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Research Article

Empirical Analysis of Public Expenditure-Growth Relationship in OECD Countries: Testing the Wagner Law

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Abstract
The relationship between public expenditure and real gross domestic product (GDP) is discussed theoretically and has been tested empirically by many researchers for a long time. Most of the studies focus on the direction of causality between two variables to determine whether the Wagner Law or Keynesian Hypothesis is valid. Due to the important duties of governments in terms of fiscal policy, the growth of the economy is important. The Wagner Law suggests a positive relationship between public expenditure and real GDP, and it is claimed that the causality is from real GDP to public expenditure. In contrast, Keynes hypothesis accepts public expenditure as an external policy tool that affects real GDP growth. In this study, analyzes are carried out using real GDP as the independent variable and public expenditures (military, education, health, subvention and transfer, investment expenditures) as the dependent variable. The effect of total public expenditures and sub-headings on growth has been analyzed using separate models. In the study covering the years 2000-2019 for 37 OECD countries, annual data on variables were obtained from the World Bank and OECD official databases. According to the results obtained in this study, in which it is desired to determine whether the Wagner Law or the Keynesian view is valid for the selected country group, it has been found that the Wagner Law is valid for some countries and the Keynesian view is valid for some countries.

Keywords: Wagner Law, Keynesian Hypothesis, Clustering Analysis, Panel Causality

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Araştırma Makalesi

OECD Ülkelerinde Kamu Harcaması-Büyüme İlişkisinin Ampirik Analizi: Wagner Kanunu'nun Sınanması

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Özet

Kamu harcamaları ile reel gayri safi yurtiçi hâsıla (GSYİH) arasındaki ilişki teorik olarak tartışılmakta ve uzun süredir birçok araştırmacı tarafından ampirik olarak test edilmektedir. Çalışmaların çoğu, Wagner yasasının veya Keynes hipotezinin geçerli olup olmadığını belirlemek için iki değişken arasındaki nedenselliğin yönüne odaklanmaktadır. Hükümetlerin maliye politikası açısından önemli görevlerinden dolayı ekonominin büyümesi önem arz etmektedir. Wagner Yasası, kamu harcamaları ile reel GSYİH arasında pozitif bir ilişki olduğunu öne sürmekte ve nedenselliğin reel GSYİH'den kamu harcamalarına doğru olduğu iddia edilmektedir. Bunun aksine, Keynes hipotezi ise kamu harcamalarını reel GSYİH büyümesini etkileyen dışsal bir politika aracı olarak kabul etmektedir. Bu çalışmada bağımsız değişken olarak reel GSYİH ve bağımlı değişken olarak kamu harcamaları (askeri, eğitim, sağlık, sübvansiyon ve transfer, yatırım harcamaları) kullanılarak analizler gerçekleştirilmektedir. Toplam kamu harcamaları ve alt başlıklarının büyüme üzerindeki etkisi ayrı modeller kurularak incelenmiştir. 37 OECD ülkesi için 2000-2019 yıllarını kapsayan çalışmada değişkenlere ait yıllık veriler Dünya Bankası ve OECD resmi veri tabanından elde edilmiştir. Seçilen ülke grubu için Wagner yasasının mı yoksa Keynesyen görüşün mü geçerli olduğu belirlenmek istenen bu çalışmada elde edilen sonuçlara göre bazı ülkeler için Wagner Yasası bazı ülkeler için Keynesyen görüşünün geçerli olduğu bulunmuştur.

Anahtar Kelimeler: Wagner Yasası, Keynesyen Hipotezi, Kümeleme Analizi, Panel Nedensellik

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INTRODUCTION

The effectiveness of public expenditures on growth has been tried to be explained with different interactions within the framework of different schools of economics. The effectiveness of the state in the economy has been discussed in two different ways by Classical and Keynesian economists. While the classicists were against state intervention, the Keynesian view acted with an approach that advocated the opposite. Within the framework of these views, the effect of public expenditures on growth has been shaped by the formation of two variables. The Keynesian view argued that an increase in public expenditure would increase growth. The relationship between the two variables, in the theory, which is also called the Wagner Law, has been in the direction that economic growth will increase public expenditures (Cergibozan et al., 2017: 76).

The effectiveness of the classical view, which continued until the Great Depression, began to decline in the 1930s. Unemployment and low growth rates experienced in the economy in these years shook the confidence in the classical school. The views of John Maynard Keynes, who argued that statist policies should be applied in the solution of economic problems, spread and adopted in a short time. In the following period, as a result of World War II and the adoption of nationalization policies by developed countries, the implementation of statist policies gained momentum. It has been determined that government expenditures have positive effects on revenues (Sarı, 2003: 26).

After World War II, the incentives are given to the development of national income accounting by governments that wanted to control the economy gradually increased. In particular, the impact of the public sector on the composition of consumption and investment expenditures followed an upward trend in this period. Many authors have adopted the idea that an increase in public expenditures can have positive effects on economic growth. In the 20th century, the German political economist Adolph Wagner (1835–1917) tried to explain the relationship between public expenditures and growth variables with the Wagner Law. The effectiveness of the Wagner Law, which has been examined in different ways by Gupta (1967 and 1968), Gandhi (1971), and Pryor (1968), has been investigated by many authors (Peacock and Scott, 2000: 1).

In studies adopting the Keynesian view, the view that public expenditures are effective on growth and those public expenditures are an important tool to solve short-term problems in the economy has been adopted. The Keynesian view saw public expenditure as an external factor used to solve short-term problems in the economy. Wagner, on the other hand, saw public expenditures as an endogenous factor (Arısoy, 2005: 64).

In this study, the relationship between public expenditures and growth has been examined within the framework of Wagner and Keynesian views. The fact that public expenditures are an important component of growth in developing countries increases the topicality of the issue. For this reason, the subject has been researched based on the theories and laws put forward. In the study, firstly, information about the subject was given and variables were defined. Then, public expenditures and the course of growth in OECD countries where the subject was investigated were examined using numerical data. The following section includes a literature review on the subject. The last part consists of empirical results of the variables. In the study in which the panel analysis was carried out, the years 2000-2019 were chosen as the time interval. It is expected that the study will contribute to the literature due to the way the subject is handled and the up-to-dateness of the analysis and data used.

The Wagner Law and Development of Public Expenditures and Growth Rate in OECD

In the 19th century, fiscal policy, especially for government expenditures, was shaped on the assumptions of classical economics doctrine, although it had no significant effect on the economy. Because governments' play a role in fiscal policy, the role of governments' has always been considered important for the growth of the economy. The law proposing the relationship between economic growth and public expenditure, later known as the Wagner Law was put forward by Adolph Wagner (1883). This law basically has assumed that economic growth would increase government expenditures (Permana and Wika, 2014: 130).

Wagner, in his study in 1883, revealed that public expenditures were in an upward trend for many country groups he examined. He has seen the increase in the effectiveness of states in social and economic life as the reason for the rising public expenditures. Wagner to increase the efficiency of the state; he has attributed the increase in demand for cultural activities, the turmoil in legal matters, and the

need for the development to be under the control of the state to achieve a balanced development (Gacener, 2005: 104).

Although Wagner was not the first person to verbalize his hypothesis, he was the first to demonstrate this law empirically. According to Wagner, there are reasons to expect the scope of public activity to expand. First, the administrative and protective functions of the state should expand due to the increasing complexity of legal relations and communication. Increasing urbanization and population concentration in social life require higher public expenditures on law and order and socioeconomic regulation. Second, Wagner has found that the income elasticity of demand for publicly provided goods such as education is greater than one. For this reason, the technological needs of industrialized society have revealed that larger amounts of capital are required than is provided by the private sector. He has stated that the state should finance large-scale capital expenditures and provide the necessary capital funds to solve this problem. The Wagner Law has taken place in the literature with its five basic versions (Chang, 2002: 1158). These can be expressed as:

Table 1: Developed Models of the Wagner Law

Model 1	Rtge = *f*(RGDP)	Peacock-Wiseman (1961)
Model 2	Rtge = *f*(RGDP/Pop)	Goffman (1968)
Model 3	Rtge/Pop = *f*(RGDP/Pop)	Gupta (1967)
Model 4	Rtge/RGDP = *f*(RGDP)	Mann (1980)
Model 5	Rtge/RGDP = *f*(RGDP/Pop)	Payne-Ewing (1996)

In the equations in Table 1, Rtge; real public expenditure, RGDP; real GDP, Rtge/Pop; total real government expenditure per capita, Rtge/RGDP; real government expenditures to GDP, RGDP/Pop represents real GDP per capita (Chang, 2002: 1158; Arısoy, 2005: 66).

Increases in real income per capita in industrializing countries have significant effects on public sectors. The growth observed in the sectors is handled together with the technological, political, and institutional changes. Wagner has been shaped the expansion of the scope of public activities for three main reasons. First, he has stressed that the state should reduce the complexity of legal affairs. It has been assumed that increasing urbanization and population concentration require social and economic regulation, which will require higher public expenditures. Second, Wagner found that the income elasticity of demand for publicly provided goods such as education and income redistribution is high. Finally, it has been observed that the technological needs of an industrialized society are higher than the rate provided to the private sector. Therefore, it has been stated that high rates of capital will be needed. It was emphasized that the necessary capital should be provided through the state (Mann, 1980: 189). In the study, the equational relationship put forward by Mann (1980) was investigated for OECD countries.

In the study conducted for OECD countries, including Turkey, the public expenditure ratios of GDP 37 countries in 2019 are included in Figure 1.

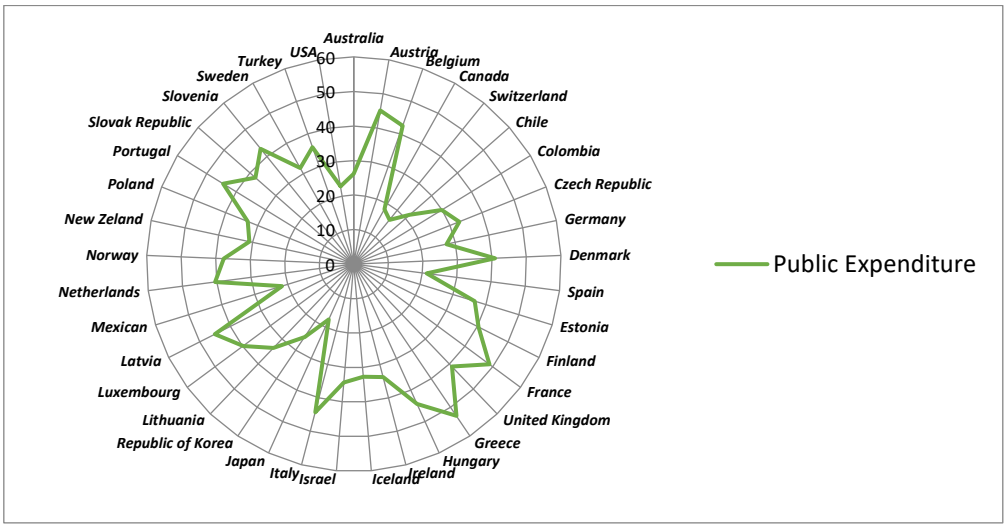

Figure 1: Development of Public Expenditures in OECD Countries (Percentage of GDP)
Source: World Bank, OECD, 2021

Considering the share allocated by OECD countries to public expenditures from GDP, Greece ranks first for 2019. Public expenditure ratios for Austria, Denmark, Finland, France, United Kingdom, Hungary, Italy, Luxembourg, Latvia, Netherlands, Portugal, and Slovenia appear to be at a similar level (about 40%). The countries where public expenditures to GDP ratios are at low levels are Canada, Switzerland, Japan, and the USA. It is observed that the share Turkey allocates to public expenditures to GDP ratio is around 35%.

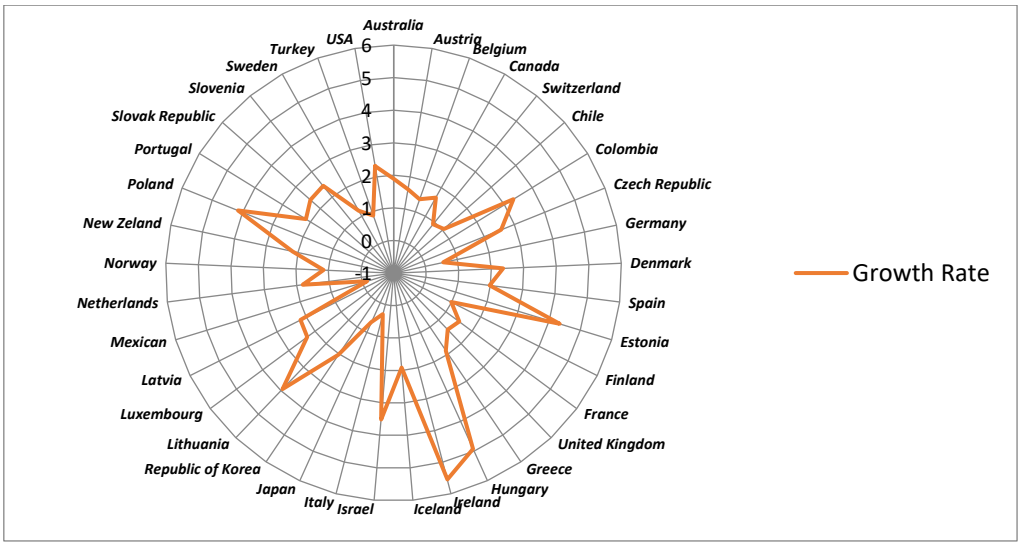

Figure 2: Growth Rate of OECD Countries for the Year 2019 (%)
Source: World Bank, 2021

Figure 2, which includes the growth rates of OECD countries, includes a comparison of the relevant countries for 2019. In 2019, the highest growth rate among OECD countries is seen in Ireland with 5.5%. Hungary, Estonia, and Poland have followed Ireland with a growth rate of 4%. Australia, Austria, Belgium, Canada, Spain, Chile, France, United Kingdom, Greece, Iceland, Netherlands, Norway, Sweden have grown between 1-2%. Switzerland, Germany, Finland, Italy, Japan, and Turkey seem to have a growth rate below 1%. Mexico was the only OECD country to turn its growth rate negative for 2019.

Related Literature

Peacock and Wiseman (1961) have tested the validity of the Wagner Law for England. In the study, the efficiency of public expenditures in the economy in England between the years 1890 and 1955 was investigated. As a result of the time series analysis and causality test performed in the study, it was determined that the Wagner Law was valid.

Ram (1986) has examined the Greece economy in the context of a small neo-classical model. Annual data for the period from 1954 to 1980 has been used in the study. In the study, in which GDP and the share of government expenditures in GDP has been used as variables, the relationship between the existing variables has examined. As a result of the analysis, it has been determined that there was no relationship between the two variables.

Barro (1989) has investigated the effect of public expenditures on growth. In the study, which consists of approximately 72 countries, it is aimed to analyze the Summers-Heston cluster by using the sampling method. For this purpose, an analysis method covering the years 1960-1985 has adopted. As a result of the analysis, the coefficients have been investigated and Barro has determined that there was a positive relationship between public investment expenditures and growth.

Yamak and Zengin (1997) have tested the validity of the Wagner Law in Turkey in the 1950-1994 periods using the Kalman filter estimation method. They have predicted that the elasticity of the size of the government sector with respect to economic growth may change over time. They have investigated the effectiveness of the variables with regression analysis. The results of the analysis have showed that the Wagner Law was valid for Turkey in the analyzed period.

Yamak and Küçükkale (1997) have tried to determine the relationship between public expenditures and growth with cointegration analysis. The relationship between the existing variables in Turkey periods 1950-1994 has been investigated. It has been determined that there is a long-run relationship between the two variables.
Chletsos and Kollias (1997) have examined the relationship between public expenditure and growth for Greece. In the study covering the years 1958-1993, government expenditures were divided into sub-headings and analyzed separately. As a result of the study, it has determined that only defense expenditures affect growth and these two variables can be explained by the Wagner Law.
Abu-Bader and Abu-Qarn (2003) have empirically examined the impact of public expenditures and their subheadings on growth. In the study conducted for Egypt (1975-1998), Israel (1967-1998) and Syria (1973-1998), public expenditures, military expenditures and GDP variables have been used. As a result of the causality analysis, military burden negatively affects economic growth for examined all the countries. Also, it was concluded that civilian government spending caused positive economic growth in Israel and Egypt.
Arısoy (2005) has examined the effect of public expenditures on growth by dividing public expenditures into sub-headings. The validity of the Wagner Law has been researched for Turkey between the years 1950-2003. As a result of the causality analysis, it has been determined that there is a relationship between current, subvention and transfer, investment expenditures and growth.
Selen and Eryiğit (2009) have investigated the relationship between public expenditures and growth using structural break tests. In the study examining Turkey, the years 1923-2006 have been chosen as the time interval. As a result of the causality analysis, it has determined that there is a one-way relationship from GDP to public expenditures.
Verma and Arora (2010) have examined whether Wagner's Law was valid in India during the period between 1950/51 and 2007/08. Analysis tests based on structural breaks have been preferred in the study. It has been observed that the first structural break given for the mild liberalization period causes insignificant changes in the growth elasticity of public expenditures. In the second break period, in which intense liberalization took place, the changes observed in elasticity have been observed to have statistically significant results. Briefly, in the study in which structural break tests were used, it has been determined that there was a relationship between the two variables and the Wagner Law was valid.
Lamartina and Zaghini (2011) have conducted a study for 23 selected OECD countries. In the study, it has been determined that there is a structural positive correlation between public expenditures and GDP per capita. In the study where panel data analysis was made, it has been determined that the Wagner Law was more effective in countries with low per capita GDP.
Kumar et al. (2012) have made a time series analysis for the years 1960-2007. For Turkey, the relationship between public expenditures and growth has been investigated with both long-run coefficients and causality analysis. It has been determined that the variables are effective on each other and the Wagner Law is valid for Turkey.
Dada (2013) has examined the effects of public expenditures and their components on growth in the Nigerian economy. In the study covering the years 1961-2010, total public expenditure, health, education, agricultural and social expenditures have been used as independent variables. In the study using time series analysis, it has determined that there was a long-run relationship between the variables.
Permana and Wika (2014) have examined the validity of the Wagner Law in the Indonesian economy in 1999-2011. In the study, in which the GARCH approach was applied, government expenditures, population, tax and growth variables have been used. As a result of the analysis, it has been concluded that the Wagner Law emerged in the post-reform period by applying the ARDL cointegration model.
Telek and Telek (2016) have investigated the relationship between public expenditures and economic growth with time series analysis methods for Turkey. Quarterly data covering the years 1998-2015 has been used in the study. The relationship between these two variables has been examined within the framework of the Wagner Law and Keynesian Hypothesis. As a result of the analysis, it has been seen that the Keynesian Hypothesis was valid in Turkey during the period examined.
Timur and Albayrak (2016) have investigated the validity of the Wagner Law for Turkey for the 1998Q1-2015Q4 time period using quarterly data. In the theory, which is tried to be explained by establishing two different models, it has been determined that there is a bidirectional relationship between public expenditures and GDP between public expenditures per capita and GDP per capita. It

has been concluded that the Wagner Law is not valid in Turkey as a result of the examined process and analysis.
Yavuz and Doruk (2018) tested the validity of the Wagner and Keynes hypothesis in their study for Turkey. In the study in which ARDL analysis was conducted, the years 1950-2017 were taken as a basis. As a result of the analysis, it has been determined that both approaches are valid for Turkey.
Karaş (2020) investigated the validity of the Wagner Law for BRICS countries and Turkey in his study. In the study in which panel analysis was carried out, analysis was made for the years 1990-2018. As a result of the analysis, it was determined that there is a causal relationship from economic growth to public expenditures throughout the panel.
Karabulut (2020) investigated the validity of Wagner and Keynes hypothesis in Turkey with VAR analysis. In the analysis covering the years 1998-2018, it was determined that the Keynes hypothesis was valid in the period examined in Turkey.

Dataset and Econometric Methodology
In the study, the relationship between public expenditures and growth has been examined by using the Mann Model, which is expressed as Model 4. The effects of total public expenditures and their sub-headings on growth have examined by establishing separate models. Panel data and clustering analysis methods have been used in the study covering the years 2000-2019. In the analysis, OECD countries have been chosen as the country group. The data set for the variables has obtained annually from the World Bank and OECD official data base. While the GDP rate of the independent variables was used, the dependent variable has been included in the analysis with its level value as per the model. An analysis has been conducted based on the studies in the literature in Mann (1980), Chletsos and Kollias (1997), Arısoy (2005), Abu-Bader and Abu-Qarn (2003), Dada (2013). It has been tried to reveal whether the Wagner or Keynesian view is effective among the variables. The model of the study is followed as:

$$\Delta RKH_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta RGDP_{t-i} + \sum_{i=1}^{r} \lambda_{1i} \Delta RKH_{t-i} + \psi_1 + \mu_{1t} \qquad (1)$$

The abbreviation **RKH** in the equation denotes the ratio of Real Public Expenditures to the Real GDP and RGDP denotes the Real GDP. In the analysis, the Mann model was created and besides the main hypothesis, public expenditures were divided into 5 items (military, education, health, subvention and transfer, investment expenditure). It is expected that the study will contribute to the literature with the data set used, the analysis method chosen and the law comprehensively addressed.

Clustering Analysis
Clustering analysis is a technique that helps to classify the units discussed in a study by bringing them together in certain groups according to their similarities, to highlight the common features of the units and to make general definitions about these classes (Kaufman and Rousseuw, 1990: 87).
Clustering analysis aims to categorize ungrouped data into groups based on their similarity and assist the researcher in providing appropriate and useful summary information. Although there are similarities between clustering and discriminant analysis because they are evaluated in grouping of individuals, there are also important differences between the two techniques. While the number of groups is known in discriminate analysis, this number does not differ during the analysis period and the researcher is expected to assign people to these clusters. In addition, the information obtained through discriminant analysis can be evaluated in the future. In clustering analysis, the number of clusters is not known and is not used in the future because it only gives results for the state of the data. In the clustering analysis, there is an assumption that the data should be normally distributed, but the normality of the distance values is considered sufficient. In addition, there is no assumption about the covariance matrix (Tatlıdil, 2002: 329). In clustering analysis, classification is carried out according to similarities and differences. Inputs are expressed as the measure of similarity or the necessity of which similarity to the data can be calculated (Johnson and Wichern, 1992: 573).

Hierarchical Clustering Methods
In clustering analysis, there are two hierarchical methods called grouper and divider (Hubert, 1974: 701). In grouper hierarchical clustering analysis, each unit or observation is first considered as a cluster. Then the two closest clusters are merged into a new cluster. Thus, the number of clusters is reduced by

one at each stage. This process is illustrated by a figure called a dendogram or tree graph. In divisive hierarchical clustering analysis, the process is the opposite of grouping hierarchical clustering analysis. This technique starts with a large set of all observations. Smaller clusters are formed by identifying dissimilar observations. The process is continued until each observation becomes a single cluster (Everitt et al., 2001: 154).

Hadri Kurozumi (2012) Unit Root Test Results

In order to test the stationarity of the series examined in the research, Hadri and Kurozumi (2012) unit root test, which takes into account the cross-sectional dependence and allows the existence of common factors by taking into account the unit root caused by the common factors that make up the series, has been discussed. Hadri and Kurozumi (2012) unit root test allows autocorrelation in the process that creates the series. This autocorrelation is corrected by the AR(p) process based on the SUR (Seemingly Unrelated Regression) method in the Sul-Phillips-Choi (2005, SPC) method. In the Lag-Augmented (LA) method, it is corrected with the dependent AR(p+1) process in the methods of Choi (1993) and Toda and Yamamoto (1995). Hadri and Kurozumi (2012) developed the KPSS unit root test developed by Kwiatkowski, Phillips, Schmidt, and Shin (1992) for panel data and used the equation as follows:

$$\boldsymbol{y_{it}} = \boldsymbol{Z_t'\delta_i} + \boldsymbol{f_t\gamma_i} + \boldsymbol{\varepsilon_{it}} \quad (2)$$

$$\boldsymbol{\varepsilon_{it}} = \boldsymbol{\phi_{i1}\varepsilon_{it-1}} + \cdots + \boldsymbol{\phi_{ip}\varepsilon_{it-p}} + \boldsymbol{v_{it}} \quad (3)$$

In this equation, $\boldsymbol{Z_t'}$ is the deteministic term. $\boldsymbol{Z_t'\delta_i}$ represents individual effects. $\boldsymbol{f_t}$ represents one-dimensional unobservable common factor. $\boldsymbol{\gamma_i}$ denotes the factor loading and $\boldsymbol{\varepsilon_{it}}$ denotes the error terms following the AR(p) process. Hadri and Kurozumi (2012) regress $\boldsymbol{y_{it}}$ on $\boldsymbol{w_t} = \left[\boldsymbol{Z_t'}, \overline{\boldsymbol{y}}_{\boldsymbol{t}}, \overline{\boldsymbol{y}}_{\boldsymbol{t-1}}, \ldots, \overline{\boldsymbol{y}}_{\boldsymbol{t-p}}\right]$ to eliminate cross-section dependency for each cross-section . In the SPC method, the series is opened in the AR(p) process and converted to the following equation:

$$\boldsymbol{y_{it}} = \boldsymbol{Z_t'\ddot{\delta}_i} + \ddot{\boldsymbol{\phi}}_{\boldsymbol{i1}}\boldsymbol{y_{it-1}} + \cdots + \ddot{\boldsymbol{\phi}}_{\boldsymbol{ip}}\boldsymbol{y_{it-p}} + \ddot{\boldsymbol{\psi}}_{\boldsymbol{i0}}\overline{\boldsymbol{y}}_{\boldsymbol{t}} + \cdots + \ddot{\boldsymbol{\psi}}_{\boldsymbol{ip}}\overline{\boldsymbol{y}}_{\boldsymbol{t-p}} + \widehat{\boldsymbol{v}}_{\boldsymbol{it}} \quad (4)$$

The long-run variance of the model's estimation $\left(\widehat{\boldsymbol{\sigma}}_{\boldsymbol{vi}}^{\boldsymbol{2}} = \frac{\boldsymbol{1}}{\boldsymbol{T}}\sum_{\boldsymbol{t=1}}^{\boldsymbol{T}}\widehat{\boldsymbol{v}}_{\boldsymbol{it}}^{\boldsymbol{2}}\right)$ and, considering this variance, the SPC variance ($\left(\widehat{\boldsymbol{\sigma}}_{\boldsymbol{iSPC}}^{\boldsymbol{2}} = \frac{\widehat{\boldsymbol{\sigma}}_{\boldsymbol{vi}}^{\boldsymbol{2}}}{\left(\boldsymbol{1}-\widehat{\boldsymbol{\phi}}_{\boldsymbol{i}}\right)^{\boldsymbol{2}}}\right)$ is calculated. Then the $\boldsymbol{Z_A^{SPC}}$ statistic is reached;

$$\boldsymbol{Z_A^{SPC}} = \frac{\boldsymbol{1}}{\widehat{\boldsymbol{\sigma}}_{\boldsymbol{iSPC}}^{\boldsymbol{2}}\boldsymbol{T^2}}\sum_{\boldsymbol{t=1}}^{\boldsymbol{T}}\left(\boldsymbol{S_{it}^w}\right)^{\boldsymbol{2}} \quad (5)$$

In the LA technique, the series in the above equation is specified in the AR(p+1) process as follows;

$$\boldsymbol{y_{it}} = \boldsymbol{Z_t'}\widetilde{\boldsymbol{\delta}}_{\boldsymbol{i}} + \widetilde{\boldsymbol{\phi}}_{\boldsymbol{i1}}\boldsymbol{y_{it-1}} + \cdots + \widetilde{\boldsymbol{\phi}}_{\boldsymbol{ip}}\boldsymbol{y_{it-p}} + \widetilde{\boldsymbol{\phi}}_{\boldsymbol{ip+1}}\boldsymbol{y_{it-p-1}} + \widetilde{\boldsymbol{\psi}}_{\boldsymbol{i0}}\overline{\boldsymbol{y}}_{\boldsymbol{t}} + \cdots + \widetilde{\boldsymbol{\psi}}_{\boldsymbol{ip}}\overline{\boldsymbol{y}}_{\boldsymbol{t-p}} + \widetilde{\boldsymbol{v}}_{\boldsymbol{it}} \quad (6)$$

The LA variance $\left(\widehat{\boldsymbol{\sigma}}_{\boldsymbol{iLA}}^{\boldsymbol{2}} = \frac{\widehat{\boldsymbol{\sigma}}_{\boldsymbol{vi}}^{\boldsymbol{2}}}{\left(\boldsymbol{1}-\widetilde{\boldsymbol{\phi}}_{\boldsymbol{i1}}-\cdots-\widetilde{\boldsymbol{\phi}}_{\boldsymbol{ip}}\right)^{\boldsymbol{2}}}\right)$ obtained from the long-term variance of the model's estimation is calculated and the $\boldsymbol{Z_A^{LA}}$ statistic is obtained;

$$\boldsymbol{Z_A^{LA}} = \frac{\boldsymbol{1}}{\widehat{\boldsymbol{\sigma}}_{\boldsymbol{iLA}}^{\boldsymbol{2}}\boldsymbol{T^2}}\sum_{\boldsymbol{t=1}}^{\boldsymbol{T}}\left(\boldsymbol{S_{it}^w}\right)^{\boldsymbol{2}} \quad (7)$$

The null hypothesis of the test, which takes into account both the serial correlation and the cross-section dependence, and is valid for all panel data sets, is "there is no unit root in the series [for $\boldsymbol{\phi_i(1) \neq 0 \forall_i}$]". The alternative hypothesis is "there is a unit root in the series [$\boldsymbol{for\ \phi_i(1) = 0\ \exists_i}$]".

Emirmahmutoğlu and Köse (2011) Panel Causality Test

Emirmahmutoğlu and Köse (2011) causality procedure is expressed as dependent on Granger causality test. This test, which can be used in heterogeneous panels, is a test that can be evaluated in cases where there is a cross-sectional dependence or there is no cointegration relationship between the variables (Altıner, 2019: 374). The model for the $\boldsymbol{k_i + dmax_i}$ VAR level in the causality test is expressed as follows:

$$z_{i,t} = u_i + A_{il} z_{i,t-1} + \cdots + A_{ik} z_{i,t-ki} + \sum_{l=ki+1}^{ki+d\,maxi} A_{il}\, z_{i,t-1} + u_{i,t}\,, i = 1, 2, \ldots, T \qquad (8)$$

Equation (2) states that parameter constraints do not include A_{il}, therefore the hypothesis H_0: $R_i \alpha_i = 0$ (no causality relationship) can be tested with standard Wald statistics.
In order to test the Granger causality hypothesis in heterogeneous panels, Fisher test statistics proposed by Fisher are evaluated. Fisher (1932) brought together several important levels (p-values) of independent tests. Fisher test statistics are used to determine the causality relationship. The equality of the test is expressed as follows:

$$\lambda = -2 \sum_{i=1}^{N} ln\,(p_i), \qquad i = 1, 2, \ldots, N \qquad (9)$$

where the pi value denotes the p values corresponding to the Wald statistics of the i-th cross-section. In addition, this test statistic has a chi-square distribution with 2N degrees of freedom. The test N value is considered valid if $T \to \infty$. Fisher test cannot give effective results in case of cross-sectional dependence in the series. In this case, the test is obtained by the bootstrap method. Therefore, the $k_i + dmax_i$ lagged VAR model is expressed as follows:

$$x_{i,t} = \mu_i^x + \sum_{j=1}^{k_i+dmax_i} A_{11,ij} x_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} A_{12,ij} y_{i,t-j} + u_{i,t}^x \qquad (10)$$

$$y_{i,t} = \mu_i^y + \sum_{j=1}^{k_i+dmax_i} A_{21,ij} x_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} A_{22,ij} y_{i,t-j} + u_{i,t}^y \qquad (11)$$

The $k_i + dmax_i$ found in the equations (4) and (5) indicate the highest degree of integration in the system for each i. In other words, it indicates the maximum relationship in order to reveal the causality relationship between variables such as x and y (Emirmahmutoğlu & Köse, 2011: 872).

Findings

In this study, in which total public expenditures and their sub-items military expenditure, education expenditure, health expenditure, subvention and transfer expenditure, investment expenditure and growth variables were examined between 2000 and 2019, firstly, a cluster analysis was performed based on the variables 2000 and 2019. First of all, the clustering analysis results for the year 2000 are stated in Table 2 follow as:

Table 2: Clustering Analysis Results for the Year 2000

	Cluster Combining				Cluster Combining		
Stage	Cluster 1	Cluster 2	Coefficient	Stage	Cluster 1	Cluster 2	Coefficient
1	11	22	9.763	19	18	24	712.504
2	12	25	21.691	20	4	27	800.250
3	14	34	35.908	21	16	21	892.511
4	15	35	51.070	22	1	11	993.780
5	24	30	71.926	23	8	14	1114.399
6	13	31	95.091	24	12	15	1239.740
7	1	5	118.475	25	10	18	1401.479
8	14	26	143.127	26	16	33	1577.467
9	10	19	173.381	27	2	9	1761.662
10	2	3	206.667	28	12	36	1967.102
11	8	13	240.294	29	4	6	2225.092
12	21	32	275.340	30	8	12	2528.427
13	28	29	310.799	31	1	4	2868.688
14	6	23	353.605	32	7	10	3270.893
15	16	20	408.126	33	7	16	4025.499
16	9	28	477.767	34	2	8	5717.146
17	11	37	551.386	35	1	2	7966.754
18	8	17	630.958	36	1	7	13958.068

When the findings obtained as a result of the analysis are evaluated, it is possible to state that the countries that unite first and are most similar (or least similar) are Spain and Japan, which appear in the first stage. After these two countries, the most similar country pairs are respectively; Estonia-Luxembourg, France-Slovenia, United Kingdom-Sweden, Lithuania-New Zealand, Finland-Poland, Australia-Switzerland. In the first 7 stages, 14 different countries are clustered in pairs, while in the 8th stage Latvia is included in the France-Slovenia cluster.
It is possible to examine the clustering stages of countries not only through the chart but also with the resulting dendrogram graph. The results obtained with the dendrogram graph are as follows:

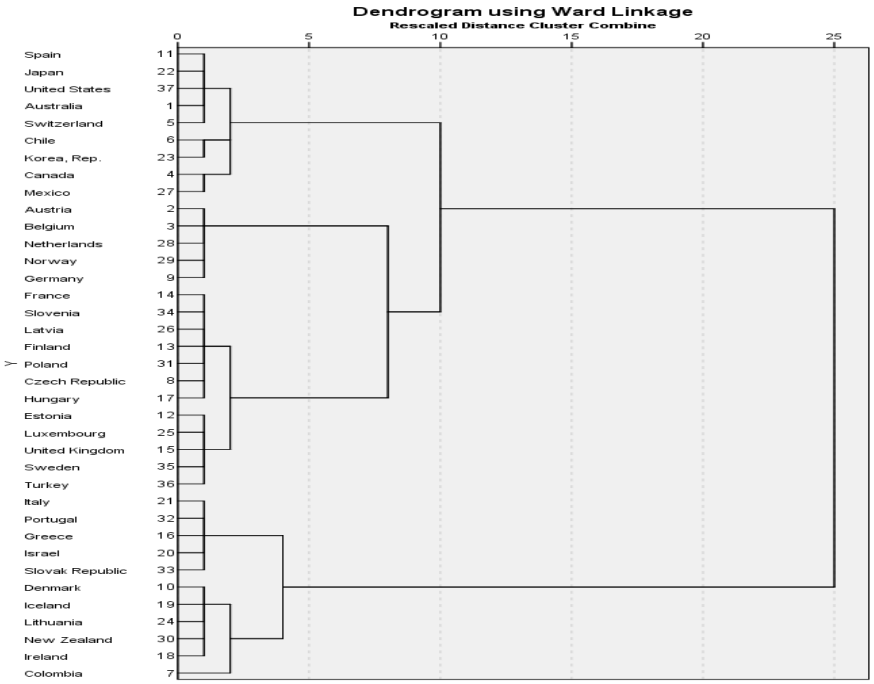

Figure 3: Display of Clustering Analysis Results of the Year 2000 with Dendrogram Chart

According to Figure 3, the countries that combine at the closest distance in the first place are Spain, Japan, USA, Australia, and Switzerland. Here, the shortness of the junction distance is also proportional to the coefficient in the table. It is seen that Austria, Belgium, Netherlands, Norway, and Germany are the countries that unite in the second rank. In the third rank, France, Slovenia, Latvia, Finland, Poland, Czech Republic, Hungary are seen to combine in a short distance. In the fourth rank, Estonia, Luxembourg, United Kingdom, Sweden, Turkey, Italy, Portugal, Greece, Israel, and the Slovak Republic combine in a short distance. In the fifth rank, Denmark, Iceland, Lithuania, New Zealand, and Ireland meet in the common cluster. Therefore, the dendrogram graph given as a figure is a more visual version of Table 2 mentioned above. Again, in the last stage of the dendrogram, it is observed that all countries unite to form a single cluster. The situation in question is shown in the chart in stage 37.

Cluster analysis results for 2019 are in Table 3 follow as:

Table 3: Clustering Analysis Results for the Year 2019

	Cluster Combining				Cluster Combining		
Stage	Cluster 1	Cluster 2	Coefficient	Stage	Cluster 1	Cluster 2	Coefficient
1	24	31	6.630	19	2	3	530.377
2	4	22	16.978	20	16	17	606.055
3	13	33	27.545	21	4	27	686.276
4	21	32	39.200	22	1	7	772.120
5	3	28	56.428	23	13	14	865.352
6	17	21	74.304	24	8	20	969.424
7	13	25	92.431	25	8	18	1075.481
8	17	34	113.068	26	4	37	1189.617
9	15	26	135.935	27	5	9	1311.566
10	12	29	159.135	28	1	12	1496.512
11	8	30	184.180	29	6	8	1719.338
12	18	19	214.165	30	13	16	1963.280
13	4	11	245.283	31	4	5	2378.441
14	1	23	276.748	32	1	4	2947.801
15	14	15	314.109	33	6	10	3885.941
16	24	36	353.997	34	1	2	4901.716
17	9	35	401.668	35	6	13	6213.351
18	20	24	457.801	36	1	6	12491.488

According to the findings obtained as a result of the analysis, it is possible to state that the countries that unite first and that are most similar (or least similar) are Lithuania and Poland, which appear in the first stage. After these two, the most similar country pairs are respectively; Canada-Japan, Finland-Slovak Republic, Italy-Portugal, Canada-Japan, Finland-Slovak Republic, Belgium-Netherlands, Hungary-Italy. In the first 7 stages, 14 different countries are clustered in pairs, while in the 8th stage Luxembourg is included in the Finland-Slovak Republic cluster.
. The results obtained with the dendrogram plot are as follows:

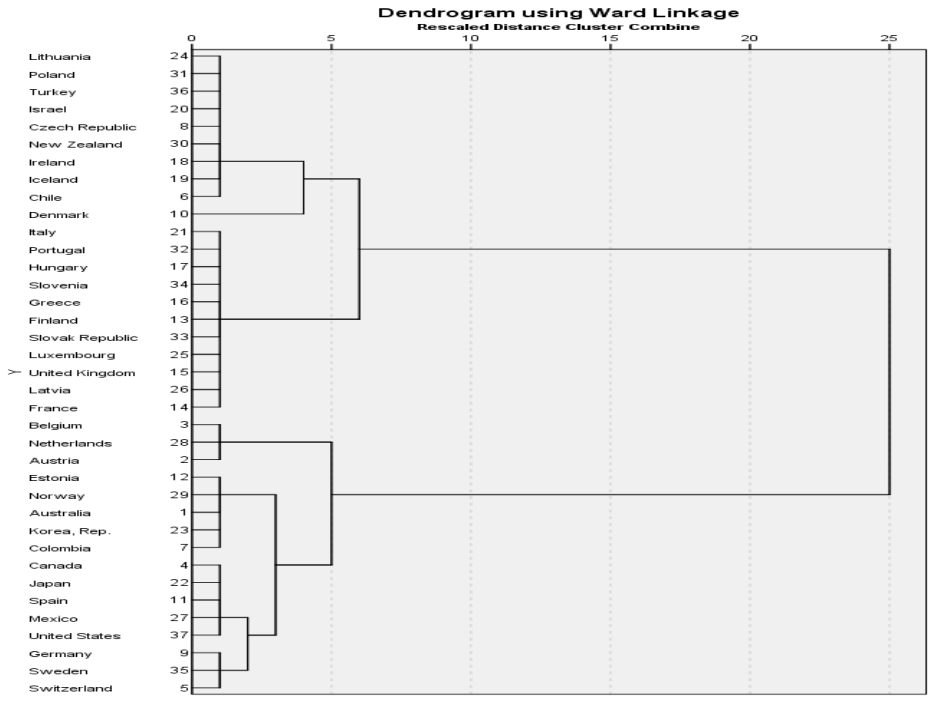

Figure 4: Display of Clustering Analysis Results for 2019 with Dendrogram Chart

According to Figure 4, the countries that combine at the closest distance in the first place are Lithuania, Poland, Turkey, Israel, Czech Republic, New Zealand, Ireland, Iceland, and Chile. It is seen that Italy, Portugal, Hungary, Slovenia, Greece, Finland, Slovak Republic, Luxembourg, United Kingdom, Latvia, and France are the countries that combine in the second rank in a short distance. Belgium, the Netherlands, and Austria combine in the third rank. In the fourth rank, Estonia, Norway, Australia, Korea, and Colombia combined. In the fifth rank, Canada, Japan, Spain, Mexico, and the USA combined. In the sixth rank, Germany, Sweden, and Switzerland meet in the common cluster. Therefore, the dendrogram graph given as a figure is a more visual version of Table 3 mentioned above. Again, in the last stage of the dendrogram, it is observed that all countries unite to form a single cluster. The situation in question is shown in the chart in step 37.
The results of the clustering analysis according to the distances are shown in Table 4 and Table 5 as follows:

Table 4: According to the Distance 5 Clustering Analysis Results

2000				2019			
Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Spain	Austria	France	Italy	Lithuania	Italy	Belgium	Estonia
Japan	Belgium	Slovenia	Portugal	Poland	Portugal	Netherlands	Norway
USA	Netherlands	Latvia	Greece	Turkey	Hungary	Austria	Australia
Australia	Norway	Finland	Israel	Israel	Slovenia		Korea
Switzerland	Germany	Poland	Slovak Republic	Czech Republic	Greece		Colombia
Chile		Czech Republic	Denmark	New Zeland	Finland		Canada
Korea		Hungary	Iceland	Ireland	Slovak Republic		Japan
Canada		Estonia	Lithuania	Iceland	Luxembourg		Spain
Mexico		Luxembourg	New Zeland	Chile	United Kingdom		Mexico
		United Kingdom	Ireland	Denmark	Latvia		USA
		Sweden	Colombis		France		Germany
		Turkey					Sweden
							Switzerland

According to the results of Table 4, it is seen that 4 clusters were formed according to 5 distances in the two years analyzed. Compared to 2000, it is seen that there are nine countries in the first cluster, five countries in the second cluster, twelve countries in the third cluster, and ten countries in the last cluster. According to 2019, there are ten countries in the first cluster, eleven countries in the second cluster, three countries in the third cluster and thirteen countries in the last cluster.

Table 5: According to the Distance 10 Clustering Analysis Results

2000			2019		
Cluster 1	Cluster 2	Cluster 3	Cluster 1		Cluster 2
Spain	Austria	Italy	Lithuania	Luxembourg	Belgium
Japan	Belgium	Portugal	Poland	United Kingdom	Netherlands
USA	Netherlands	Greece	Turkey	Latvia	Austria
Australia	Norway	Turkey	Israel	France	Estonia
Switzerland	Germany	Slovak Republic	Czech Republic		Norway
Chile	France	Denmark	New Zeland		Australia
Korea	Slovenia	Iceland	İreland		Korea
Canada	Latvia	Lithuania	Iceland		Colombia
Mexico	Finland	New Zeland	Chile		Canada
	Poland	İreland	Denmark		Japan
	Czech Republic	Colombia	Italy		Spain
	Hungary		Portugal		Mexico
	Estonia		Hungary		USA
	Luxembourg		Slovenia		Germany
	United Kingdom		Greece		Sweden
	Sweden		Finland		Switzerland
	Turkey		Slovak Republic		

According to the results of Table 5, it is seen that 3 clusters were formed according to 10 distances in 2000, and 2 clusters were formed according to 10 distances in 2019. Compared to 2000, it is seen that there are nine countries in the first cluster, seventeen countries in the second cluster, and eleven countries in the last cluster. According to 2019, it is seen that there are twenty-one countries in the first cluster and sixteen countries in the last cluster.

In panel data analysis, cross-section dependencies are tested before determining the stationarity of the variables. The cross-section dependence plays a guiding role in the determination of the unit root analysis of the series. The results of the cross-section dependency test of the model created within the scope of the study are as stated in Table 6:

Tablo 6: Cross-Section Dependence Test

Expenditure			Growth		
Test	Statistic	Prob.	Test	Statistic	Prob.
Breusch-Pagan LM	2965.266	0.00	Breusch-Pagan LM	4985.518	0.00
Pesaran scaled LM	61.98571	0.00	Pesaran scaled LM	117.3403	0.00
Bias-corrected scaled LM	61.01203	0.00	Bias-corrected scaled LM	116.3666	0.00
Pesaran CD	28.53507	0.00	Pesaran CD	66.34626	0.00
Military			Education		
Test	Statistic	Prob.	Test	Statistic	Prob.
Breusch-Pagan LM	4427.513	0.00	Breusch-Pagan LM	3165.143	0.00
Pesaran scaled LM	102.0510	0.00	Pesaran scaled LM	67.46229	0.00
Bias-corrected scaled LM	101.0773	0.00	Bias-corrected scaled LM	66.48861	0.00
Pesaran CD	42.76280	0.00	Pesaran CD	2.417078	0.00
Health			Transfer		
Test	Statistic	Prob.	Test	Statistic	Prob.
Breusch-Pagan LM	6608.072	0.00	Breusch-Pagan LM	5197.106	0.00
Pesaran scaled LM	161.7980	0.00	Pesaran scaled LM	123.1378	0.00
Bias-corrected scaled LM	160.8243	0.00	Bias-corrected scaled LM	122.1641	0.00
Pesaran CD	52.84694	0.00	Pesaran CD	19.50492	0.1661
Investment					
Test	Statistic	Prob.			
Breusch-Pagan LM	4867.876	0.00			
Pesaran scaled LM	114.1169	0.00			
Bias-corrected scaled LM	113.1432	0.00			
Pesaran CD	25.32835	0.00			

Note: The symbols *, ** and *** show the significance levels at 1%, 5% and 10%, respectively.

As it is seen in Table 6 since the probability values of the variables are less than 0.01, the null hypothesis is rejected and it is seen that there is a cross-section dependence in the series. The tests to be applied after the cross-sectional addiction finding is obtained should be second-generation tests.

The results of the Delta Test used to assess the homogeneity are shown in Table 7:

Table 7: Delta Test Examine

Delta Δ	2.466	prob	0.002
Delta Δ_{adj}	2.717	prob	0.003

The probability values of both Delta Δ and Delta Δ_{adj} tests appeared to be less than the threshold value of 0.05 thus the H_0 hypothesis was rejected and the variables were found to be heterogeneous.

The results obtained with the Hadri-Kurozumi unit root test, one of the second generation unit root tests decided after the cross-sectional dependency test, are shown in Table 8 as follows:

Tablo 8: Hadri-Kurozumi Unit Root Test Results

I(0)			I(1)		
Expenditure		prob	Expenditure		prob
ZA_spac	14	0.00	ZA_spac	0.2914	0.3854
ZA_la	12.24	0.00	ZA_la	1.034	0.1506
Growth		prob	Growth		prob
ZA_spac	9.907	0.00	ZA_spac	1.62	0.051
ZA_la	14	0.00	ZA_la	2.28	0.011
Military		prob	Military		prob
ZA_spac	6.433	0.00	ZA_spac	-0.38	0.65
ZA_la	6.92	0.00	ZA_la	-0.32	0.62
Education		prob	Education		prob
ZA_spac	5.18	0.00	ZA_spac	1.076	0.141
ZA_la	5.95	0.00	ZA_la	0.724	0.235
Health		prob	Health		prob
ZA_spac	33.76	0.00	ZA_spac	0.2077	0.417
ZA_la	49.58	0.00	ZA_la	-1.440	0.9252
Transfer		prob	Transfer		prob
ZA_spac	2.81	0.00	ZA_spac	-1.14	0.87
ZA_la	5.88	0.00	ZA_la	-0.67	0.74
Investment		prob	Investment		prob
ZA_spac	13.86	0.00	ZA_spac	0.6884	0.2456
ZA_la	16.52	0.00	ZA_la	2.15	0.0156

Note: The symbols *, ** and *** show the significance levels at 1%, 5% and 10%, respectively.

According to the Hadri-Kurozumi unit root test results, the null hypothesis that the series is stationary for all the variables examined was rejected. The first difference of these variables was taken and the variables were made stationary.

The results of Emirmahmutoğlu and Köse causality tests, which were carried out to determine the causality relationship between the variables, are presented in the tables below. First, the results of the analysis examining the causality relationship between public expenditures and growth are as follows:

Table 9: Causality Test Results between Public Expenditure and Growth

Expenditure→Growth	Lag	Wald Stats.	Prob.	Growth→Expenditure	Lag	Wald Stats.	Prob.
Australia	1	0.321	0.571	Australia	1	0.884	0.347
Austria	1	0.987	0.32	Austria	1	0.002	0.968
Belgium	1	0.165	0.684	Belgium	1	0.19	0.663
Canada	3	13.27	0.004*	Canada	3	3.369	0.338
Switzerland	3	2533	0.469	Switzerland	3	3.776	0.287
Chile	1	1093	0.296	Chile	1	7.314	0.007*
Colombia	1	1852	0.174	Colombia	1	0.232	0.63
Czech Republic	2	1804	0.406	Czech Republic	2	0.01	0.995
Germany	1	0.207	0.649	Germany	1	0.081	0.776
Denmark	1	0.179	0.672	Denmark	1	0.003	0.957
Spain	3	8136	0.043	Spain	3	3.312	0.346
Estonia	2	0.38	0.827	Estonia	2	0.908	0.635
Finland	1	1720	0.19	Finland	1	0.446	0.504
France	1	4133	0.042	France	1	0.951	0.33
United Kingdom	1	2072	0.15	United Kingdom	1	3.111	0.078***
Greece	1	5137	0.023*	Greece	1	0.009	0.926
Hungary	1	1317	0.251	Hungary	1	1.334	0.248
Ireland	1	5398	0.02*	Ireland	1	0.352	0.553
Iceland	3	1275	0.735	Iceland	3	8.459	0.037
Israel	3	0.774	0.856	Israel	3	6.763	0.08***
Italy	1	0.795	0.373	Italy	1	0.602	0.438
Japan	1	0.491	0.483	Japan	1	0.031	0.861
Korea, Rep.	1	0.26	0.61	Korea, Rep.	1	0.315	0.575
Lithuania	3	0.922	0.82	Lithuania	3	0.885	0.829
Luxembourg	1	0.109	0.742	Luxembourg	1	0.004	0.948
Latvia	1	22.053	0.00*	Latvia	1	0.249	0.710
Mexico	2	1.168	0.558	Mexico	2	0.488	0.784
Netherlands	1	0	0.99	Netherlands	1	0.085	0.77
Norway	1	0.324	0.569	Norway	1	0.058	0.81
New Zealand	3	40.174	0.00*	New Zealand	3	0.234	0.972
Poland	2	6.089	0.048	Poland	2	6.319	0.042
Portugal	1	2.464	0.117	Portugal	1	0.023	0.878
Slovak Republic	1	5.405	0.02*	Slovak Republic	1	1.552	0.213
Slovenia	1	6.883	0.009*	Slovenia	1	0.151	0.697
Sweden	3	4.087	0.252	Sweden	3	5.758	0.124
Turkey	2	1.728	0.421	Turkey	2	1.050	0.592
USA	3	1.158	0.763	USA	3	2.364	0.5
Panel Fisher Test Stats.		168.200	0.00*	Panel Fisher Test Stats.		73.961	0.479

Note: *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively.

The findings obtained as a result of the analysis show that there is a one-way causality relationship at the 1% significance level from public expenditures to growth for the panel in general. It is seen that this causality relationship obtained confirms the Keynesian Hypothesis.

According to the individual test results, it is seen that there is a causality relationship at the 1% significance level from public expenditures to growth in Canada, Greece, Latvia, New Zealand and Slovenia. It is seen that the causality relationship obtained in these countries also confirms the Keynesian hypothesis. In the United Kingdom and Israel countries, it is seen that there is a causality relationship at the 10% significance level from growth to public expenditures. The causality relationship obtained confirms the Wagner Law.

The results of the analysis examining the causality relationship between military expenditures and growth are as follows:

Table 10: Causality Test Results between Military Expenditure and Growth

Military- Growth	Lag	Wald Stats.	Prob.	Growth- Military	Lag	Wald Stats.	Prob.
Australia	3	9.892	0.02**	Australia	3	0.481	0.786
Austria	3	11.937	0.008*	Austria	3	0.008	0.929
Belgium	1	1.431	0.232	Belgium	1	0.014	0.904
Canada	1	0.78	0.377	Canada	1	1.065	0.302
Switzerland	3	9.470	0.024**	Switzerland	3	4.072	0.131
Chile	1	0.048	0.826	Chile	1	0.048	0.826
Colombia	2	2.010	0.366	Colombia	2	2.010	0.366
Czech Republic	1	0.024	0.802	Czech Republic	1	3.024	0.082***
Germany	1	0.018	0.893	Germany	1	0.018	0.893
Denmark	3	10.991	0.102	Denmark	3	10.991	0.012**
Spain	1	1.128	0.288	Spain	1	1.128	0.288
Estonia	3	0.898	0.731	Estonia	3	19.898	0.00*
Finland	1	0.244	0.114	Finland	1	8.244	0.004*
France	1	0.247	0.619	France	1	0.309	0.578
United Kingdom	2	0.391	0.822	United Kingdom	2	0.391	0.822
Greece	1	0.008	0.928	Greece	1	0.008	0.928
Hungary	3	0.735	0.522	Hungary	3	7.735	0.052***
Ireland	1	0.216	0.642	Ireland	1	0.216	0.642
Iceland	1	0.334	0.994	Iceland	1	0	0.995
Israel	3	4.564	0.207	Israel	3	9.748	0.021**
Italy	1	0.942	0.332	Italy	1	0.728	0.394
Japan	2	1.731	0.421	Japan	2	0.759	0.684
Korea, Rep.	3	4.308	0.23	Korea, Rep.	3	4.308	0.23
Lithuania	2	0.705	0.703	Lithuania	2	0.705	0.703
Luxembourg	2	1.217	0.544	Luxembourg	2	1.217	0.544
Latvia	3	3.524	0.318	Latvia	3	3.524	0.318
Mexico	2	0.554	0.758	Mexico	2	2.763	0.096***
Netherlands	1	0.211	0.646	Netherlands	1	3.473	0.324
Norway	3	0.154	0.23	Norway	3	19.754	0.00*
New Zealand	1	0.007	0.933	New Zealand	1	0.342	0.559
Poland	2	1.069	0.586	Poland	2	1.069	0.586
Portugal	1	0.134	0.714	Portugal	1	0.031	0.86
Slovak Republic	1	0.025	0.875	Slovak Republic	1	0.004	0.948
Slovenia	1	1.942	0.163	Slovenia	1	1.478	0.224
Sweden	2	5.150	0.076***	Sweden	2	6.010	0.111
Turkey	3	3.338	0.342	Turkey	3	3.338	0.342
USA	3	3.195	0.363	USA	3	3.068	0.381
Panel Fisher		130.973	0.00*	Panel Fisher		18.660	0.641

Note: *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively.

According to the findings obtained as a result of the analysis, it is seen that there is a one-way causality relationship at the 1% significance level from military expenditures to growth for the panel in general. It is seen that this causality relationship obtained confirms the Keynesian Hypothesis.
According to the individual test results, there is a 1% significance level causality relationship from military expenditures to growth in Austria. It is seen that there is a causality relationship at the 5% significance level from military expenditures to growth in Australia and Switzerland, and at 10% significance level from military expenditures to growth in Sweden. It is seen that the causality relationship obtained in these countries also confirms the Keynesian hypothesis. In Estonia, Finland and Norway, a causality relationship is observed at the 1% significance level from growth to military expenditures. It is seen that there is a causality relationship at the 5% significance level from growth to military expenditures in Denmark and Israel, and at 10% significance level from growth to military expenditures in the Czech Republic, Hungary and Mexico countries. The causality relationship obtained confirms the Wagner Law.
The results of the analysis examining the causality relationship between education expenditures and growth are as follows:

Table 11: Causality Test Results between Education Expenditure and Growth

Education-Growth	Lag	Wald Stats.	Prob.	Growth - Education	Lag	Wald Stats.	Prob.
Australia	1	0.01	0.921	Australia	1	4.197	0.04*
Austria	1	0.002	0.96	Austria	1	0.002	0.961
Belgium	1	0.012	0.912	Belgium	1	0.236	0.627
Canada	1	1.839	0.175	Canada	1	6.065	0.014**
Switzerland	1	0.033	0.855	Switzerland	1	0.092	0.762
Chile	1	0.547	0.46	Chile	1	3.7	0.054***
Colombia	1	6.846	0.009*	Colombia	1	0.109	0.741
Czech Republic	1	2.080	0.149	Czech Republic	1	0.017	0.897
Germany	1	2.396	0.122	Germany	1	0.146	0.703
Denmark	1	0.006	0.937	Denmark	1	0.007	0.935
Spain	1	2.213	0.137	Spain	1	0.359	0.549
Estonia	3	4.566	0.207	Estonia	3	0.767	0.857
Finland	1	0.003	0.959	Finland	1	0.046	0.83
France	1	0.038	0.845	France	1	0.018	0.894
United Kingdom	1	0.023	0.88	United Kingdom	1	0.055	0.815
Greece	1	0.002	0.962	Greece	1	5.701	0.017**
Hungary	1	0.172	0.678	Hungary	1	0.055	0.815
Ireland	1	1.962	0.161	Ireland	1	0.318	0.573
Iceland	3	2.686	0.443	Iceland	3	5.452	0.142
Israel	2	2.214	0.331	Israel	2	1.69	0.43
Italy	2	0.353	0.838	Italy	2	2.178	0.337
Japan	1	2.370	0.124	Japan	1	0.161	0.688
Korea, Rep.	1	0.854	0.356	Korea, Rep.	1	1.667	0.197
Lithuania	3	19.541	0.00*	Lithuania	3	0.202	0.98
Luxembourg	3	3.640	0.303	Luxembourg	3	1.599	0.66
Latvia	3	14.022	0.003*	Latvia	3	1.175	0.759
Mexico	2	3.369	0.186	Mexico	2	7.852	0.02**
Netherlands	1	0	0.99	Netherlands	1	0.09	0.759
Norway	1	0.474	0.491	Norway	1	0.314	0.575
New Zealand	1	0.003	0.955	New Zealand	1	3.384	0.066***
Poland	3	10.142	0.017**	Poland	3	3.255	0.354
Portugal	2	0.015	0.992	Portugal	2	1.064	0.587
Slovak Republic	1	0.668	0.414	Slovak Republic	1	0.135	0.714
Slovenia	1	0.807	0.369	Slovenia	1	0.029	0.864
Sweden	3	17.840	0.00*	Sweden	3	0.555	0.91

Turkey	2	0.836	0.658	Turkey	2	0.061	0.97
USA	3	24.720	0.00*	USA	3	5.113	0.16
Panel Fisher		131.958	0.00*	Panel Fisher		72.347	0.53

Not: *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively.

According to the findings obtained as a result of the analysis, it is seen that there is a one-way causality relationship at the 1% significance level from education expenditures to growth for the panel in general. It is seen that this causality relationship obtained confirms the Keynesian Hypothesis.
According to the individual causality test results, there is a causality relationship at the 1% significance level from education expenditures to growth in Colombia, Lithuania, Latvia, Sweden and the USA. It is seen that there is a causality relationship at the level of 5% significance from education expenditures to growth in Poland. It is seen that the causality relationship obtained in these countries also confirms the Keynesian Hypothesis. In Australia, Canada, Greece and Mexico, there is a causality relationship from growth to education expenditures at the 5% significance level. It is seen that there is a 10% significance level causality relationship from growth to education expenditures in Chile and New Zealand. The causality relationship obtained confirms the Wagner Law.
The results of the analysis examining the causality relationship between health expenditures and growth are as follows:

Table 12: Causality Test Results between Health Expenditure and Growth

Health -Growth	Lag	Wald Stats.	Prob.	Growth-Health	Lag	Wald Stats.	Prob.
Australia	1	7.591	0.006*	Australia	1	0.012	0.914
Austria	1	0.016	0.9	Austria	1	0.001	0.97
Belgium	2	1.099	0.577	Belgium	2	2.298	0.317
Canada	2	2.948	0.229	Canada	2	1.389	0.499
Switzerland	3	1.528	0.676	Switzerland	3	2.230	0.526
Chile	1	0.230	0.124	Chile	1	3.773	0.052***
Colombia	2	0.496	0.78	Colombia	2	8.928	0.012**
Czech Republic	2	0.448	0.799	Czech Republic	2	0.194	0.907
Germany	3	5.142	0.162	Germany	3	2.065	0.559
Denmark	2	1.549	0.461	Denmark	2	10.222	0.006*
Spain	3	15.790	0.001*	Spain	3	7.948	0.047**
Estonia	3	0.607	0.895	Estonia	3	7.593	0.055***
Finland	1	0.829	0.363	Finland	1	0.004	0.947
France	2	1.170	0.557	France	2	0.899	0.638
United Kingdom	1	2.268	0.132	United Kingdom	1	20.271	0.00*
Greece	1	0.002	0.965	Greece	1	0.154	0.695
Hungary	1	0.099	0.753	Hungary	1	0.038	0.845
Ireland	1	0.59	0.442	Ireland	1	0.065	0.799
Iceland	1	0.586	0.444	Iceland	1	0.895	0.344
Israel	3	4.475	0.214	Israel	3	7.757	0.051***
Italy	1	6.195	0.013**	Italy	1	0.684	0.408
Japan	2	3.064	0.216	Japan	2	12.684	0.002*
Korea, Rep.	3	8.216	0.042	Korea, Rep.	3	19.909	0.00*
Lithuania	2	7.385	0.025**	Lithuania	2	4.644	0.098
Luxembourg	1	0.074	0.79	Luxembourg	1	0.414	0.52
Latvia	3	15.004	0.002*	Latvia	3	3.710	0.295
Mexico	3	4.398	0.222	Mexico	3	10.946	0.012**
Netherlands	2	0.54	0.762	Netherlands	2	0	0.999
Norway	3	0.723	0.868	Norway	3	6.962	0.073***
New Zealand	1	12.395	0.00*	New Zealand	1	0.704	0.4
Poland	2	8.442	0.015**	Poland	2	5.156	0.076***
Portugal	3	3.5	0.321	Portugal	3	0.485	0.922
Slovak Republic	1	0	0.995	Slovak Republic	1	1.489	0.222
Slovenia	1	0.855	0.355	Slovenia	1	0.004	0.95
Sweden	2	2.401	0.301	Sweden	2	7.470	0.024**
Turkey	3	1.510	0.68	Turkey	3	2.471	0.48
USA	2	5.218	0.074***	USA	2	0.13	0.937
Panel Fisher		34.870	0.37	Panel Fisher		151.488	0.00*

Not: *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively.

According to the findings obtained as a result of the analysis, it is seen that there is a one-way causality relationship at the 1% significance level from growth to health expenditures for the panel in general. It is seen that this causality relationship obtained confirms the Wagner Law.
According to the individual test results, there is a causality relationship at the 1% significance level from growth to health expenditures in Denmark, United Kingdom and Japan. In Colombia, Spain, Mexico and Sweden, there is a causality relationship from growth to health expenditures at a significance level of 5%. It is seen that there is a 10% significance level causality relationship from growth to health expenditures in Estonia, Israel, Norway and Poland. It is seen that the causality relationship obtained in these countries also confirmed by the Wagner Law. In Australia, Spain, Latvia and New Zealand, there is a causality relationship from health expenditures to growth at the 1% significance level. In Chile, Italy, Lithuania and Poland, there is a causality relationship from health expenditures to growth at the 5% significance level. It is seen that there is a causality relationship at the 10% significance level from health expenditures to growth in the USA. The causality relationship obtained confirms the Keynesian Hypothesis.
The results of the analysis examining the causality relationship between subvention-transfer expenditures and growth are as follows:

Table 13: Causality Test Results between Subvention-Transfer Expenditure and Growth

Subvention /Transfer- Growth	Lag	Wald Stats.	Prob.	Growth-Transfer	Lag	Wald Stats.	Prob.
Australia	3	0.614	0.893	Australia	3	6.859	0.077***
Austria	2	1.823	0.402	Austria	2	0.254	0.881
Belgium	1	0.003	0.955	Belgium	1	0.068	0.794
Canada	2	7.048	0.029**	Canada	2	4.510	0.105
Switzerland	1	1.122	0.29	Switzerland	1	1.257	0.262
Chile	1	0.429	0.512	Chile	1	1.258	0.262
Colombia	3	10.088	0.018**	Colombia	3	1.010	0.799
Czech Republic	1	1.127	0.288	Czech Republic	1	0.498	0.48
Germany	1	0.162	0.688	Germany	1	0.222	0.637
Denmark	1	0.607	0.436	Denmark	1	2.022	0.155
Spain	1	0.144	0.704	Spain	1	0.002	0.963
Estonia	2	0.698	0.705	Estonia	2	0.99	0.61
Finland	1	0.195	0.659	Finland	1	0.047	0.829
France	1	0.379	0.538	France	1	0.438	0.508
United Kingdom	1	0.634	0.43	United Kingdom	1	0.763	0.38
Greece	1	2.148	0.143	Greece	1	0.012	0.911
Hungary	1	0.036	0.85	Hungary	1	0.28	0.597
Ireland	3	2.195	0.533	Ireland	3	2.061	0.56
Iceland	1	0.062	0.803	Iceland	1	0.981	0.322
Israel	2	0.028	0.986	Israel	2	0.148	0.929
Italy	1	0.104	0.748	Italy	1	0	0.998
Japan	2	7.457	0.024**	Japan	2	0.307	0.858
Korea, Rep.	3	1.256	0.74	Korea, Rep.	3	1.686	0.64
Lithuania	1	0.01	0.919	Lithuania	1	1.078	0.299
Luxembourg	2	17.095	0.00*	Luxembourg	2	0.151	0.93
Latvia	2	0.909	0.635	Latvia	2	1.975	0.372
Mexico	3	1.966	0.579	Mexico	3	1.976	0.577
Netherlands	3	14281	0.003*	Netherlands	3	0.155	0.271
Norway	1	0.238	0.625	Norway	1	0.017	0.895
New Zealand	1	3.610	0.06***	New Zealand	1	0.029	0.87
Poland	2	5.987	0.04**	Poland	2	1.028	0.598
Portugal	2	0.856	0.652	Portugal	2	0.337	0.845
Slovak Republic	1	0.001	0.973	Slovak Republic	1	0.926	0.336
Slovenia	1	0,003	0.984	Slovenia	1	0.718	0.397
Sweden	2	4.228	0.121	Sweden	2	0.932	0.627
Turkey	3	14.914	0.00*	Turkey	3	0.130	0.102
USA	1	1.108	0.292	USA	1	0.874	0.35
Panel Fisher		109.745	0.00*	Panel Fisher		62.852	0.82

Not: *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively.

According to the findings obtained as a result of the analysis, it is seen that there is a one-way causality relationship at the 1% significance level from subvention and transfer expenditures to growth for the panel in general. It is seen that this causality relationship obtained confirms the Keynesian Hypothesis.

According to the individual test results, there is a causality relationship at the 1% significance level from subvention and transfer expenditures to growth in Luxembourg, Netherlands and Turkey. In Canada, Colombia, Japan and Poland, there is a causality relationship from subvention and transfer expenditures to growth at the 5% significance level. It is seen that there is a 10% significance level causality relationship from subvention and transfer expenditures to growth in New Zealand. It is seen that the causality relationship obtained in these countries also confirms the Keynesian Hypothesis. It is seen that there is a causality relationship at the 10% significance level from growth to subvention and transfer expenditures in Australia. The causality relationship obtained confirms the Wagner Law.
The results of the analysis examining the causality relationship between investment expenditures and growth are as follows:

Table 14: Causality Test Results between Investment Expenditure and Growth

Investment-Growth	Lag	Wald Stats.	Prob.	Growth-Investment	Lag	Wald Stats.	Prob.
Australia	3	19.472	0.00*	Australia	3	0.558	0.139
Austria	1	0.227	0.634	Austria	1	3.392	0.065***
Belgium	1	0.073	0.786	Belgium	1	0.432	0.511
Canada	2	2.793	0.247	Canada	2	4.786	0.091
Switzerland	3	1.468	0.69	Switzerland	3	47.913	0.00*
Chile	1	0.254	0.614	Chile	1	0.614	0.433
Colombia	3	4.626	0.201	Colombia	3	7.338	0.062***
Czech Republic	1	1.225	0.268	Czech Republic	1	0.046	0.831
Germany	3	16.006	0.001*	Germany	3	1.913	0.591
Denmark	1	7.645	0.006*	Denmark	1	2.407	0.121
Spain	1	5.028	0.025**	Spain	1	0.64	0.424
Estonia	3	4.455	0.216	Estonia	3	7.219	0.065***
Finland	3	4.742	0.192	Finland	3	3.196	0.362
France	2	1.783	0.41	France	2	10.044	0.007*
United Kingdom	2	5.607	0.06***	United Kingdom	2	2.087	0.35
Greece	1	0.001	0.975	Greece	1	2.550	0.11
Hungary	1	0.15	0.698	Hungary	1	0.042	0.837
Ireland	1	0.734	0.989	Ireland	1	1148	0.284
Iceland	1	3.231	0.072***	Iceland	1	0.01	0.919
Israel	3	0.963	0.81	Israel	3	3.050	0.384
Italy	2	0.35	0.838	Italy	2	12.227	0.002*
Japan	3	0.968	0.619	Japan	3	24.661	0.00*
Korea, Rep.	3	5.897	0.12	Korea, Rep.	3	5.360	0.15
Lithuania	1	4.257	0.039**	Lithuania	1	0.231	0.631
Luxembourg	2	0.262	0.88	Luxembourg	2	2.233	0.33
Latvia	2	12.353	0.002*	Latvia	2	0.82	0.664
Mexico	2	3.453	0.178	Mexico	2	0.536	0.765
Netherlands	3	6.013	0.111	Netherlands	3	12.348	0.006*
Norway	3	25.134	0.00*	Norway	3	0.175	0.114
New Zealand	1	0.546	0.46	New Zealand	1	4.763	0.03**
Poland	1	0.371	0.542	Poland	1	0.335	0.563
Portugal	2	3.024	0.221	Portugal	2	4.540	0.103
Slovak Republic	2	0.683	0.711	Slovak Republic	2	1.384	0.501
Slovenia	1	1.092	0.296	Slovenia	1	0.473	0.988
Sweden	2	2.705	0.259	Sweden	2	0.62	0.733
Turkey	2	2.187	0.34	Turkey	2	11.502	0.00*
USA	2	3.435	0.179	USA	2	0.348	0.84
Panel Fisher		159.179	0.00*	Panel Fisher		19.000	0.34

Not: *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively.

According to the findings obtained as a result of the analysis, it is seen that there is a one-way causality relationship at the 1% significance level from investment expenditures to growth for the panel in general. It is seen that this causality relationship obtained confirms the Keynesian Hypothesis.
According to the individual test results, there is a causality relationship at the 1% significance level from investment expenditures to growth in Australia, Germany, Denmark, Latvia and Norway. In Spain and Lithuania countries, there is a causality relationship from investment expenditures to growth at the 5% significance level. It is seen that there is a 10% significance level causality relationship from investment expenditures to growth in England and Iceland. It is seen that the causality relationship obtained in these countries also confirms the Keynesian Hypothesis. In Switzerland, France, Italy, Japan, Netherlands and

Turkey, there is a causality relationship from growth to investment expenditures at a significance level of 1%. In New Zealand, there is a causality relationship from growth to investment expenditures at the 5% significance level. It is seen that there is a 10% significance level causality relationship from growth to investment expenditures in Austria, Colombia and Estonia. The causality relationship obtained confirms the Wagner Law.

CONCLUSION AND DISCUSSION

Wagner (1890) put forward the idea that the increase in public expenditure is an inevitable feature of developed and developing states. In the public finance literature, this proposal emphasized that as per capita income increases the share of the state in public sector expenditures also increases to meet the increasing protective, administrative and educational functions of the state. This means that economic growth is the cause of the growth in government spending. That is, public expenditure plays no role in economic growth and is therefore not seen as a policy tool. The Keynesian Hypothesis, on the other hand, accepts public expenditures as independent and exogenous, and claims that causality extends from the growth in public expenditures to the growth in national income. More importantly, according to this theory, public expenditure becomes a policy variable that can be used to affect economic growth. Based on this hypothesis, many developing countries have assigned the public sector the role of promoting growth and economic development. Various forms of market failure seem to have reinforced this policy. It is believed that government harmonizes conflicts between private and social interests, resists exploitation by foreign interests, and increases socially desirable investment. Since a large public sector means large government expenditures, government spending appears to spur growth in income. The role of the public sector is often criticized on the grounds that government is less effective than market forces in allocating resources. In addition, the regulatory process and, in this context, monetary and fiscal policies can potentially distort the incentive system. The rapid expansion of public expenditures may also lead to structural changes that support the relative growth of the service sector.

In this study, the relationship between variables covering the years 2000-2019 and public expenditures and growth for 37 OECD countries is tested. In the study, in which GDP was used as the independent variable, public expenditures (military, education, health, subvention and transfer, investment expenditure) were used as the dependent variable. The effect of total public expenditures and its sub-headings on growth has been examined by establishing separate models and the validity of the Wagner Law or Keynesian Hypothesis for OECD countries has been tried to be revealed. When the findings obtained as a result of the analyzes are examined for cluster analysis, for findings of the year 2000 are evaluated, it is possible to state that the countries that unite first and are most similar (or at least dissimilar) are Spain and Japan, which appear in the first step. The countries that converge in the first place at the closest distance are Spain, Japan, the United States of America, Australia, and Switzerland. When the findings of 2019 are evaluated, it is possible to state that the countries that unite first and are most similar (or least similar) are Lithuania and Poland, which appear in the first step. The countries that converge in the closest distance in the first place are Lithuania, Poland, Turkey, Israel, Czech Republic, New Zealand, Ireland, Iceland, and Chile.When the findings obtained as a result of the analyzes are examined throughout the panel; It is seen that there is a causality relationship at the 1% significance level from investment expenditures, subvention and transfer expenditures, education expenditures, military expenditures and public expenditures to growth. It is seen that this causality relationship confirms the Keynesian hypothesis. The only place where the Wagner Law is valid is the situation between the variables where there is a causality relationship at the 1% significance level from growth to health expenditures.

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