capita Relation



4.5. Panel Data Analysis Causality Tests

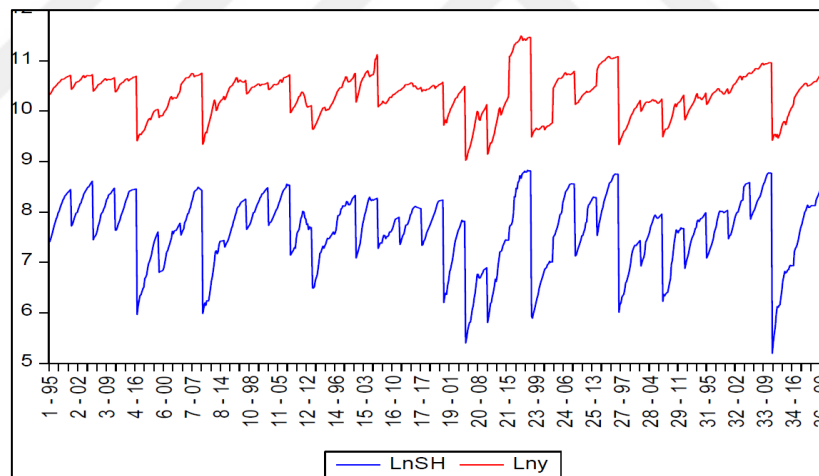
Three basic conditions must be met in order to ensure efficiency in GMM estimation, The first of these conditions is that it does not matter whether there is first-

order autocorrelation in the model, but there is no second-order autocorrelation. The desired situation is that the basic hypothesis for 1st order autocorrelation (AR (1)) cannot be rejected, regardless of whether the basic hypothesis is rejected for 2nd order autocorrelation (AR (2)). The second condition is that the basic hypothesis of the sargan test, which is established as "over-identification restrictions are valid", cannot be rejected and the probe value should not be below 1.000 and below 0.25. The third and last condition is that the number of instrument variables used in the model must be equal to N or smaller than N (Yerdelen Tatoğlu, F., 2018, pp. 80-109).

In this part the effects of health expenditure on economic growth in 36 OECD countries are examined by dynamic panel data analysis for the period 1990-2019 and the relation can be followed in Figure .

Figure 9

The Relationship Between Health Expenditure per Capita and National Income Per Capita in OECD Countries



Note. From Worldbank 2020

$$Y=AK^{\alpha}L^{\beta}$$

$$\text{Log}Y=\text{Log}A+\text{Log}K\alpha+\text{Log}L\beta$$

$$\text{Log}Y=\text{Log}A+\alpha\text{Log}K+\beta\text{Log}L$$

In Cobb Douglas function Y; total production, A; technology level, K; capital stock, L; the amount of labour, α and β indicate the shares of capital and labour in production.

$$dY/dt = dA/dt + dK/dt + DL/dt$$

$$\beta = 1 - \alpha$$

$$Y = AK^\alpha L^{1-\alpha}$$

$$Y/L = (AK^\alpha L^{1-\alpha}) / L$$

$$y = Ak^\alpha$$

y is production per labour force, k shows the capital stock per labour force. A is the (external) technology parameter that cannot be explained by the model, and it is also called Solow Residue in the literature (Aslan & Yılmaz, 2015, p. 18).

In the Endogenous Growth Theory developed by Romer (1986) and Lucas (1988), technological progress;

It has been included in the model as a result of human capital and human capital has been accepted as the most important determinant of economic growth.

In this case, the equation was rearranged to include human capital (H) and the following model was obtained:

$$y = Hk^\alpha$$

In this study, human capital; represented by per capita health expenditures (SH) and included in the analysis.

$$y = (SH)^\gamma k^\alpha$$

$$\ln y = \ln(SH)^\gamma + \ln k^\alpha$$

$$\ln y = \gamma \ln SH + \alpha \ln k \quad \text{so the model is } \ln y_t = \beta_0 + \beta_1 \ln SH_t + \beta_2 \ln k_t + \epsilon_t$$

Here y ; real national income per capita, SH ; real health expenditure per capita calculated according to purchasing power parity, k ; shows the real stock of fixed capital per labor force.

β_1 ; β_2 ; show the effect of the 1% change in the fixed capital stock per capita on the per capita national income. Our expectation as a result of the analysis; The positive results of β_1 and β_2 , that is, increases in per capita health expenditures and per capita fixed capital stock will positively affect per capita national income and economic growth of countries.

4.5.1. Econometric method

At first using Im, Pesaran, Shin (2003) and Breitung (2000) panel unit root tests the stationarity of the series studied; then by using Pedroni panel cointegration test the existence of cointegration was examined. Long and short term analyzes between series; Panel Dynamic Ordinary Least Squares (PDOLS) method was used. Causality relationships between series; Dumitrescu & Hurlin (2012) were analyzed with the panel causality test.

4.5.2. Panel unit root test

Econometric analyses are sensitive to the stationarity of the series. Because spurious regression problem may be encountered in analyses to be made with non-stationary series (Engle & Granger, 1987). For this reason, unit root test should be applied to the series first in the analysis. In this study, the stationarity of the series was investigated by Im, Pesaran and Shin, & Breitung panel unit root tests. These tests are based on a model such as:

$$\Delta Y_{it} = \delta_i Y_{it-1} + \sum_{j=1}^p \beta_{ij} \Delta Y_{it-j} + X_{it}' \theta + \varepsilon_{it}$$

Here p ; optimum delay length, X_{it}' ;

$H_0: |\delta_i| = 1$ The series is not stationary for all countries that make up the panel $H_1: |\delta_i| < 1$ The series is stationary for all countries that form the panel format. It has been accepted that the unit root parameter δ_i may differ between the countries that make up the panel. The hypotheses of this test are: $H_0: |\delta_i| = 1$ For some countries that make up the panel, the series is not stationary $H_1: |\delta_i| < 1$ Series is stationary for some countries making up the panel format. In the study, Pesaran and Shin, Breitung & Im panel unit root tests were performed, and the results are presented in **Table 28**.

Table 28

Panel Data Unit Root Results

Variable	Breitung Test		Im, Pesaran ve Shin Test	
	Test statistics	Probablity Value	Test statistics	Probablity Value
<i>Ln_y</i>	-1,02	0,15	0,44	0,69
<i>LnHE</i>	1,14	0,87	-1,63*	0,05
<i>Lnk</i>	-0,72	0,22	-0,97	0,19

Variable	Breitung Test		Im, Pesaran ve Shin Test	
	Test statistics	Probability Value	Test statistics	Probability Value
ΔLny	-11,35***	0,00	-11,57***	0,00
$\Delta LnHE$	-4,22***	0,00	-4,59***	0,00
ΔLnk	-6,09***	0,00	-13,55***	0,00

Note. *** and * are stationary at 1% and 10%, respectively, Δ indicates that the first difference of the relevant variable is taken. The optimum lag length was determined according to the Akaike information criterion.

According to Engle & Granger (1987), since the series are not stationary in their level values, spurious regression problem may be encountered in the analyses to be made with the level values of these series.

Therefore, the existence of a cointegration relationship between the series should be tested.

4.5.3. Panel cointegration test

In this study, the existence of cointegration between the series was examined with the Pedroni (2004) test.

Pedroni (2004) panel unit root test is based on the following equation:

$$y_{it} = \alpha_i + \delta_{it} + \beta_1 x_{1i,t} + \beta_2 x_{2i,t} + \dots + \beta_M x_{Mi,t} + \varepsilon_{i,t}$$

Here $t=1, \dots, T$; $i=1, \dots, N$; $m=1, \dots, M$.

In this test, y and x should not be stationary in level, but should be series that become stationary when their difference of the same degree is taken.

When the error term series is stationary, it is decided that the series are cointegrated.

For this, when the series of error terms are opened and written in accordance with the AR (1) process; $\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + u_{i,t}$

Against the autocorrelation problem, when the lagged values of the difference of the dependent variable are added as explanatory variable;

$$\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + \sum_{j=1}^p \psi_{ij} \Delta \varepsilon_{i,t-j} + v_{i,t} \text{ obtained.}$$

Hypotheses of the Pedroni panel cointegration test:

$H_0: |\rho_i| = 1$ No cointegration between series

$H1: |\rho| < 1$ There is cointegration between the series format.

Table 29

Panel Cointegration Test Results

	Test stat	Prob. Value	Weighted	
			Test stat	Prob. Value
Panel v statistics	5,35***	0,00	0,31	0,36
Panel ρ statistics	-0,27	0,37	1,21	0,82
Panel PP statistics	-4,30***	0,00	-2,17**	0,01
Panel ADF statistics	-3,53***	0,00	-3,95***	0,00
Grup ρ statistics	3,24	0,94	-	-
Grup PP statistics	-1,96**	0,01	-	-
Grup ADF statistics	-4,36***	0,00	-	-

Note. *** and **; indicates the existence of a cointegration relationship at the 1% and 5% significance level, respectively.

According to the results in Table 29; There is a cointegration relationship between health expenditures, fixed capital investments and economic growth Since the cointegration relationship between the series was determined, it was decided that long- and short-term analyses could be started.

4.5.4. Long term analysis

In the study, long-term analysis was carried out using the level values of the series, within the framework of Equation (16), with the PDOLS method. While estimating the cointegration coefficient, this method includes the lag and antecedents of the independent variable in the model, thus avoiding the problems of internality, autocorrelation and varying variance.

Table 30

Long Term Analysis Results

Variable	Coefficient	t- statistics	Prob. Value	R ²	Adj. R ²
LnHE	0,27***	22,81	0,00	0,99	0,98
$\Delta Ln k$	0,32***	14,14	0,00		

Note. *** means statistically significant at the 1% level.

According to the findings in Table 30; GDP per capita in OECD countries for the period 1990-2019; 1% increase in health expenditures per capita increased 0.27%, 1% increase in fixed capital stock per labour force increased 0.32%.

The obtained findings are in line with theoretical expectations.

It has been found that the effects of the increases in the fixed capital stock per labour force on the national income are more than the health expenditures.

4.5.5. Short term analysis

In the study, the short-term analysis was carried out by with the PDOLS method.

$$\Delta Lnyt = \alpha_0 + \alpha_1 \Delta LnHEt + \alpha_2 \Delta Lnkt + \alpha_3 ECTt-1 + vt$$

There is a long-term causality relationship from the independent variables to the dependent variable (Binh, 2013, pp. 58-59). In the study, the short-term analysis was carried out with the PDOLS method and the results are presented in Table 31.

Table 31

Short Term Analysis

Variable	Coefficient	t- statistics	Probability Value	R ²	Adjusted R ²
$\Delta LnHE$	0,22***	22,81	0,00	0,55	0,55
$\Delta Ln k$	0,26***	14,14	0,00		
$ECTt-1$	-0,04**	-2,26	0,02		

Note. *** and **, means statistically significant at the 1% and 5% level respectively.

According to the findings in Table 31; in the short run, increases in per capita health expenditures and per capita fixed capital stock increase per capita national income, again the effect of per capita fixed capital stock is greater. The coefficient of error correction term was found to be statistically significant. In this case, the error correction mechanism of the model works. In other words, the deviations occurring in the short run disappear and the series maintain their stable relations in the long run. The fact that the coefficient of error correction term is statistically significant also reveals the existence of a long-term causality relationship from health expenditures and fixed capital stock to economic growth. Panel Causality Test The causality relationships between the series included in the analysis can be tested with different methods such as Granger (1969) and Dumitrescu & Hurlin (2012) causality tests. Among these methods, the Granger (1969) test tests the existence of a causal relationship between the variables in all countries that make up the panel, while the Dumitrescu & Hurlin (2012) causality test is a stronger test that can reveal the causal relationships valid for certain countries (Gülmez, 2015, p. 27). For this reason, the

existence of causal relationships between the series was examined with the help of Dumitrescu & Hurlin (2012) causality test.

Dumitrescu & Hurlin (2012) causality test hypotheses;

$H_0: \beta_i(k)=0$ There is no causality at all the countries from X to Y

$H_1: \{\beta_i(k)=0, i=1,2,\dots,N1$ There is causality at some countries from X to Y

$(k) \neq 0, i=N1+1, N1+2,\dots,N$ there is causality is in the form.

In the study, Dumitrescu & Hurlin (2012) panel causality tests were performed and the results are presented in Table 32.

Table 32

Dumitrescu & Hurlin (2012) Panel Causality Test Results

<i>H0 Hypothesis</i>	<i>W – statistics</i>	<i>$\bar{Z}$ – Statistics</i>	<i>Prob. Value</i>
<i>LnHE$\rightarrow$Lny</i>	3,04*	1,73*	0,06
<i>Ln$y$$\rightarrow$LnHE</i>	7,33***	11,57***	0,00
<i>Lnk$\rightarrow$Lny</i>	3,42***	2,76***	0,00
<i>Ln$y$$\rightarrow$Lnk</i>	6,84***	10,34***	0,00
<i>Lnk$\rightarrow$LnHE</i>	5,81***	7,92***	0,00
<i>LnHE$\rightarrow$Lnk</i>	4,37***	4,63***	0,00

Note. *** and * indicate the existence of a causal relationship from the first variable to the second variable at the significance level of 1% and 10%, respectively.

As a result, there are two-way and very strong causal relationships between health expenditures and economic growth, between fixed capital stock and economic growth, and between health expenditures and fixed capital stock in OECD countries. Here, the causality relationship between health expenditures and economic growth; It is suggested that increasing health expenditures accelerate economic growth by increasing human capital, while increasing economic growth enables individuals and countries to allocate more resources to health services.

Causality relations between fixed capital stock and economic growth; This suggests that the increased amount of capital (machinery-equipment, factory building, etc.) increases the production and income in the economy, while the increased income allows more fixed capital investments to be made in the countries.

The mutual causality relationship between health expenditures and fixed capital stock is; building, road, etc. in the field of health. It implies that the expenditures of medical machinery and equipment purchased for use in this field positively affect the fixed capital stock of the countries, while the increasing fixed

capital stock increases the national income and expenditures for the health sector in the countries.

4.6. Dynamic Panel Data Analysis

In the study, the effect of health expenditures on economic growth was investigated with balanced panel analysis, using data from 22 OECD countries for the period 1990-2017.

Dynamic panel data analysis method is used in the study. Dynamic panel data analysis has advantages such as more number of observations and more homogeneous structure, increasing the degree of freedom and reducing the problem of connection between explanatory variables.

In addition, dynamic panel data analysis can give more effective results in cases such as autocorrelation, changing variance, and internality problems. Two-stage system generalized moments (two-step System-GMM) method also gives stronger results in dynamic panel data analysis. (Hayaloğlu & Topal, 2017, p. 199). Because the lagged value of the dependent variable is included in the model as an independent variable, and the internality problem that may occur can be eliminated from the beginning.

In the differential GMM developed by Arellano & Bond (1991), the problems that may occur in the dynamic panel estimation can be eliminated by using the previous period values of the dependent variable as the instrument variable and by taking the first-order differences of the variables and including them in the model. System GMM panel data analysis is used when the time dimension (T) is smaller than the unit size (N), and the efficiency of the model is increased by including more instrumental variables in the model (Hayaloğlu & Topal, 2017, p. 199).

4.6.1. Model and dataset

Below is the econometric model created to analyse the relationship between health expenditures and economic growth and other components of economic growth with dynamic panel data:

$$GSHit = \alpha + \beta_1 GSHit-1 + \beta_2 HEit + \beta_3 DEMit + \beta_4 TFFVit + \beta_5 FSt + uit$$

In the model, time t is country i ; α constant term; β 's are slope coefficients; μ is the unit effect and u is the error term. *GSH*, which shows the economic growth rate, is the dependent variable. *SH* is the main independent variable and expresses the ratio of health expenditures to national income, while other variables are control variables that have an effect on economic growth. *TVF* Total Factor Productivity is the ratio of *FS* physical capital stock to national income. In Equation the growth rate of national income per capita, the ratio of health expenditures to national income and the ratio of physical capital stock to national income, which are the main components of economic growth, are modelled over total factor productivity and democracy index. In this study, the relationship between health expenditures and economic growth (the rate of increase in national income) was determined by 22 OECD countries (Canada, England, Australia, Belgium, New Zealand, Austria, Denmark, Finland, Ireland, Greece, Germany, Hungary, Iceland, Japan, Korea, Netherlands, Switzerland, Norway, Italy, Spain, Sweden and the USA) were analysed using annual data for the period 1990-2019. The data are taken from Penn World Table 9.1, OECD Stat and Polity IV, the series expressed in million USD based on 2011. Data analyses were carried out using Stata 15 and Gauss 20 computer programs. In order to provide balanced panel analysis, the condition of having an equal number of data from 23 countries were taken into account, and 1147 observation values were obtained from 37 countries with 31 years of data for the period 1990-2021.

Table 33

Data Sources

Variable	Explanation	Data source
GSH	real gross domestic product per capita, adjusted for purchasing power parity	Penn World Table 9,1
HE	real health expenditure per capita adjusted for purchasing power parity	OECD Stat
FS	Physical Capital Stock	Penn World Table 9,1
TFV	Total Factor Efficiency	Penn World Table 9,1
DEM	Democracy Index	Polity IV

Table 34*Descriptive Statistics*

Variables	Average	Stand. Dev.	Min.	Max.
GSH	2.135	2.847	-9.135	11.114
FS	22.305	3.573	11.543	35.675
TFV	0.9881076	0.0656486	0.7329	1.2125
DEM	9.905842	0.3663462	8	10
HE	8.693	2.023	3.994	16.517

Table 35*Dynamic Panel Data Analysis Results*

Variables	Pooled LSM	Fixed Effect LSM	Differnece-2 GMM	System-2 GMM
<i>Gsh(-1)</i>	0.233* (12.62) [0.000]	0.285* (8.09) [0.000]	0.243* (11.13) [0.000]	0.204* (5.53) [0.000]
HE	0.226* (5.14) [0.895]	0.186* (7.96) [0.993]	0.201* (7.98) [0.547]	0.203* (9.22) [0.001]
FS	0.277* (5.74) [0.168]	0.284* (4.54) [0.522]	0.352* (6.74) [0.132]	0.232* (2.74) [0.003]
TVF	0.362* (5.77) [0.691]	0.326* (10.02) [0.271]	0.354* (5.32) [0.267]	0.298* (4.17) [0.046]
DEM	0.164* (7.39) [0.889]	0.088*** (1.72) [0.857]	0.189* (3.46) [0.542]	0.148** (2.15) [0.427]
Constant	14.436* (6.03)	12.536* (2.65)	11.365* (3.17)	14.305* (3.73)
Wald (χ^2)	3688.92 [0.000]	8098.02 [0.000]	3992.27 [0.000]	1376.45 [0.000]
Sargan (χ^2)	19.795 [0.833]	18.003 [0.905]	20.917 [0.794]	19.564 [0.848]
AR(1)	-3.339 [0.000]	-3.199 [0.001]	-3.305 [0.001]	-3.285 [0.001]
AR(2)	1.622 [0.102]	1.513 [0.125]	1.647 [0.100]	1.572 [0.115]
Hansen Test			9.12 [0.764]	6.18 [0.905]
Fark Hansen			0.19 [0.996]	1.35 [0.241]
R ²	0.94	0.98		
Country Number	23	23	23	23
Observation Number	690	690	690	690
Instrumental variable number			16	15

Two-stage GMM models are preferred to correct the heteroscedasticity and autocorrelation problems of single-stage GMM estimators (Tatoğlu, 2018, p. 134). The difference GMM estimation results are shown in column 3 of the table. The autoregressive coefficient, which was not within the lower and upper limits shown in the 1st and 2nd columns, was found to be statistically significant at the 1% level. Other variables were not found to be statistically significant. In the 4th column, two-stage system GMM results are seen and the validity and significance of the Wald test statistic and the system GMM method were questioned. Sargan & Hansen test statistics are whether the instrument variables are valid; With AR(1) and AR(2) tests, it was questioned whether there was a first and second order autocorrelation in the model. The model was found to be statistically significant at the 1% level according to the Wald test statistic. There is no first-order or second-order autocorrelation problem in the model. It has been determined that the instrumental variables used in the Sargan and Hansen test are also valid. The difference Hansen test also showed that there was no internal validity problem. Therefore, the necessary assumptions are provided to use the system GMM. When the coefficients estimated using the system GMM are examined, it is seen that the most important factor of economic growth is total factor productivity. When the ratio of health expenditures to national income increases by 1%, the economic growth rate increases by 0.203. This is in line with the Keynesian view in the literature and the endogenous economic growth model based on human capital. The effect of democracy index on economic growth remained as the lowest factor with 0.149.

4.7. Analysis of panel data using the nonlinear least squares method using the Gauss-Newton algorithm (iterative simulation) with the Convergence Hypothesis Approach

According to convergence hypothesis approach, undeveloped countries will have a higher growth rate, while developed countries will have a lower growth rate. This part follows papers mainly Ulusoy (2001) and Ulusoy & Yalçın (2011).

Ulusoy & Yalçın (2011), states “If the speed of convergence parameter is positive, one can predict the sign of the coefficients in formula, The first coefficient $(1 - e^{-\beta t})\alpha(1 - \theta) > 0$ indicates that the more a country saves, the more rapidly it grows, The second $(1 - e^{-\beta t})\beta > 0$, indicates that the scale of the labour force is a contributing

factor to the per worker output, The third coefficient $(1 - e^{-\beta t})$ shows the effect of economic freedom on the production of a country and it is expected to be positive, Finally, the last term $e^{-\beta t}$ indicates that countries grow faster if they are initially below their balanced growth path”.

By using Cobb Douglas function, it is derived $A_{it} / A_{it} = Y_{it}^{\beta_1} HER_{wit}^{\alpha} A_{it}^{\theta-1} \gamma$

then

$$\begin{aligned} Lny_{it} = & (1 - e^{-\beta t}) \alpha (1 - \theta) Lns_{it} + (1 - e^{-\beta t}) \beta_1 LnL_{it} + (1 - e^{-\beta t}) \theta LnHE_{it} + \\ & (1 - e^{-\beta t}) Ln(\gamma + (1 - \alpha) \beta_1 n_{it}) + (1 - e^{-\beta t}) \alpha (1 - \theta) Ln[\delta + (1 - \alpha) (1 - \theta) n_{it} + \\ & e^{-\beta t} Lny_{t-1} + \mu_{it} \end{aligned}$$

This is the reverse of the neoclassical approach, that is, output per worker is now proportional to Health Expenditure Labor Level and savings rate.

The higher the productivity of labor in economically free countries, the greater the positive effect of income savings per worker around balanced growth path values.

The results of the Pearson correlation matrix between the variables used in the analysis are below.

	HER	s	n
L	0.506	-0.121	-0.088
HER		-0.090	-0.262
s			0.082

When the correlation coefficients were examined, there was a positive and moderate ($r=0.506$) positive and low-level, negative and low-level ($r=-0.088$) negative-oriented low-level relationship between the L variable and the HC, s and n variables, respectively.

In addition, it is seen that there is a negative and low-level relationship ($r=-0.090$),

($r=-0.262$) between the HC variable and the s and n variables, respectively.

Another finding is that there is a positive low-level relationship between the s variable and the n variable ($r=0.082$).

In general, no high level of negative or positive correlation was found.

The nonlinear least squares estimation results of the dynamic econometric model are below.

Parameter	Beta	SD	t	p
β	0.206	0.024	8.440***	<0.001
α	-11.336	13.290	-0.850	0.394
θ	1.033	0.030	34.030***	<0.001
β_1	-0.045	0.028	-1.600	0.110
$\emptyset$	1.449	0.171	8.480***	<0.001

The coefficient of the θ parameter was found to be positive and statistically significant ($p<0.05$). In the light of this finding, when the productivity of the new technology stock increases by 1%, the per capita income increases by 1.033%.

The ratio ($\emptyset$) coefficient of per capita health expenditures to national income is positive and statistically significant ($p<0.05$). According to this finding, when the ratio of health expenditures per capita to national income increases by 1%, per capita income increases by 1.449%.

The labor (β_1) coefficient was negative and not statistically significant ($p>0.05$).

For the coefficient of convergence (β), the model converged at the point where the β coefficient was the smallest as a result of 5000 iterations with the NLS technique.

The coefficient of convergence is the initial value of the capital stock, which decreases exponentially at the rate $\beta > 0$, with the weight of the capital value per worker and the weighted average of the initial and balanced growth path values. This ratio indicates that it converges to the balanced growth of physical productivity. It is seen that these coefficient results are statistically significant and the coefficient is low

(0.206 per year, $p < 0.05$). In light of this finding, GDP per capita growth for 23 countries is slow and will be effective in the long run. Life on a logarithmic scale of output per half worker is approximately;

$$\ln(2)/0.206 = 3.365 \text{ years}$$

In other words, it takes 3,365 years to close half of the gap between countries' per capita income.



CONCLUSION AND RECOMMENDATIONS

Accelerating economic growth, increasing per capita national income and providing a more prosperous country for its citizens is the main goal and task of all the country's administrators. Investments in areas such as health, education, transport, justice and security are at the point of equitable distribution of wealth in the country and equal benefit of all citizens. Also, within the framework of internal growth models developed by Romer (1986) and Lucas (1988); health and education expenditures will increase the level of education and health of working people, increase human capital, and continuously increase economic growth.

In this context, the effects of health expenditures on national income were investigated in the framework of the Armey Curve Approach using the data from the 2012 OECD country for the period 1975 to 2012 by means of second generation dynamic panel data analysis methods taking account of horizontal section dependency.

In this context, the existence of horizontal section dependency between the panellist countries; Breusch and Pagan (1980) investigated LM, Pesaran (2004) LMS, Pesaran (2004) CD and Baltagi, Feng & Kao (2012) LMBC tests and it was found that there is horizontal section dependency among the panelist countries. Stability of series; from the second-generation unit root tests, taking into account the horizontal section dependency and the multiple structural fractures in the series, Carrion-i-Silvestre et al. (2005) developed PANKPSS method and it is seen that the levels of the series are not static and become stable when the first differences are taken. Dumitrescu & Hurlin (2012) examined the existence of causality relations between the series and found that there is mutual causality between the per capita health expenditure and the per capita income, that is, these variables are affected by each other. The existence of the cointegration relation between the series; It has been tested by the method developed by Basher & Westerlund (2009), taking into consideration the horizontal section dependency and the multiple structural fractures in the cointegration vector. As a result of this test it has been determined that the series are cointegrated, that is, long-term co-movement and analysis with level values of these series will not contain false regression problem. Homogeneity of cointegration coefficients; Pesaran & Yamagata (2008) and it has been determined that the slope

coefficients of the cointegration equation are not homogeneous. Cointegration coefficients; It was estimated by Panel AMG method developed by Eberhardt & Bond (2009), which is resistant to autocorrelation, varying variance and intrinsic problems, considering horizontal section dependency. As a result of this estimation; Canada, New Zealand and falling per capita spending on health in Turkey, the relationship between national income per person has been shown to be valid Armeey Curve approach. In the other 18 OECD countries and the panel as a whole, the Armeey Curve approach has been determined to be between per capita health spending and per capita national income. By using the data obtained from this estimate, the optimal amounts of health expenditure for each country and panel are estimated, and the expected rate of increase in per capita national income when this amount is reached.

According to this; In the 18 OECD countries included in the pillar and available for examination by the Armeey Curve approach, the per capita health expenditures increased by an average of \$ 1626.47, reaching the figure that per capita national income could reach 46868 by increasing by 12.27% per capita. Switzerland has seen an increase in optimum health spending, which has shown that this country should reduce health spending to some extent.

Based on the findings of the study; it can be said that countries that want to increase their per capita national income should increase their per capita health spending while doing so by calculating the optimum amount of health spending.

By dynamic panel data analysis, the relationship between health expenditures and democracy index and economic growth in the 1990-2017 period in 22 OECD countries was investigated with the system GMM technique, which has an important place in dynamic panel data methodology.

The results of the study determined the existence of a positive relationship between health expenditures, physical capital stock, total factor productivity and democracy index and GSH.

According to the panel Granger causality results, health expenditures, capital stock and total factor productivity are the Granger causes of GSH. No causality could be detected from democracy to GDP.

These results prove that health expenditures and democracy index are among the determinants of GDP in OECD countries in the long run.

In addition, the factors affecting economic growth have been sorted for OECD countries in a sense and it has been determined that total factor productivity, physical capital stock, health expenditures and democracy index increase the economic growth rate, respectively.



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APPENDIX

Appendix A: Descriptive Statistics on Data Set

	<i>GDPC</i>	<i>HEXPC</i>
Average	21297,56	1745,93
Median	19560,6	1418,052
Most	66363,07	8454,406
Least	1243,247	29,2337
Standard deviation	12182,23	1372,433
Distortion	0,634367	1,380569
Stickiness	2,896531	5,537606
Jarque&Bera Test Statistic	53,8781	467,6057
Jarque&Bera Test Probability Valuation	0	0
Total	16995453	1393252
Sum of Deviation Squares	1,18E+11	1,50E+09
Observation Number	798	798

Appendix B: Optimum Delay Length Determination Table

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-12726,97	NA	3,08e+13	36,73583	36,74894	36,74090
1	-9554,215	6318,030	3,29e+09	27,59081	27,63012	27,60601
2	-9478,669	150,0026	2,68e+09	27,38433	27,44985	27,40967
3	-9455,799	45,27834	2,54e+09	27,32987	27,42160*	27,36534
4	-9446,386	18,58134*	2,50e+09*	27,31424*	27,43219	27,35986*
5	-9444,693	3,332655	2,51e+09	27,32090	27,46506	27,37665

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

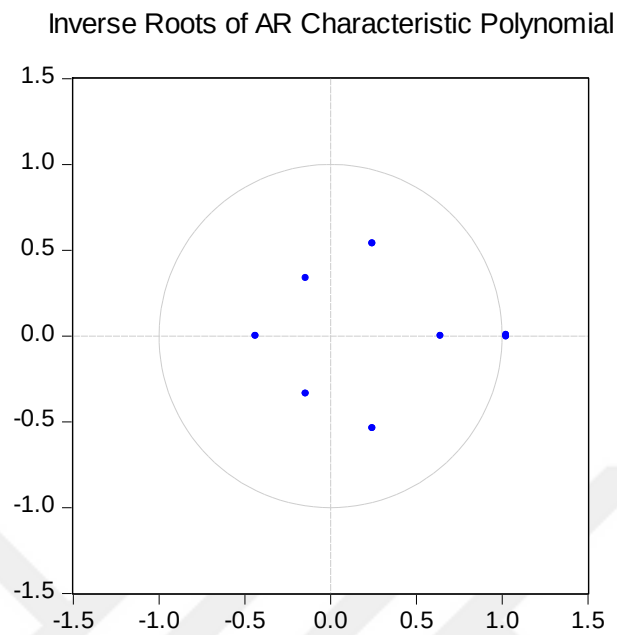
FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Appendix C: Reverse Characteristic Roots Graph of 4 Delayed VAR Model



The fact that the points in this graph are generally within the circle of the unit is evidence that the established model is stable and therefore the causality analysis is reliable.

Appendix D: Non-Linear Gauss Method 5000 Iteration Results

Iteration No	beta	alfa	sigma	beta_bir	teta	u0
1	0,282	0,500	0,500	-0,626	0,804	-0,427
2	2,066	0,500	0,500	0,766	-0,220	-1,926
3	1,640	0,500	0,500	-0,106	-0,318	1,681
4	-2,357	0,500	0,500	0,542	-0,786	1,266
5	-0,078	0,500	0,500	0,691	-0,068	0,901
6	-4,892	0,500	0,500	1,205	-2,123	0,948
7	-0,597	0,500	0,500	0,964	-1,651	-0,483
8	-0,225	0,500	0,500	0,963	0,276	0,638
9	0,012	0,500	0,500	-0,777	1,252	1,298
10	-0,317	0,500	0,500	-3,837	1,600	-2,179
11	1,154	0,500	0,500	2,764	-0,288	0,623
12	-2,295	0,500	0,500	-0,338	-0,704	0,193
13	-1,621	0,500	0,500	3,256	1,942	1,547
14	-0,542	0,500	0,500	0,648	0,971	-0,847
15	0,609	0,500	0,500	-3,963	-0,107	3,042
16	-1,315	0,500	0,500	-0,916	-3,328	-0,420
17	-0,575	0,500	0,500	2,033	3,401	3,239
18	0,843	0,500	0,500	0,179	-0,761	0,199
19	-0,750	0,500	0,500	0,121	-3,179	-1,327
20	-1,652	0,500	0,500	-1,749	0,970	3,473
21	-2,141	0,500	0,500	-0,335	-0,887	-0,213
22	-0,114	0,500	0,500	-0,991	1,354	-2,283
23	1,489	0,500	0,500	-1,888	-0,293	-1,089
24	1,648	0,500	0,500	-1,306	2,493	2,708
25	0,759	0,055	0,778	0,415	0,076	0,867

Iteration No	beta	alfa	sigma	beta_bir	teta	u0
26	0,053	0,928	0,717	0,713	0,652	0,385
27	0,826	0,808	0,721	0,275	0,917	0,002
28	0,598	0,075	0,518	0,676	0,805	0,472
29	0,570	0,968	0,207	0,371	0,976	0,104
30	0,184	0,822	0,681	0,490	0,672	0,950
31	0,644	0,786	0,472	0,674	0,695	0,181
32	0,809	0,804	0,667	0,567	0,583	0,962
33	0,363	0,822	0,884	0,363	0,767	0,000
34	0,709	0,136	0,748	0,098	0,836	0,909
35	0,385	0,759	0,938	0,135	0,695	0,791
36	0,098	0,085	0,122	0,970	0,023	0,493
37	0,775	0,913	0,038	0,385	0,270	0,241
38	0,007	0,285	0,651	0,263	0,239	0,539
39	0,599	0,304	0,464	0,174	0,845	0,844
40	0,792	0,090	0,646	0,601	0,952	0,351
41	0,816	0,224	0,462	0,687	0,475	0,903
42	0,017	0,051	0,886	0,506	0,985	0,789
43	0,049	0,648	0,438	0,960	0,086	0,229
44	0,598	0,906	0,912	0,879	0,369	0,021
45	0,397	0,212	0,093	0,349	0,947	0,433
46	0,285	0,155	0,404	0,412	0,066	0,059
47	0,803	0,344	0,735	0,270	0,019	0,839
48	0,863	0,227	0,685	0,881	0,106	0,846
49	0,332	0,575	0,764	0,869	0,827	0,065
50	0,139	0,265	0,540	0,097	0,770	0,487
51	0,339	0,747	0,081	0,018	0,884	0,574
52	0,705	0,649	0,602	0,539	0,624	0,022

Iteration No	beta	alfa	sigma	beta_bir	teta	u0
53	0,690	0,419	0,778	0,595	0,582	0,012
54	0,406	0,748	0,233	0,352	0,668	0,379
55	0,290	0,999	0,230	0,201	0,516	0,080
56	0,552	0,245	0,581	0,232	0,511	0,574
57	0,070	0,508	0,864	0,608	0,802	0,080
58	0,793	0,628	0,507	0,750	0,283	0,334
59	0,049	0,322	0,351	0,181	0,812	0,142
60	0,193	0,203	0,833	0,893	0,322	0,876
61	0,617	0,784	0,308	0,865	0,129	0,910

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4997	0,639	0,049	0,308	0,725	0,328	0,938
4998	0,572	0,080	0,857	0,051	0,439	0,213
4999	0,028	0,245	0,603	0,757	0,663	0,414
5000	0,793	0,765	0,023	0,284	0,546	0,590