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The Relationship Between Health Systems and Health Expenditures In OECD Countries: An Econometric Approach*

OECD Ülkelerinde Sağlık Sistemleri ve Sağlık Harcamaları İlişkisi: Ekonometrik bir Yaklaşım**

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Abstract: This study aims to examine the determinants of health expenditures in OECD countries and and assess the impact of health systems on these determinants. In this direction, it is constructed a panel cointegration regression model with the annual data of 27 OECD countries between 1995-2020 years. In addition, since this study aims to understand the effects of health systems on the determinants of health expenditures, health systems are modeled separately. For this reason, in the first model it was examined the data of 27 OECD countries. In the second model, it is modeled the data of 14 countries that have adopted the Beveridge health and in the third model, it modeled the data of 13 countries that have adopted the Bismarck health system. In order to obtain accurate results from the analyses, it was conducted the tests to the that required by panel cointegration analysis. In this direction, first of all, homogeneity and cross-section dependence tests were performed to the series. According to result of these tests, it was determined that the series are heterogeneous and they have cross-section dependence. Therefore, second generation panel unit root tests based on heterogeneity were applied to the series. The unit root tests revealed that the series were stationary at the same degree. So afte that models were constructed. Then homogeneity and cross-section dependence tests were conducted for the models and it was revealed that all three models were heterogeneous and have cross-section dependence. In the next stage, the models were tested for cointegration. Finally in the last stage, it was evaluated the results of the CUP-FM cointegration estimator. As a result of this estimation, it is revealed that health systems have an impact on the determinants of health expenditures.

Keywords: Health Expenditures, Beveridge, Bismarck, Panel Data, Cointegration

&

Özet: Bu çalışmada OECD ülkelerinde sağlık harcamalarını belirleyen etkenler ve sağlık sistemlerinin bu etkenler üzerinde etkili olup olmadığı anlaşılmaya çalışılmıştır. Bu doğrultuda 27 OECD ülkesinin 1995-2020 yılları arasındaki yıllık verileri ile panel eşbütünleşme regresyonu modeli oluşturulmuştur. Bunun yanında bu çalışmada; sağlık sistemlerinin, sağlık harcamalarının belirleyicileri üzerindeki etkilerinin anlaşılması amaçlandığı için sağlık sistemleri ayrı ayrı modellenmiştir. Bu nedenle birinci modelde 27 OECD ülkesinin verileri incelenmiştir. İkinci modelde ise Beveridge sağlık sistemini benimseyen 14 ülkenin verileri, üçüncü modelde Bismarck sağlık sistemini benimseyen 13 ülkenin verileri modellenmiştir. Analizlerden doğru sonuçlar alabilmek için çalışmada kullanılan serilere ve kurulan modellere panel eşbütünleşme analizinin gerektirdiği testler uygulanmıştır. Bu doğrultuda öncelikle serilere homojenlik ve yatay kesit bağımlılık testleri yapılmış ve bu testler sonucunda serilerin heterojen oldukları ve yatay kesit bağımlılığına sahip oldukları saptanmıştır. Buradan hareketlere serilere heterojenliği esas alan ikinci nesil panel birim kök testleri uygulanmıştır. Birim kök testleri sonucunda serilerin aynı derecede durağan olduklarının anlaşılması üzerine modeller oluşturulmuş ve bu sefer modellere yönelik homojenlik ve yatay kesit bağımlılık testleri yapılmış ve 3 modelin de heterojen olduğu ve yatay kesit bağımlılığına sahip oldukları ortaya konmuştur. Sonraki aşamada ise modellere kointegrasyon testleri yapılmıştır. Çalışmanın son aşamasında da CUP-FM eşbütünleşme tahmincisinin sonuçları değerlendirilmiştir. Bu tahmin sonucunda ise sağlık sistemlerinin sağlık harcamalarını belirleyen etkenler üzerinde etkili olduğu ortaya konmuştur.

Anahtar Kelimeler: Sağlık Harcamaları, Beveridge, Bismarck, Panel Veri, Eşbütünleşme

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1. Introduction

Since the 1980s, both developed and developing countries have increased their expenditures on healthcare goods and services. That has made it necessary to evaluate this field from an economic perspective. Therefore, this study focuses on health expenditures in OECD countries.

There are many reasons for the increase in health expenditures in OECD countries. The most important of these reasons are the increase in income, the increase in life expectancy at birth, the development of health technology and the increase in the share of the elderly population in the total population.

This increase in health expenditures leads to an improvement in health indicators but on the other hand this increase, poses a problem for the sustainability of the health sector. Therefore, in order to ensure this sustainability, health financing needs to be well managed. At this point, health systems come to the fore. So, in this study, two prominent health systems, Beveridge and Bismarck health systems affects on the determinants to the health expenditure are analyzed.

Beveridge and Bismarck health systems develop different policies for the same purpose. The main points of difference between these two health systems are the method of providing health financing, the proportion of private health institutions and whether health policies are determinated by central or regional management.

In the Beveridge health system, health expenditures are financed from the general budget. On the other hand, in the Bismarck health system, health expenditures are financed by premiums collected from employees and employers. Another differance between the Beveridge and Bismarck health systems is that the proportion of private health institutions. In the In the Beveridge health system the rate of private health institutions is lower than in the Bismarck health system. Morever, in the Beveridge health system, health policies are determined by central administration while in the Bismarck health system, decisions are taken by regional administrations. As a result, Beveridge and Bismarck health systems differ in many important aspects. Therefore, this study focuses on whether these differences affect health expenditures. Therefore, in this study, it is conducted an econometric analysis to understand the impact of these two health systems on the determinants of health demand.

At this point it was established 3 models in this study. In the first model, the data of 27 OECD countries were analyzed without any health system distinction. In the second model, it was analyzed the data of 14 countries adopting the Beveridge health system and in the third model, it is anlayzed the data of 13 countries adopting the Bismarck health system and the results are evaluated. In that way, it was discussed whether health system effective on the determinants of health demand. In briefly, this study aims to understand determinants of health expenditures and whether health demand differ depending on health systems in OECD countries.

2. Health Expenditures

Health Expenditures are expenditures that made by public or private sector to protect and improve health and its industry. In terms of scope, it includes expenditures and investments for medical care, public health, health management and regulations (Food and Health Bureau, 2022). There are also different definitions for health expenditure made by international organizations such as the World Health Organization (WHO) and the OECD.

According to the World Health Organization, health expenditures refer to the expenditures made for the provision of preventive and developmental health services, family planning activities, nutrition activities and health assistance in emergency situations (World Health Organization, 2022).

On the other hand, according to the OECD's definition, health expenditures are discribed as activities aimed to protect and improve personal and collective health. According to the OECD definition, health

expenditures are largely carried out by the states. However, private health institutions, voluntary health organizations and insurance companies expenditures on health also evaluated within the total health expenditure (OECD, 2020).

As a result, although different institutions define health expenditures in different ways, the common thread to all this is health expenditures prioritize health itself. Expenditures which indirectly affect health in case primary objective is different from this focus, does not included in health expenditures. Therefore, at this point it can be claimed that although there are different definitions on it, there is no differentiation in the scope of the health expenditures as a base.

2.1. Health Expenditures in OECD Countries

In order to understand better the effectiveness of health policies, it is important to observe the changes in GDP per capita and health expenditures in OECD countries over the years and to associate these changes with health indicator. Therefore, it would be useful to examine these data at this stage.

In both theoretical and empirical studies, it is accepted that GDP per capita is the most important determinant of health expenditures. Accordingly, Figure 1 shows the relationship between GDP per capita and health expenditures per capita in OECD countries in 2020. As can be seen from this figure, there is a very close relationship between health expenditures and GDP.

Source: OECD and World Bank

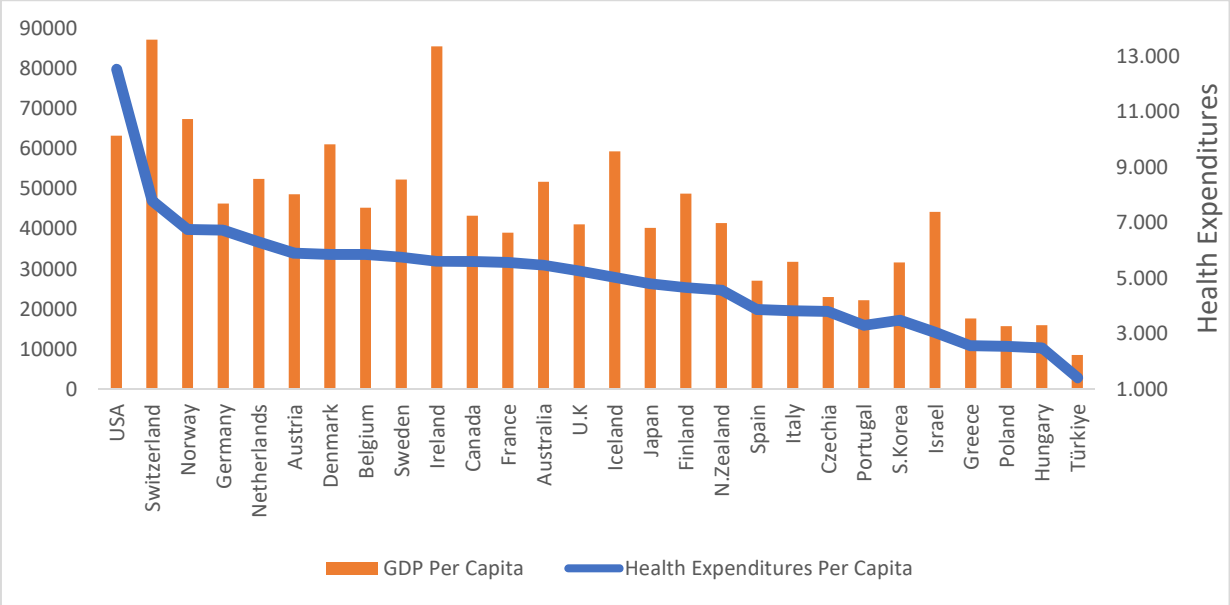

Figure 1: GDP Per Capita and Health Expenditure Per Capita In Selected OECD Countries In 2020

As can be seen on Figure 1, with a few exceptions, countries which have high GDP per capita have high health expenditures per capita and countries with relatively low GDP per capita have low health expenditures per capita. For the purpose of better understanding the relationship between these two phenomena, it is necessary to look how changes those two variables recorded since the 1990s, when health reforms came to the fore.

According to World Bank data, in OECD countries the average GDP per capita was $ 16,978 in 1990. This has reached to $23,008 in 2000, to $35,025 in 2010 and finally to $38,116 in 2020. As a result, if looked at the general trend, it can be seen that in OECD countries the average GDP per capita between1990 to 2020 shows an upward direction. (World Bank, 2021).

There is also an upward trend in average health expenditures per capita in OECD countries. In 1990, health expenditures per capita were 1,176 dollars, which has increased to 1,805 dollars in 2000, to 3,092 dollars in 2010 and finally to 4,264 dollars in 2020 (OECD, 2021). Therefore, both GDP per capita and health expenditures per capita are on an upward trend in OECD countries.

As a result, it is observed that both GDP and health expenditures increase in OECD countries, while health expenditures increase more than GDP. But it is also necessary to look at whether these increases differ from country to country and whether this change increases the life expectancy at birth. Consequently, Figure 2 shows how many times GDP and health expenditures per capita have increased in selected OECD countries from 1990 to 2020, and how many years the life expectancy at birth has increased.

Source: OECD and World Bank

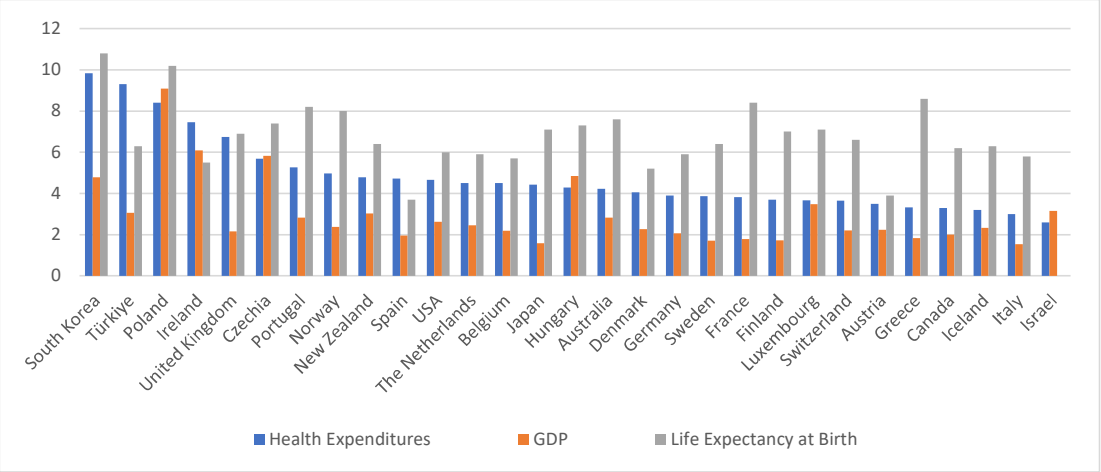

Figure 2: Change in GDP, Health Expenditure and Life Expectancy At Birth In Selected OECD Countries From 1990 to 2020

Accordingly to the Figure 2, South Korea is the country that increased its health expenditures the most from 1990 to 2020. South Korea increased its health expenditures per capita by 9.3 times while increased life expectancy at birth in by 10.8 years. Also, Poland increased its health expenditures by 8.41 times, and this increased life expectancy at birth by 10.2 years. On the other hand, although Türkiye and Ireland have increased their health expenditures at a high rate, they have not been able to increase their life expectancy at birth by much. Because these countries in 2020 they are still behind other countries in health expenditures per capita (OECD, 2021).

Austria, Sweden, France, Finland, Luxembourg, Sweden, Greece, Canada, Iceland, and Italy did not increase their spendings on health as much as the other countries. But life expectancy at birth increased significantly in these countries. Therefore, it can be concluded as increases in health expenditures are not sufficient for good health. For good health, health expenditures should be supported by a good health system (Karim, Eikemo and Bambra 2010).

2.2. Health Indicators in OECD Countries

Population over the age of 65 is considered as an important economic indicator since it shows both dependency ratio as well as enables a better analysis of health demand. A high level of this ratio means the elderly population has a significant share in the country. And it is accordingly expected to increase health expenditures and demand. This causality is also mutual. As a matter of fact, due to the result of increasing health expenditures, the life expectancy at birth is increasing, and this also increases the share of the rate aged 65 and over in the total population. While the proportion of the population over the age of 65 in OECD countries was 11.36% in 1990 indeed, this rate has increased to 12.81% in 2000, to 14.41% in 2010 and finally to 17.46% in 2020. This creates several problems for the insurance systems by increasing the dependent population and it also trends upward the health expenditures due to the increase in the elderly population. In this sense, policies should be developed to prevent this situation in OECD countries.

On the other hand, life expectancy at birth is considered as an important indicator for understanding the extent to which social health has improved. Therefore, Figure 3 shows the relationship between health expenditures and life expectancy at birth in selected OECD countries in 2020.

Source: OECD and World Bank

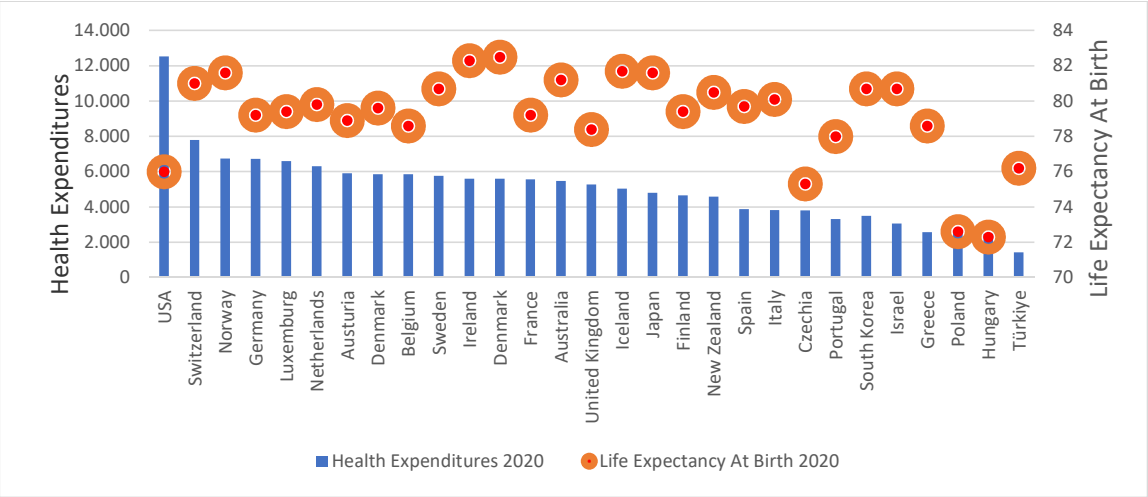

Figure 3: Relationship Between Health Expenditure and Life Expectancy at Birth In Selected OECD Countries

As can be seen from the figure, there is a positive correlation between these two variables. Over the years due to the rising health expenditures, life expectancy at birth has increased. As a matter of fact life expectancy at birth increased from 74.5 in 1990 to 76.93 in 2000, to 79.15 in 2010 and finally to 79.7 in 2020 in OECD countries. As a result, in OECD countries both the proportion of the population over the age 65 and the life expectancy at birth are on increase by years. However, this increase occurs at different levels from country to country. In this sense, in order to a better understanding of this difference, health expenditures and health indicators in the selected OECD countries have been listed below in 1990 and in 2020.

Table 1: Health Expenditures and Health Indicators In Selected OECD Counties (1990-2020)

	Health Expenditure Per Capita		*Share of health expenditures in GDP (%)*		*Life Expectancy at Birth*		*Rate of Aged 65 Vver in Total Population*	
	1990	***2020***	***1990***	***2020***	***1990***	***2020***	***1990***	***2020***
USA	2.685	12.530	11,2	16,77	75,4	75,5	12,5	16,89
Switzerland	2.136	7.787	7,6	11,29	77,5	81,1	14,6	18,73
Norway	1.361	6.748	7,1	10,52	76,6	81,6	16,3	17,73
Germany	1.725	6.731	8	11,70	77,4	79,2	14,9	21,86
Luxemburg	1.476	6.594	5,3	5,37	75,7	79,4	13,4	14,56
Netherlands	1.400	6.299	7	10,13	77,1	79,8	12,8	19,64
Austuria	1.482	5.899	7,7	10,43	75,8	78,9	14,9	19,15
Denmark	1.441	5.849	8	9,66	74,9	79,6	15,6	20,04
Belgium	1.302	5.846	7,1	10,66	76,2	78,6	14,9	19,26
Sweden	1.490	5.754	7,2	10,87	77,7	80,7	17,8	20,06
Ireland	752	5.604	5,6	6,68	74,8	82,3	11,4	14,47
Canada	1.700	5.595	8,4	10,84	77,5	82,5	11,3	17,99
France	1.450	5.564	8	11,06	77	79,2	14	20,56
Australia	1.166	5.468	6,5	9,91	76,9	81,2	11,1	16,32
United Kingdom	783	5.268	5,1	10,15	75,7	78,4	15,7	18,65
Iceland	1.575	5.034	5,6	8,64	78,1	81,7	11,4	14,58
Japan	1.089	4.800	5,8	10,74	78,9	81,6	12,1	28,79
Finland	1.262	4.662	7,3	9,15	75,1	79,4	13,4	22,49
New Zealand	1.023	4.577	6,7	9,74	75,5	80,5	11,2	15,56
Spain	821	3.870	6,1	9,13	76,9	79,7	13,6	19,65
Italy	1.274	3.819	7	8,67	77,1	80,1	14,9	23,37
Chezia	491	3.803	3,7	7,83	71,5	75,3	12,5	20,05
Portugal	630	3.308	5,5	9,53	74,1	78	13,4	22,29
South Korea	356	3.493	3,6	8,16	71,7	80,7	5,1	15,69

Israel	1.162*	3.054	6,5	7,46	76,7	80,7	9,1	12,06
Greece	774	2.563	6,1	7,84	77,1	78,6	13,7	22,40
Poland	303	2.547	4,3	6,45	70,7	72,6	10,1	18,40
Hungary	589**	2.484	---	6,35	69,4	72,3	13,3	20,10
Türkiye	152	1.417	2,4	4,34	67,5	76,2	4,4	9,30

1995, ** 1991

Source: OECD and World Bank

According to the table, USA is the country have the highest health expenditures per capita and the highest ratio of health expenditures to GDP both in 1990 and in 2020. However, these high levels of health expenditures in the United States are not reflected in life expectancy at birth at the same rate. On the other hand, in Switzerland, Norway, Germany, Luxembourg, the Netherlands, Austria and Denmark, both the health expenditures per capita and the life expectancy at birth are high.. In this sense, it can be concluded that the increase in health expenditures alone does not lead to positive results in health outcomes. So Increases in health expenditures should be supported by a effective health system.

3. Health Systems

There are different health systems implemented in the world and these health systems have an important impact on health expenditures. Therefore, in order to understand this impact, it would be useful to know these health systems. Health policies may differ according to the economic, political, social, cultural and demographic characteristics of countries. But despite all these differences, there are two main health systems that are widely applied in the world. These systems are the Beveridge model financed by taxes and the Bismarck model financed by insurance premiums (Lameire, Joffe, and Wiedemann, 1994; Hörl, de Alvaro, and Williams, 1999).

The main differences between Beveridge and Bismarck health systems are the methods of providing health financing and the share of private health institutions in the health sector. In addition, the coverage of health insurance may also differ within the framework of the models. Table 2 shows the main differences between the Beveridge and Bismarck health systems, which are the most widely used in the world.

Table 2: Health Systems

Health System	***Beveridge***	***Bismarck***
Financing	Budget	Insurance Premiums
Coverage	Whole Population	Premium payers and their families
Management	Central government Heavy public intervention	Decentralized regional governance Low public intervention
Costs	Prices under control, costs relatively low	Prices are flexible, costs relatively high
Health Services	Most hospitals are state-owned	Public and private hospitals provide services together
Advantages	-Easy access to health services -Free health care -There is no competition between public and private health institutions so costs are low	-Waiting time is short -The existence of local organization ensures more effective results at the regional level -Because it is premium-based, low-income earners pay lower premiums
Disadvantages	-Waiting times are long	-Increase number of pensioners may create problems in financing

3.1. Beveridge Model

In the Beveridge health system model, health expenditures are financed from the tax revenues of the central budget. In this sense, health care is financed like an ordinary public services such as security, lighting, road construction, etc. (Musgrove, 2000).

The main principles of the Beveridge system are as follows (HCA, 2022);

- Financing with tax revenue

- Public health services
- Central management
- Covarege all population
- Free or low-cost health services

In the Beveridge system, health services are largely provided by state-owned health institutions. In this sense, health service is basically a service provided without profit motive. Health workers are also largely employed by the public sector. Nevertheless, private health institutions also provide services in this system. However, the private health institutions fees are controlled by public authorities (HCA, 2022).

In the Beveridge system, health policies are determined by the central government and the decisions include all the health institutions. At this sense, private health institutions' services are also determined by the central authority (Isik, Isik, and Kiyak, 2005).

In the Beveridge system, health care is a fundamental human right. Everyone in society has this right, regardless of their contribution to health financing or whether they are employed or not. In this sense, the Beveridge health system covers the entire population, not just workers and their families. Therefore, everyone benefits equally from health services. In addition, in the Beveridge system, health services are free or low cost. As a matter of fact, health service fees are very low in Sweden and these fees are kept at a certain level by public authorities (Or, Cases, Lisac, Vrangbaek, Winblad and Bevan, 2010).

Besides advantages of Beveridge system, there are also several criticisms of it. One of them is the long waiting times for health services (Harrison, 1997). Another criticism of the Beveridge system is that health services may be disrupted during periods of economic crisis. The decrease in tax revenues in times of crisis leads to a decrease in the financing of health services (Kutzin, 2011).

In summary, in the Beveridge system, health service is a fundamental right for all population that should be provided. These services finance with the tax revenues of the central budget not from revenues from health services itself. In this sense, countries that adopt this system do not need to increase their revenues from the health sector in order to ensure the sustainability of health services. Therefore, in this system health services are free or cheap.

Finally, some of the countries that have utilize the Beveridge health system are the UK, Ireland Norway Finland, Sweden, Iceland, Spain, Portugal, Italy, Greece, Denmark, Australia and New Zealand (HCA, 2022).

3.2. Bismarck Model

In the Bismarck model, health services are financed by insurance premiums which taken from workers and employers (Busse, Blümel, Knieps, and Bärnighausen, 2017). The main principles of the Bismarck system are as follows (HCA, 2022);

- Financing with premiums
- Private and public health services
- Regional management
- Compulsary insurance
- Low-cost health services

In the Bismarck model, the amount of insurance premiums are depend on income. Therefore, peoples' contributions to social insurance are not equal and people who have higher income pay higher premiums. At this point, it can be said that the Bismarck health system model acts on the principle of equal service despite different premiums.

On the other hand, the Bismarck system is financed by employees and employers, but health care covers all citizens. Received premiums are used for various funds like sickness fund so that non-working or retired citizens can also benefit from public health services free of charge. For example, in Germany, received premiums are used to provide health care services for the uninsured people at lower prices. Therefore, the Bismarck model also has a high coverage (Busse, Blümel, Knirps, and Bärnighausen, 2017).

In the Bismarck model, health services are largely performed by public health institutions just like Beveridge model. However, the proportion of private health institutions is higher in the Bismarck model than in the Beveridge model. This is an important difference between the Beveridge and Bismarck health systems. (Or, Cases, Lisac, Vrangbaek, Winblad, and Bevan, 2010).

Another important difference between the Beveridge and Bismarck health systems is about insurance's compulsary. In the Bismarck system, premium payments are compulsory. Premiums are taken directly from the payroll of wage. Therefore people have no right to withdraw from the public health insurance system. However, in addition to public insurance, people have right to have private insurance too (Tulchinsky, 2018).

In this system, health policies are not determined from a central management for the whole country. Unlike the Beveridge health system, regional managements are stronger in this system (World Health Organization, 2008). Regional management in the health system accelerates the processes of changing health policies according to the characteristics of the region and provides opportunities for the implementation of innovations and increases the effectiveness of health policies (Saltman, Bankauskaite, and Vrangbaek, 2007).

Besides advantages, the Bismarck health system has disadvantages as well. The most important disadvantage of the Bismarck health system is that premiums are high in some countries. Especially in times of economic crisis, due to rising unemployment, sickness fund beneficiaries get rise. This may lead to higher premiums paid by insured people. Another important criticism of Bismarck is that costs are higher than in the Beveridge system (Vera, 2019).

In summary, the Bismarck health system model is a health system based on premium payments and health policies determined by regional authorities. Just like in the Beveridge health system, health services in here also are provided at low cost and cover the entire population. The system is adopted by countries such as Germany, Austria, Belgium, Japan, Switzerland, France, the Netherlands and Türkiye.

4. Cointegration

Cointegration is the integrated movement of two or more variables in the same direction in the long run. The fact that these variables move in different directions in the short run does not eliminate the existence of cointegration relationship. Because cointegration is based on the long-run relationship (Hendry and Juselius, 2000).

In order to apply the cointegration method, the series do not need to be stationary, it is sufficient if they can become stationary at the same degree. In this aspect, it is not necessary to take the difference of the series to make it stationary. However, in order to avoid the problem of spurious regression, the characteristics of the variables should be understood correctly in cointegration analysis (Meuriot, 2015).

Therefore, to avoid erroneous conclusions, homogeneity and cross-section dependence tests should be applied to each series and the appropriate unit root test should be determined according to the results of these tests. After applying the appropriate unit root test, if the series are found to be stationary at the same degree, at this stage the model can be constructed.

In this case, firstly, homogeneity and cross-section dependence tests should be performed for the model. Then, appropriate cointegration tests are determined by results of homogeneity and cross-section dependence tests. If cointegration tests show that the variables are cointegrated, cointegration estimations should be applied and the results should be evaluated.

5. Literature Review

In the literature, to reveal the determinants of health expenditures, many studies have been conducted by using different variables. However, income is the most used variable among these variables. In addition, investments, life expectancy at birth and population over 65 have also been widely used in studies to determine factors affecting health expenditures. In this part of the study, it is shown the important studies in this field.

Table 3: Literature Review

Researcher(s)	Period and Country	Variables	Conclusion
Joseph P. Newhouse (1977)	13 developed countries (1972)	GDP, Private sector health expenditures, Public health expenditures	Income is most important explanatory factor for changes in health expenditures.
Blomqvist and Carter (1996)	24 OECD countries (1960-1991)	Health expenditures per capita, GDP per capita, Population over the age of 65	the population over the age of 65 significantly affects health expenditures.
Herwartz and Theilen (2003)	19 OECD countries (1960-1997)	Health expenditures per capita, GDP per capita, Population over the age of 65	Income is the most important determinant of health expenditures.
Clemente, Marcuello, Montanes and Pueyo (2004)	22 OECD countries (1960-1977)	Public health expenditures, Private health expenditures, GDP	In the long run, both public and private health expenditures are cointegrated with GDP.
Dreger and Relmers (2005)	21 OECD countries (1975-2001)	Health expenditures, GDP, Life expectancy at birth, Infant mortality rate, Elderly population rate	-Income is not the only determinant of health expenditures. -Life expectancy at birth, infant mortality rates and elderly population also increase health expenditures.
Baltagi and Moscone (2010)	20 OECD countries (1971-2004)	Health expenditures per capita, GDP per capita, Dependent population rate	Variables are cointegrated in the long run.
Amiri and Ventelou (2012)	20 OECD countries (1970-2009)	Health expenditures, GDP	There is a rmutual causality between health expenditures and GDP.
Giang Phi (2017)	35 OECD countries (2000-2013)	GDP per capita, Private health investments, Number of doctors per capita, Number of hospital beds per capita, Alcohol consumption per capita, Cigarette consumption per capita, population over 65 years, Life expectancy at birth	-There is a strong relationship between GDP per capita and health expenditures per capita. -Population over 65 and life expectancy at birth are important factors affecting health expenditures. -Increase in alcohol and cigarette consumption does not affect health expenditures much.
Feng, Watt, Charlesworth, Marsden, Roberts ve Sussex (2017)	18 OECD countries (1982-2012)	GDP, Health prices, Population over 65 years, Mortality rates, Average personal income, Expenditure on medication	-There is a relationship between health expenditures and income in the long run. -There is a positive correlation between population over 65 years and health expenditures. -Other variables were found insignificant and so were not evaluated.
Hyejin, Oh and Meng (2019)	20 OECD countries (1960-1997)	GDP, Health expenditures	The variables are cointegrated and health services are luxury goods in 13 out of 14 countries.

6. Data

In this study, cointegration analysis is performed with the data belongs to 27 OECD countries between 1995 and 2020 years. Three models were established in the study. The first model includes 27 OECD countries, the second model includes 14 OECD countries adopting the Beveridge health system among these 27 countries, and the third model includes 13 OECD countries adopting the Bismarck health system among these 27 countries.

The reason why Beveridge and Bismarck health systems are modeled separately is to understand which health system prioritizes social health and which one prioritizes the total profit. Analyses were conducted with E-views 12 and GAUSS 2022 programs and logarithms of variables were taken to ensure that the series are normally distributed.

In the second model, the analysis is performed with the countries adopting Beveridge model. They are the United States of America, the United Kingdom, Denmark, Finland, Ireland, Spain, Sweden, Greece, Italy, Canada, Norway, Portugal, Greece, Australia and New Zealand. In the third model the analysis is applied on the countries adopting Bismarck model on their system. They are Germany, Austria, Belgium, France, the Netherlands, Switzerland, Luxembourg, Türkiye, Japan, Czechia, Hungary, Poland and South Korea.

6.1. Variables

The study is conducted to determine the factors affecting health expenditures. The variables in cases were determined by utilizing the economics literature. Table 4 shows the variables used, the abbreviations of the variables and the factors represented by the variables.

Table 4: Variables

Variables	***Abbreviation***	***Variable Type***	***Represented***
Out of Pocket Expenditure Per Capita	(OOP)	Dependent	Health Demand
Total Health Expenditures Per Capita	(HE)	Independent	Health Investments
GDP Per Capita	(GDP)	Independent	Income
Life Expectancy at Birth	(LE)	Independent	Human
Population over the age of 65	(P)	Independent	Elderly Population
Sum of the Number Hospital Beds and Doctors	(HD)	Independent	Health Supply

In this base, the health expenditures are analyzed from both supply and demand perspectives. The dependent variable out-of-pocket expenditures per capita represents health demand, while the sum of the number of hospital beds and doctors per 1000 people represents health supply. Indeed, theoretical and empirical studies in the literature emphasize that developments in health supply will increase the demand for health (Shain and Roemer, 1959; Clemente, Marcuello, Montanes and Pueyo 2004; Hosoya, 2014; Okunade, Karakuş and Okeke, 2004; Tchoe and Nam, 2010; Phi 2017).

Another important variable associated with health expenditures is income. Studies in the literature have shown that rising income increases health expenditures (Kleiman, 1974; Newhouse, 1977; Hyejin, Oh, and Meng, 2019). In this sense, the income variable was added to the model based on the literature.

In the model, the variable of total health expenditures per capita represents health investments. Public and private sector investments in health are expected to increase the demand for health services (Newhouse, 1977). For this reason, health expenditures per capita are used as an independent variable in this model. On the other hand the life expectancy at birth variable was added to the model based on the hypothesis that human development will increase the demand for health services. According to that hypothesis, improvements in health services have an impact on the increase in life expectancy at birth and this situation creates health demand (Poullier, Hernandez, Kawabata and Savedoff 2002).

Another variable used in the study is the ratio of the population over 65 years. As the elderly population increases, demand for health services also increases (Di Matteo, 2005; Phi 2017). So in this study, since it is taken into account the proportion of elderly population increase in OECD countries, this variable was used in the model.

Another important factor affecting health expenditures is health systems. But health systems were not used as a variable in the model. However, countries that adopted the Bismarck and Beveridge health systems were modeled separately. So it was aimed to understand whether there is a difference in health expenditures due to health systems.

6.2. Model

The cointegration equations used in all three models are as follows.

$$logOOP_{it} = a_i + (\beta_1 logHE_{it} + \beta_2 logGDP_{it} + \beta_3 logLE_{it} + \beta_4 logP_{it} + \beta_5 logHD_{it}) + \lambda_i F_t + \theta_t + \varepsilon_{it}$$

α_i: observable effects, γ_t: unobservable effects , δ_t: cross-section dependence

In below descriptive statistics for all three models are shown:

Table 5: Descriptive Statistics

	Arithmetic Mean	***Median Mean***	***Max. Value***	***Min. Value***	***Standart Error***
OECD					
Out of Pocket Expenditure Per Capita	536	507	1838	52	272.15
Total Health Expenditures Per Capita	36268	33585	123678	2897	21501
GDP Per Capita	3115	2813	12530	175	1710
Life Expectancy at Birth	76.63	77.05	82.10	65.40	3.12
Population over the age of 65	15.60	15.74	28.79	5.45	3.69
Sum of the Number Hospital Beds and Doctors per Capita	8.88	8.51	17.26	3.44	2.79
Beveridge					
Out of Pocket Expenditure Per Capita	583	572	1229	126	201
Total Health Expenditures Per Capita	37868	35510	102913	11526	17478
GDP Per Capita	3301	2920	12530	1008	1753
Life Expectancy at Birth	77.61	78.21	81.6	71.6	2.24
Population over the age of 65	14.53	15.93	23.37	2.25	5.79
Sum of the Number Hospital Beds and Doctors per Capita	7.78	7.21	12.37	4.21	1.88
Bismarck					
Out of Pocket Expenditure Per Capita	501	436	1838	52	332
Total Health Expenditures Per Capita	34689	31126	123678	2897	25402
GDP Per Capita	2945	2693	7787	175	1691
Life Expectancy at Birth	75.62	76.10	82.10	65.4	3.66
Population over the age of 65	15.47	15.67	28.79	5.45	4.21
Sum of the Number Hospital Beds and Doctors per Capita	3.39	3.21	9.08	1.04	1.6

As can be seen from the table, the mean values of the variables in the 3 models are very close to each other. However, in Beveridge model, GDP per capita and health expenditures per capita are higher than the Bismarck model. On the other hand, the sum of the number of beds and doctors per capita in the Beveridge model is almost double of the one in Bismarck model.

7. Emprical Results

7.1. Unit Root Tests

The series are tested for homogeneity and cross-section dependence. For the homogeneity test, the Delta test which is developed by Pesaran and Yamagata is applied (2008). On the other hand, to understand if the series have cross-section dependence it is implemented Breusch Pagan LM, Pesaran CDlm, Pesaran CD and Lmadj (Puy) tests. Table 6 shows the results of homogeneity tests for the series.

Table 6: Cross-section Dependence Tests

	Breusch Pagan LM	***Pesaran CDlm***	***Pesaran CD***	***Lmadj (Puy)***
Ln_out of pocket	508.887***	4.760***	-2.316**	17.392***
Ln_GDP	1815.447***	52.279***	2.220**	21.016***
*Ln_* health_expenditures	687.902***	11.271***	-2.556***	18.583***
*Ln_* life expectancy	739.498***	13.148***	-0.192	28.419***

*Ln*_ over_65_years_population	593.699***	7.845***	2.294**	32.404***
*Ln*_ Ln_Sum of the Number Hospital Beds and Doctors per Capita	567.064***	6.876***	-0.360	1.946**

According to the results of the tests, all the series are heterogeneous and all have the cross-section dependence. Therefore, it should be applied to the second generation panel unit root tests based on heterogeneity to the series. So in this study, the second generation PANIC (PPC), CIPS and PANIC KPSS (PS-PPC) are used to test the stationarity of the series.

The general equation of the second generation panel unit root tests is as follows;

$$model\ with\ constant; \qquad y_{it} = a_{it} + \lambda_i' f_t + e_{it}$$

$$model\ with\ constant\ and\ trend \quad y_{it} = a_{it} + b_{it} + \lambda_i' f_t + e_{it}$$

The unit root test results can be seen in Table 7.

Table 7: Unit Root Tests

	Constant			***Constant and Trend***		
Level	***PS-PPC KPSS***	***CIPS***	***PPC***	***PS-PPC***	***CIPS***	***PPC***
Ln_out of pocket	6.306*** (0.000)	-2.056	0.456 (0.648)	6.872*** (0.000)	-2.204	1.153 (0.248)
Ln_GDP	6.184*** (0.000)	-1.948	-1.225 (0.220)	4.966*** (0.000)	-2.305	-1.158 (0.246)
Ln_health_expenditures	5.168*** (0.000)	-1.822	2.152** (0.031)	4.184*** (0.000)	-2.305	1.153 (0.248)
Ln_life expectancy	2.558*** (0.005)	-1.680	0.613 (0.539)	5.418*** (0.000)	-1.951	1.790* (0.073)
Ln_over_65_years_population	2.279** (0.011)	-1.880	-0.057 (0.954)	6.869*** (0.000)	-2.008	-0.172 (0.862)
Ln_Sum of the Number Hospital Beds and Doctors per Capita	7.668*** (0.000)	-1.885	-1.146 (0.143)	6.270*** (0.000)	-2.339	0.317 (0.750)
First Difference						
D_Ln_out of pocket	-1.892 (0.971)	-2.732***	5.478*** (0.000)	0.198 (0.422)	-2.809**	3.082*** (0.002)
D_Ln_GDP	-2.032 (0.979)	-2.672***	4.792*** (0.000)	1.440* (0.076)	-2.899***	3.972*** (0.000)
D_Ln_health_expenditures	-0.846 (0.968)	-2.792***	7.687*** (0.000)	-1.612 (0.947)	-2.960***	3.409*** (0.000)
D_Ln_life expectancy	-0.773 (0.780)	-2.473***	INF*** (0.000)	1.021 (0.154)	-2.626*	11.195*** (0.000)
D_Ln_over_65_years_population	-3.894 (1.000)	-2.299**	3.252*** (0.001)	-2.421 (0.992)	-2.568	INF*** (0.000)
D_Ln_Sum of the Number Hospital Beds and Doctors per Capita	1.076 (0.141)	-3.196***	3.850*** (0.000)	0.329 (0.371)	-3.299***	1.176* (0.077)

1-)The number of lags used in the tests is 4. The factor criterion used in the PANIC test is ICP2 and the maximum number of the factors is taken as 2. The long-run Bartlett and Kurozumi rule is also used in the PANIC KPSS test.
2-) * significant at 10% level ** significant at 5% level * significant at 1% level**
3-) The values inside the parentheses express probability values.

In PANIC and CIPS tests, the null hypothesis means that the series have unit root. On the other hand, in the PANIC KPSS test, the null hypothesis means that the series are stationary. As a result of all the 3 tests, it is concluded that the series have unit root at the level and series are stationary at the first level. Therefore, at this stage it can be tested by the cointegration with the available series.

7.2. Homogeneity and Cross-Section Dependence Tests For Models

Some of the cointegration tests are sensitive about cross-section dependence, while others are not. Also some cointegration tests can be applied to homogeneous models while others can be applied to heterogeneous models. Moreover, cointegration estimators are also sensitive to homogeneity and cross-section dependence. Therefore, in order to choose the appropriate cointegration test and estimator, homogeneity and cross-section dependence tests should be performed on the models.

So in this study, homogeneity and cross-section dependence tests are applied to the models. The results of the homogeneity tests are shown in Table 8.

Table 8: Homogeneity Tests

	Delta Test		***Adapted Delta Test***	
	Statistic Value	***Prob.***	***Statistic Value***	***Prob.***
OECD Model	19.790***	0.000	22.994***	0.000
Beveridge Model	13.252***	0.000	15.398***	0.000
Bismarck Model	14.013***	0.000	16.282***	0.000

*** significant at 10% level ** significant at 5% level *** significant at 1% level**

In Delta homogeneity test, the null hypothesis means that the model is homogeneous and the alternative hypothesis means that the model is heterogeneous. On the other hand, here it can be seen that the probability values of the all three models are below 0.05. So, the null hypothesis should be rejected for all the three models. Therefore, this indicates that all three models are heterogeneous. In this case, it should be chosen cointegration tests and estimators that take heterogeneity into account.

Besides, the results of the cross-section dependence tests are shown in Table 9.

Table 9: Cross-Section Tests

	Breusch Pagan LM	***Pesaran CDlm***	***Pesaran CD***	***Lmadj (Puy)***
OECD Model	625.375*** (0.000)	8.997*** (0.000)	6.824*** (0.000)	13.908*** (0.000)
Beveridge Model	154.347*** (0.001)	3.405 (0.000)	5.711 (0.000)	4.972*** (0.000)
Bismarck Model	168.466*** (0.000)	7.243*** (0.000)	0.044 (0.482)	5.894*** (0.000)

*** significant at 10% level ** significant at 5% level *** significant at 1% level**

In the Breusch Pagan LM, Pesaran CDlm, Pesaran CD and Lmadj cross-section dependence tests, the null hypothesis means that there is no cross-section dependence in the model, while the alternative hypothesis means that there is cross-section dependence. In this sense, if the probability values of the tests below 0.05, it has to be a rejection of the null hypothesis. In other words, this means that there is cross-section dependence in the models.

According to the results of the tests, in the OECD model and Beveridge model, all four tests show that there is cross-section dependence in the models. In the Bismarck model, the results of three tests show that there is cross-section dependence in the model, while the Pesaran CD test reveals that there is no cross-section dependence in the model. However, considering that N is larger than T in the Bismarck model, it can be said that the efficient tests are Pesaran CDlm and Lmadj tests for the Bismarck model. Therefore, it can be concluded that the Bismarck model also has cross-section dependence.

As a result, according to the cross-section dependence tests, there is cross-section dependence in all three models. Therefore, the second generation cointegration tests and estimators should be performed for these three models.

7.3. Cointegration Tests

As a result of the tests, all three models of OECD, Beveridge and Bismarck models are heterogeneous and they have cross-section dependence. Therefore, in this study, second generation ECM (Westerlund 2007), Durbin H. (Westerlund 2008) and LM with Breaks panel cointegration tests were conducted for these three models. The results of the tests are shown in Table 10.

Table 10: Cointegration Tests

	Constant			***Constand and Trend***		
	ECM	DH	LM	***ECM***	DH	LM
OECD Model	-3.571***	3.924***	------	-2.155**	3.568***	-1.853**
Beveridge Model	-2.096**	5.985***	------	-4.975***	4.427***	-2.439***
Bismarck Model	5.903***	1.786**	------	4.537***	1.441**	-3.717***

*** significant at 10% level ** significant at 5% level *** significant at 1% level**

In ECM, Durbin H. and LM with breaks panel cointegration tests, the null hypothesis mean that there is no cointegration and the alternative hypothesis mena that there is cointegration. According to all three tests, there is cointegration in the OECD, Beveridge and Bismarck models.

7.4. Cointegration Estimates

Since all three models are heterogeneous and have cross-section dependence, second generation panel cointegration tests are applied for models. According the results of the tests, it reveals that the all 3 models are cointegrated. At this stage, CUP-FM, OLS-cd, BA-OLS, IFE, CCE and FAR cointegration estimations were performed to understand the effects of independent variables on the dependent variable in these cointegrated models. Table 11 shows the results of CUP-FM, OLS-cd, BA-OLS and IFE cointegration estimates. The results of CCE and FAR cointegration estimates are not included in the table since the variables are found insignificant.

Table 11: Cointegration Estimates

OECD				
	OLS-cd	**CUP-FM**	**BA-OLS**	**IFE**
GDP Per Capita	0.555***	1.388***	1.429***	0.078***
Total Health Expenditures Per Capita	0.731***	1.487***	1.549***	0.755***
Life Expectancy at Birth	0.084***	0.139***	0.181***	4.674***
Population over the age of 65	0.089***	0.069***	0.090***	-0.335***
Sum of Nomber Hospitel Beds and Doctors Per Capita	0.384***	0.803***	0.852***	-0.028***
Beveridge				
GDP Per Capita	0.598***	1.389***	1.436***	0.132***
Total Health Expenditures Per Capita	0.233***	0.585***	0.624***	0.609***
Life Expectancy at Birth	0.429***	1.063***	1.129***	2.926***
Population over the age of 65	0.477***	0.963***	1.010***	0.137*
Sum of Nomber Hospitel Beds and Doctors Per Capita	0.082***	0.340***	0.368***	-0.024***
Bismarck				
GDP Per Capita	0.736***	1.444***	1.557***	0.052*
Total Health Expenditures Per Capita	0.582***	1.013***	1.078***	0.557***
Life Expectancy at Birth	0.058***	-0.017	-0.007	8.080***
Population over the age of 65	0.250***	0.499***	0.528***	-0.521***
Sum of Nomber Hospitel Beds and Doctors Per Capita	0.447***	0.806***	0.813***	-0.008

*** significant at 10% level ** significant at 5% level *** significant at 1% level**

It is considered that the most efficient estimator is the OLS-cd. So in this study, it is interpreted the results of OLS-cd estimator. According to the results, GDP per capita is one of the most important determinant of health demand in all 3 models. In fact, 1% increase in GDP per capita increases out-of-pocket health

expenditures by 0.55% in the OECD model, 0.59% in the Beveridge model and 0.73% in the Bismarck model.

Another important determinant of health demand is the total health expenditures which represent health investments made by the public and private sectors. In the OECD model, 1% increase in health expenditures increases out-of-pocket health expenditures by 0.73%. This rate is 0.23% in the Beveridge model and 0.58% in the Bismarck model. Therefore, the power of health investments to create health demand is lower in the Beveridge model compared to the other two models.

When it looked other variables' affects, it can be seen that the life expectancy at birth and elderly population variables create health demand only in the Beveridge model. On ther other hand, the variable of the sum of the number of hospital beds and doctors per capita is effective most in the Bismarck model. The fact that in Bismarck model 1% change in the sum of the number of hospital beds and doctors per capita increases out-of-pocket health expenditures by 0.45%. This rate is only 0.08% in the Beveridge model. In this sense, it can be said that this variable, which represents health supply is a determinant of health demand in the Bismarck model, unlike the Beverdige model.

As a result, in the OECD model, the main determinants of health demand are GDP per capita and health expenditures which means health investments. In the Beveridge model, the main determinants of health demand are GDP per capita, life expectancy at birth and the proportion of elderly population. In the Bismarck model, GDP per capita, health expenditures and the sum of the number of hospital beds and doctors per capita are the main determinants of health demand.

8. Conclusion

In recent years, there have been remarkable increases in health expenditures due to income, life expectancy at birth, technology and population growth, and these increases have brought health economics to the forefront. Therefore this study focuses on the determinants of health expenditures in OECD countries and whether these determinants differ according to Beveridge and Bismarck health systems. In addition, the study tries to understand which health system prioritizes social welfare and which prioritizes the profits of capitalists. So in this study, the determinants of health demand are analyzed by modeling health systems separately.

According to the results, in the OECD model the determinants of health demand are GDP per capita, total health expenditures which means health investments and the sum of the number of hospital beds and doctors per capita. In the Beveridge model, these variables are GDP per capita, life expectancy at birth and the proportion of elderly population. In the Bismarck model, the determinants of health demand are GDP per capita, health expenditures and the sum of the number of hospital beds and doctors per capita. In this sense, it can be said that the GDP per capita affects the health demand. Moreover, the elasticity of health demand is below 1 for all three models. Therefore, it was concluded that health is not luxury good, it is necessity good.

According to another important result, the Beveridge health system is able to keep the costs of health services lower. Accordingly, it can be said that the central government is more effective in controlling prices than regional governments in health services. As a matter of fact, in Beveridge system, 1% increase in the number of beds and doctors per capita increases total health expenditures by only 0.08%. On the other hand, this rate is 0.30% in the Bismarck system.

According to another result, the Beveridge health system is more effective in responding to demand than the Bismarck health system. The reason for this is that the ratio of private health institutions is lower in the Beveridge model. In fact, according the cointegration estimates, the variable of life expectancy at birth, which expresses human development, stands out as a more effective factor in the Beveridge model in terms of creating health demand.

Within the framework of the results, it can be said that the Beveridge health system is more effective than the Bismarck health system both in terms of controlling costs and responding to demand. In this respect, this study revealed that a centralized administration is necessary for price control in health services. In addition, it is concluded from this study that in the Bismarck model, where the ratio of private health institutions is high, demand is shaped according to supply rather than supply according to demand.

As a result, health systems have power to influence the determinants of health demand. In this sense, it can be said that health demand is quite sensitive to health systems.

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