Study on the variables reflecting the action of interest groups. The case of Greek economy

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Research Article

Keywords:

Posted Date: November 19th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-2262891/v1

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Abstract: In literature there are many studies considering the action of interest groups in several countries’ societies and economies. In order to study the effect of special interest groups in the economy of each country, a multitude of variables have been used by researchers. After an extended bibliographic research in the recording of the economy affecting variables that have been used, this research presents a methodology for the selection of those which better represent the action of interest groups in the economy of Greece. The methodology used is based on Principal Component Analysis and therefore on the correlation tests needed. In this way it can be concluded which variables can be more advantageous in future research.

1. Introduction

Several scientists from different disciplines are engaged in research with interest groups. From a sociological point of view, it is of great interest to examine how they are formed, the reasons that lead to their creation of their creation as well as how they finally affect the social masses. Political scientists focus not only on the political conditions that favor the development of these groups in a country, but also on the way they act depending on the regime that prevails in each country. Another interesting research issue is the political implications of interest groups from their action, which have many peculiarities. Economists from their own point of view deal with the effects of interest groups action on countries’ economies.

This study considers that interest groups behave as Mancur Olson explains in his book *The Logic of Collective Action* [1]. It does not deal at all with the methods that interest groups use to achieve their goals, but with the consequences on the economy of each country. The most important of those are also mentioned by Mancur Olson in his
second book *The Rise and Decline of Nations* [2], which has received numerous citations, more than 12,000. In this book, Olson uses the exclusive interest group model developed in the *Logic of Collective Action* (1965) [1] to underline the differences in national incomes, growth rates, inequality, unemployment, and susceptibility to business cycles.

Particularly, Olson notes that differences in the interests and relative effectiveness of privileged and latent groups are to blame for many of the problems associated with life in society. Privileged groups have relatively narrow and limited interests, which make them more effective at lobbying government for preferential policies. Privileged groups expect to capture most of the benefits of the policies lobbied for—often simply additional profits or higher salaries. However, they will bear only a very small portion of the losses associated with their tax, trade, and regulatory privileges. Latent groups bear most of those costs through higher prices, transaction costs, and taxes. As the number of politically active groups increases, more and more privileges are created (and thus have to be defended). As time passes by, distributive policies therefore tend to increase the associated complexity and rigidity of entry barriers, tax codes, tariff schedules, regulatory law, and other policies creating group privileges. That stiffness consequently makes the economic and political systems less adaptable and less innovative. Inequality increases as privileges proliferate and economic growth falls because of the deadweight losses from regulation and increased rigidity. The members of well-organized groups become relatively richer, while members of latent groups, who bear the costs without associated benefits, become relatively poorer. Unemployment rises and the amplitude of business cycles increases, because of the market’s reduced ability to adjust to micro- and macroeconomic shocks [3].

In the next sections of the study, we will at first present the action of interest groups in Greece. We will introduce the methodology used, this of Principal Component Analysis (PCA) and a thorough variable analysis, in order to select the appropriate variables that highlight the influence of interest groups on Greek economy. There will also follow an extended report on the results of the study and how they can be used in a future research.
2. The action of interest groups in Greece

Mancur Olson in his second implication in the *Rise and Decline of nations* (1982) [2], refers: “Stable societies with unchanged boundaries tend to accumulate more collusions and organizations for collective action over time”. The meaning of this implication is that countries which are not involved in any war or conflict that would result in border change, or countries which have stable political system and strong governments democratically elected by the citizens, tend to accumulate more and more collusions and interest groups for collective action over time. Sclerotic effects also tend to be stronger in democratic nations, but are dependent upon how strict a definition of democracy is used [4].

Considering the period after the colonels’ coup (1967-1974), this scenario seems to be confirmed for Greece. After the fall of the dictatorship in 1974, Greece had had a stable democratic political system until today. Important changes regarding the role of interests in the social dialogue have been taking place since 1974 both on the socio-political and the legal institutional front. The Constitution of 1975 marks an important shift in a number of ways: for example, by guaranteeing the right to form unions and the right to strike. The Constitution protects the right to form associations as well as the right not to be involved in collective (public) activity [5].

Thus, after 1974 modern Greek society includes trade unions, business associations, chambers, freelancers’ associations, ecclesiastical organizations, associations and unions based on their place of origin, informal groupings of people in provincial towns, and many others [6], where each group works in its own way to promote its interests.

A thorough analysis of the complex interactions between the various government branches, interest groups, voters and the media in the context of the weak Greek institutions, is provided by Pelagidis and Mitsopoulos (2006) [7].

The way in which the various interest groups in Greece acted and functioned, their relations with the respective government, the government corruption and the general corruption of the public sector, the bureaucracy of the public sector, the pluralism, and even the premature or successive elections, all these are the result of pressure from
interest groups. On this subject, Greek political scientists, sociologists and economists have reported extensively on publications, books and newspaper articles [5-10].

The interest groups in Greece are very active and the results of their action are reflected in the country’s economy, as mentioned in the seventh impact of Olson's theory. It states that distributional coalitions due to interest slow down a society’s capacity to adopt new technologies and to reallocate resources in response to changing conditions, and thereby reduce the rate of economic growth.

Greece has a large number of special interest groups which have developed various entry barriers; they slow down the adoption of new technologies, particularly in the public sector, and have diverted the development of incentives in society [10]. The prices of many goods and services are higher compared to other European countries due the lack of healthy competition. Interest groups have altered the development of Greek society, making the dream of every young person to get a highly paid position in privileged state companies with the main privilege being early retirement. In his thorough study for Greece, [10] conclude that special interest groups in Greece are detrimental to economic growth, full employment, prudent governance, equal opportunities and social mobility.

The above conclusions are also confirmed in the study of Papadakis, Atsalakis and Zopounidis (2022) [11], regarding the implementation of the implications of Olson’s theory in Greece. As emerged by their study, second and seventh implication of Olson’s theory are confirmed in the case of Greece.

3. Methodology of Principal Component Analysis (PCA)

The Principal Component Analysis (PCA) was originally defined in a statistical context by Pearson (1901) [12] via an extension of the geometric argument just presented. The most usual definition in terms of successive maximization of variance came thirty (30) years later by Hotelling in 1933 [13-14].

The central idea of principal component analysis is to reduce the dimensionality of a data set consisting of a large number of interrelated variables [15-16] while retaining as much as possible of the variation present in the data set. This is achieved by transforming to a new set of variables, the principal components (PCs), which are uncorrelated, and which are ordered so that the first few retain most of the variation present in all of the original variables [15].
The main advantage of the method is the application without any a priori assumption for the variables that participate \([13,16-18]\). Subsequently, the main elements of the Principal Component Analysis \([12-14,17,19]\) will be presented below.

3.1 Analytic presentation of PCA

We assume that for this study, a set of data \(n\) observations is available, each of which is characterized by the values it receives in \(P\) arithmetical variables, \(X_1, X_2, X_3, \ldots X_p\). The value displayed in the data table for the variable \(X_j\) in observation \(i\) will be denoted by \(x_{ij}\).

The analysis of principal components is a statistical method whose main purpose is to describe the data table \(X(n, P) = x_{ij}\).

Consider each line \(i\) of table \(X\), as a point in the space of \(P\) dimensions. The values obtained by the observation \(i\) in \(P\) variables \((x_i: i = 1, 2, \ldots, P)\) are considered as the coordinates of the corresponding point in the \(P\) axes of this space. Therefore, all the information provided by the \(X\) data table can be compared to a cloud of \(n\) points in \(\mathbb{R}^P\) space. The goal is to be able to observe the cloud of points in a space with less dimensions than the original ones, even \(m\) \((m < P)\).

To achieve this, we try to define a linear combination of dimensions \(m\) that passes as close as possible to the center of mass of the original cloud of the data points, that is, the average of the squares of the \(x_i\) distances of the cloud points from this linear combination to be minimal and each \(x_i\) point to be depicted in this linear combination from its projection.

If we set \(m = 0\) to the dimension, it means that we are looking for a point that is as close as possible to the center of the points, which is none other than the center of mass \(G\) of the cloud.

\[
G = \frac{1}{n} \sum_{i=1}^{n} x_i \tag{3.1}
\]

If we set \(m = 1\), this means that we are looking for a line that passes as close as possible to the center of mass \(G\) of the cloud of points. This line \(\Delta_1\) will pass through the center of mass of the cloud \(G\) and is called the first major axis of the cloud. If we take \(G\) as the beginning of this axis, we have created the first main component \(Y_1\).

If we set \(m = 2\) the dimension of the desired linear combination, we try to set a level that passes as close as possible to the center of mass \(G\) of the cloud. This level is as close as possible to the center of mass \(G\) of the cloud. This level passes through the center of mass \(G\) and contains the first main axis \(\Delta_1\). So to define the level completely, it is enough to define a second straight line \(\Delta_2\), passing through the center of mass and rectangular on the first main axis. This second straight line \(\Delta_2\), is the
second axis. The coordinates of the projections of the points (observations) $x_i$ on the second main axis $\Delta_2$, are taken again, as beginning the center of mass $G$, which now coincides with the beginning of the axes and create the second main component $Y_2$.

The determination of the linear combination can be generalized for the dimensions $m = 3, m = 4, \ldots, m = P$. Because the main components are not related to each other, they allow us to study the position of the projections of the $x_i$ points on them, as well as the correlations between the initial variables $x_i$ and the main components $Y_j$. In this way, is managed to reduce the serious problem that arises when the dimensions of the data table we are studying are large.

In each line $i$ of the table of data $X$, corresponds the point $x_i : = (x_{i1}, x_{i2}, \ldots, x_{ip})$ of the space $\mathbb{R}^p$. $N$ symbolizes the cloud of the $x_i$ points of the $\mathbb{R}^p$ space.

The center of mass $G$ of cloud $N$ is defined by the formula:

$$G = \frac{1}{n} \sum_{i=1}^{n} x_i \quad (3.2)$$

Where $x_i = (\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_p)$ and $\bar{x}_j = \frac{1}{n} \sum_{i=1}^{n} x_{ij} \quad (3.3)$, the mean value of $x_i$ variable.

Also the square of the distance of the $x_i$ point from the center of mass $G$ is denoted by the formula: $d^2(x_i, G) = \sum_{j=1}^{p} (x_{ij} - \bar{x}_j)^2 \quad (3.4)$

The scattering of cloud $N$ around the center of mass $G$ is measured by the formula:

$$I(N, G) = \frac{1}{n} \sum_{i=1}^{n} d^2(x_i, G) \quad (3.5)$$

And finally is formed: $I(N, G) = \sum_{j=1}^{p} S_j^2 \quad (3.6)$,

where $S_j^2 = \frac{1}{n} \sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2 \quad (3.7)$ the covariance of $x_i$ variable.

The magnitude of $I(N,G)$, which expresses the scattering of the cloud $N$ around the center of mass $G$, is called in the data analysis the total inertia of the cloud $N$ with respect to the center of mass $G$.

Let $u_1, u_2, \ldots, u_m$ be a system of $m$, rectangles between them in pairs vectors of the vector space $\mathbb{R}^p$.

Symbolize with $L, = \{x: x = \sum_{k=1}^{m} a_k u_k\}$, its subsoil of $\mathbb{R}^p$ created by the vectors $u_1, u_2, \ldots, u_m$.

Even, an $h$ vector of $\mathbb{R}^p$. The linear combination $h + L = \{z: z = h + x, x \in L\}$ passing through the point which defined by the $h$ vector and is parallel to the subsurface $L$. That is, the vector $h$ causes a parallel shift of the subspace $L$. The dimension of the new linear combination $h + L$ is the same as the dimension of $L$ (with the parallel displacement the dimension of the subsurface does not change).
Let us now consider a y vector of \( \mathbb{R}^P \). There is a single x vector of \( \mathbb{L} \) that is closest to y. This is none other than the rectangular projection \( P_L(y) \) of \( \mathbb{L} \). This projection is characterized by the orthogonality between the y- \( P_L(y) \) vector and of \( u_1, u_2, \ldots, u_m \). This property mathematically determines the projection of the relationship:

\[
P_L(y) = \sum_{k=1}^{m} (y' u_k) u_k'
\]  

(3.8)

The projection of the y vector on the linear combination \( h + \mathbb{L} \) is given by the relation

\[
P_{h+L}(y) = h + P_L(y - h)
\]  

(3.9)

This relationship defines the projection of y vector on \( h + \mathbb{L} \) as a transfer by h of the projection of \( y - h \) on \( \mathbb{L} \).

As mentioned above, by analyzing the main components, we try to define that linear combination of \( h + \mathbb{L} \), \( m \) dimensions, which passes as close as possible to the middle of the cloud of the N points. Or more specifically, we want to define the linear combination \( h + \mathbb{L} \), which minimizes the quantity,

\[
I(N, h + L) = \frac{1}{n} \sum_{i=1}^{n} d^2(x_i, P_{h+L}(x_i))
\]  

(3.10)

Next, consider the subspace \( \mathbb{L} \), the two vectors h and g, as well as the parallels to \( \mathbb{L} \), \( h + \mathbb{L} \) and \( g + \mathbb{L} \) subspaces. Consider the \( x_i \) vector and symbolize with \( y_i \) and \( z_i \) its projections in the subspaces, \( g + \mathbb{L} \) and \( h + \mathbb{L} \).

Applying Huggens transformation:

\[
I(N, h + L) = I(N, g + L) + d^2(y, P_{h+L}(g))
\]  

(3.11)

the inertia transformation: \( I(N, g) = I(M, g) + I(N, g + L) \)

(3.12)

and by using the formula:

\[
d^2(x_i, g) = d^2(y_i, g) + d^2(x_i, y_i)
\]  

(3.13)

We conclude that the linear combination \( g + \mathbb{L} \) that minimizes \( I(N, g + L) \) is the same that maximizes the inertia \( I(M, g) \) at the same time,

\[
\frac{1}{n} \sum_{i=1}^{n} d^2(x_i, g) = \frac{1}{n} \sum_{i=1}^{n} d^2(y_i, g) + \frac{1}{n} \sum_{i=1}^{n} d^2(x_i, y_i)
\]  

(3.14)

### 3.2 Eigenvalues and Loadings

Now, we consider the vector subspace \( \mathbb{L}=(u_1, u_2, \ldots, u_m) \) of the \( \mathbb{R}^P \) vector space, created by the system of \( m \), rectangles in pairs, vectors \( u_1, u_2, \ldots u_m \).

It is known, for the variance –covariance table \( S = [S_{ik}] \), the valid formula:

\[
S = \frac{1}{n} \sum_{i=1}^{n} (x_i - g)(x_i - g)'
\]  

(3.15)
Therefore, it appears that the inertia of the cloud interpreted by the linear combination 
\( g + L \) is:
\[
I(M, g) = \sum_{i=1}^{m} u_k^r S u_k \tag{3.16}
\]

The ideal combination of dimensions \( m \), that is, the subsurface that can best interpret 
the cloud of points \( N \), will be of the form \( g + L \). The subspace \( L \) is a vector space \( m \) of 
dimensions, created by the rectangles per two vectors \( u_1, u_2, \ldots, u_m \) of which the 
maximum possible inertia of the cloud is interpreted, as \( \sum_{k=1}^{m} u_k^r S u_k \) (3.17)

It turns out that the determination of the subsurface \( L \), is given by the characteristic 
vectors \( u_1, u_2, \ldots, u_m \) of the variance - covariance table, which correspond to the 
largest values of \( \lambda_1, \lambda_2, \ldots, \lambda_m \) arranged in descending order.

It is also known that the inertia of the cloud that will be interpreted by this ideal linear 
combination will be equal to:
\[
I(M, g) = \sum_{k=1}^{m} \lambda_k \tag{3.18}
\]

The variances of the main components are called, characteristic roots or eigenvalues 
\( \lambda_m \) and number as many components as, in addition it is valid for them that 
\( \lambda_1 > \lambda_2 > \lambda_3 \ldots > \lambda_m \). An important feature of the characteristic roots is that their sum is 
equal to the sum of the variations of the initial variables (Petridis 2015).

It is also shown that the correlation between the initial variable \( x_j \) and the main 
component function \( u_k \) is given by the quotient:
\[
\frac{\sqrt{\lambda_k}}{s_j} u_{kj} \tag{3.19}
\]

This quotient for any correlation between the initial variables and the main 
components is called loadings and shows the intensity of the action that the initial 
variables develop to create the components. The higher the loads, the more important 
the candidate variables are for the formation of the main components (Petridis 2015).

4. Selecting the appropriate variables for the research

In the bibliography review, great importance is given to the study of variables 
used in the international literature for special interest groups. A thorough research of 
the variables that have been used to study the effects of interest groups action on the 
countries’ economies has been developed in the study of Papadakis and Atsalakis 
2019, \textit{Survey of Interest Groups Influence in an Economy} [20]. Because of the 
hundred different variables used in the articles, the initial purpose of this study is to
focus on the variables with most references in the research articles, considering that those variables are more likely to represent the effect of interest groups.

The variables with the most references to articles as emerged from the study of Papadakis and Atsalakis 2019 [20], in descending order are:

a) **GDP per capita**, [4,21-30]

b) **Number of interest groups**, [4,22,27-35]

c) **GDP growth rate**, [22,24,30-32,34-42]

d) **Government spending**, [4,22,32,35,43-45]

e) **Population**, [21,22,27,35,30,42,45]

f) **Duration of political stability**, [21,25,37,38,40,42,46]

g) **political rights/ democracy**, (4,29,30,35,42,45)

h) **Investment**, [4,31,32,34,35,48]

i) **GDP**, [31,34,35,42,45,48]

j) **Tax revenues**, [4,22,38,27,44]

k) **Inflation**, [4,30,34,42,48]

l) **GDP per capita rate of growth**, [36,44,47,48]

m) **Government revenue as percentage of GDP**, [24,27,36]

The aim of data analysis that follow, is the selection of the appropriate variables, which best reflect the action of interest groups in a country's economy, according to bibliographic research.

Before the beginning of data analysis, firstly is necessary to abort the variables that are not seems really useful to participate in the analysis. Secondly, to concern the time period where there are available data for all the variables with respect to the second implications of Olson’s theory. It is important for the reliability of the analysis that the data of the variables have to correspond in to the same time period. Thirdly, to note the sources of the data sets.

There are not reliable data for the variable ‘‘Number of interest groups’’, as there is currently no official source that has measured or even approached the number of interest groups operating in Greece. As mentioned in the introduction chapter, the term interest groups has a general meaning and it is objectively impossible to count them. It would be possible to find data from chambers and add up the trade unions, which are officially recognized and the labor unions, so that there is at least one
estimate. In the international literature there is this kind of estimating the number of interest groups, but in the case of Greece this effort has two downsides. First, every year the number of the unions remain almost constant without significant changes, so it does not help the study and second and more importantly that this is not a complete picture of the real number of interest groups. According to Iordanoglou (2013) [6], after 1974 in modern Greek society includes trade unions, business associations, chambers, freelancers' associations, ecclesiastical organizations, associations and unions based on their place of origin, informal groupings of people in provincial towns, and many others where each group works in its own way to promote its interests. For these reasons, the variable “Number of interest groups”, is rejected from the group of variables under consideration.

The variable “Population”, show the number of the general population of Greece. In Greece, the Hellenic Statistical Authority officially makes a national population-housing census every ten years, the last was in 2011 and the next is expected in 2021 (H.S.A. 2011). This means that the value of this variable would remain constant for each year, and would change every ten years. A variable with constant value for each decade, loose the meaning of the variable, so for this reason is rejected from the group of analysis.

The variable “Duration of political stability”, especially for Greece, can be recording as the duration of the “political stability” [26], or the “years of last turmoil” [47]. As was sufficiently developed in section 2, the study period of the action of the interest groups according to the effects of Olson's theory, is after the fall of the dictatorship in 1974. Therefore, starting the counting from the year 1974, one unit will be added for each subsequent year. That is, the variable would take the values 1,2,3,4,5 etc. Consequently, the presence of a variable with such values in the following analysis is not essential, so it is rejected.

The last variable which is not applicable in our study is the “political rights/democracy”. This variable in every study in the international literature has had a different meaning or definition and has been calculated only for one year at a time.

In the study of Murell (1984) [21] was calculated for 1969, as a linear combination with essentially arbitrary weights of variables, measuring freedom to form organization, freedom of expression, right to vote etc. At the same time in
Weede (1984) [36] had the definition of “Hewitt’s index of full democracy” where Hewitt considers that full democracy occurs if the following factors appear simultaneously: universal adult male suffrage, secret ballot, and responsible government. Weede (1986) [37] refers to it as “age of democracy in 1971”, while Knack (2003) [30] had taken values as “a property rights index”. In the study of Coates and Wilson (2007) [48] as “democracy” had taken the average annual value of a measure of the general openness of political institutions. In the study of Coates, Heckelman and Wilson (2007) [48] the “political rights” were measured as an index of the degree of freedom in the electoral process, political pluralism and participation, and functioning of government, using an inverse of the original 1-7 scale such that higher values represent more political rights. The same definition used as the “political rights” variable, Coates et al. (2007a) [42] in their study, as “democracy” in the study of Coates et al. (2007b) [45] the variable reported the democracy and autocracy, as average of three years prior to beginning of period, (0 to 10 values reflect democracy, -10 to 0 values reflect autocracy). In the study of Coates et al. (2010) as “political rights” indicated an index of relative ranking from one (best) to seven (worst) concerning the political rights of the country and the “democracy” variable in study of Heckelman and Wilson (2013) [35] was computed as a straight average of the political rights and civil liberties values (PRLC).

As follows, the variable “democracy” or “political rights” is not a variable with a specific fixed definition and in most research tasks it has the role of a qualitative variable that indicates the level of democracy or political rights in the country. As far as Greece is concerned, after the fall of the dictatorship in 1974, when there was a real violation of citizens’ political rights, democracy was established in the country, with the restoration of democratic legitimacy, in July 1974. The Government of National Unity set as its first goal the consolidation of the Republic and partially reinstated the 1952 Constitution. The first free parliamentary elections (November 17, 1974) and the referendum on the form of the regime (December 8, 1974), which advocated the rule of the non-monarchical democracy, was followed by the Constitution of 1975. This Constitution, although ultimately voted only by the parliamentary majority, gradually gathered during the implementation, in view of the wider possible acceptance by the country's political forces. (Hellenic Parliament: Constitutional History)
The country's new constitutional charter introduced the government of a presidential parliamentary democracy, containing from the outset a broad list of individual and social rights adapted to the demands of the times. The rule of law was effectively protected, and the country's participation in international organizations and - indirectly - in the then EEC (in the way it was consisted at that time) was foreseen. (Hellenic Parliament: Constitutional History)

The most widely used measure of inflation and, by proxy, of the effectiveness of the government’s economic policy, is the Consumer Price Index (CPI). The CPI gives the government, businesses, and citizens an idea about prices changes in the economy, and can act as a guide in order to make informed decisions about the economy.

CPI measures food; beverages; housing; apparel; transportation; medical care; recreation; education and communication; and other goods and services. It is one of the most-used economic indicators to measure inflation, as it calculates the change in cost on a bundle of consumer goods and services over time. Inflation shows the change in the purchasing power of the currency. Higher sale prices indicate a decrease in consumer purchases and a rise in inflation, eventually leading to adjustments in income and the cost of living.

In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth. In finance, an investment is a monetary asset purchased with the idea that the asset will provide income in the future or will later be sold at a higher price for a profit. In order to have a competent picture of investments in Greece, mainly of foreign investors that shows whether they trust Greece to invest, despite the action of interest groups in it, is the Foreign Direct Investment (FDI).

A foreign direct investment (FDI), is an investment made by a firm or individual in one country into business interests located in another country. Generally, FDI takes place when an investor establishes foreign business operations or acquires foreign business assets in a foreign company. However, FDIs are distinguished from portfolio investments in which an investor merely purchases equities of foreign-based companies.

In summary, the variables that will be tested below are:

1. GDP per capita,
2. GDP growth rate,
3. Government spending,  
4. Investment,  
5. GDP,  
6. Tax revenues,  
7. Inflation,  
8. GDP per capita rate of growth,  
9. Government revenue as percentage of GDP.

A complete data set is collected, from the first quarter of 1999 to the fourth quarter of 2018, so the variables will be tested in this common time period. The source of the data set of each variable is shown in the table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Source</th>
<th>Source Link</th>
<th>Time period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation - CPI</td>
<td>OECD</td>
<td><a href="https://data.oecd.org/greece.htm">https://data.oecd.org/greece.htm</a></td>
<td>Q1 1999 - Q4 2019</td>
</tr>
</tbody>
</table>

In more detail the variables “GDP per capita”, “GDP growth rate”, “General Government Total expenditure”, “GDP”, “GDP per capita rate of growth”, have been collected from the Hellenic Statistical Authority, the variables “Investment” and the
“Tax Revenues” from CEIC data, the “inflation” from the OECD, and the “Government revenue” as percentage of GDP, has been collected from IMF.

All the variables are quantitative variables, more specifically, “GDP”, “Government spending” and “Tax revenues”, are measured in millions euro, the “GDP growth rate” has been calculated as the percentage change for the corresponding quarter of the previous year (y-o-y), the “government spending”, because of its general concept, contains the data of “Total expenditure of General Government”, as reported by the Hellenic Statistical Authority.

5. Variable Data Analysis

The steps of the methodology that will be followed in this analysis are: firstly a normality tests for all the variables is necessary, secondly correlation test to find out the variables with high correlation, and thirdly with the Principle Component Analysis will be derived the finals significant variables, which reflect the action of interest groups in the Greek economy by the optimist way.

5.1 Normality test

Applying the normality test, the Kolmogorov-Smirnov criterion can be calculated as well as the probability that it has been made false, if we accept that the data of the sample do not follow the normal distribution. This probability level is called significant level and symbolized by “sig”. Usually when sig, has values higher than 0.05 is accepted that the normal distribution applies to the sample values [14]. The values for the probability level are presented in the table 2, as emerged by the SPSS application.
Table 2. SPSS Results for one sample Kolmogorov-Smirnov tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>Kolmogorov-Smirnov</th>
<th>N</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate y-o-y</td>
<td>1.236</td>
<td>80</td>
<td>0.094</td>
</tr>
<tr>
<td>Tax revenue</td>
<td>0.749</td>
<td>80</td>
<td>0.63</td>
</tr>
<tr>
<td>CPI</td>
<td>1.273</td>
<td>80</td>
<td>0.053</td>
</tr>
<tr>
<td>Gen Government Expenditure</td>
<td>0.955</td>
<td>80</td>
<td>0.322</td>
</tr>
<tr>
<td>FDI</td>
<td>1.165</td>
<td>80</td>
<td>0.133</td>
</tr>
<tr>
<td>Gen Govern. Revenue</td>
<td>0.53</td>
<td>80</td>
<td>0.941</td>
</tr>
<tr>
<td>GDP</td>
<td>0.951</td>
<td>80</td>
<td>0.327</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>0.926</td>
<td>80</td>
<td>0.358</td>
</tr>
<tr>
<td>GDP per capita growth rate</td>
<td>0.982</td>
<td>80</td>
<td>0.301</td>
</tr>
</tbody>
</table>

As emerged by the table 2, the significant level for all the variables is higher than 0.005. So it is confirmed the null hypothesis $H_0$, that the distribution is not statistical significantly different than the normal.

5.2 GDP group variables analysis

It is important that the data set of the nine variables under examination appear a normal distribution, because this will allow with the correlation test and hereupon applying PCA method in order to choose the main variables. In the group consisted of these nine variables, there are four of them which are related to GDP.

1) GDP per capita
2) GDP growth rate
3) GDP per capita rate of growth
4) GDP

Which form an individual group, in which a correlation test will be conducted among the variables. The data of the variables as referred to table 1, concern the
period from Q1 1999 to Q4 2019. By using the SPSS application, is calculated the correlation coefficient between the variables and is showed in the table 3.

Table 3. Correlation matrix for the four variables related to GDP.

<table>
<thead>
<tr>
<th></th>
<th>GDP millions</th>
<th>GDP per capita</th>
<th>GDP per capita growth rate</th>
<th>GDP growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP millions</td>
<td>1,000</td>
<td>.999</td>
<td>-.424</td>
<td>-.460</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>.999</td>
<td>1,000</td>
<td>-.418</td>
<td>-.456</td>
</tr>
<tr>
<td>GDP per capita growth rate</td>
<td>-.424</td>
<td>-.418</td>
<td>1,000</td>
<td>.829</td>
</tr>
<tr>
<td>GDP growth rate</td>
<td>-.460</td>
<td>-.456</td>
<td>.829</td>
<td>1,000</td>
</tr>
</tbody>
</table>

As emerged by the table 3, the correlation coefficient between “GDP” and “GDP per capita” is 0,999. Therefore these two variables not only have a high correlation, but are almost identical. For this reason, one of the two variables comes out of the group and the study for the three variables continues, in order to reach the main one, by applying the PCA method.

With the help of the SPSS application the method of the Principal Component Analysis (PCA) is applied and in the tables 4 and 5 are presented the results.

Table 4 Total Variance Explained

<table>
<thead>
<tr>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>2,159</td>
<td>71,958</td>
</tr>
<tr>
<td>,671</td>
<td>22,382</td>
</tr>
<tr>
<td>,170</td>
<td>5,660</td>
</tr>
</tbody>
</table>

Table 5 Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>GDP growth rate</th>
<th>GDP per capita growth rate</th>
<th>GDP per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.923</td>
<td>.910</td>
<td>-.692</td>
</tr>
</tbody>
</table>
From PCA, it is emerged that only one variable has initial eigenvalue higher than 1, and to be more precise it has the value 2,159 with 71,958% variance. This variable as emerged by the component matrix is the “GDP growth rate”, because it has the higher component value (0.923). Therefore, as principal component from the GDP group, emerged the “GDP growth rate”.

After selecting the most appropriate variable from the group of GDP-variables, the final group of variables which the analysis will proceed further, is formed as follows:

1. GDP growth rate
2. Gen. Government Expenditure
3. Investment (FDI)
4. Tax revenues
5. Inflation (CPI)
6. Government revenue

6. Results

Initially, the correlation is checked in this group of variables and the resulting correlation coefficients are presented in the table 6.

Table 6. Correlations results

<table>
<thead>
<tr>
<th></th>
<th>GDP Growth rate</th>
<th>Tax revenues</th>
<th>Inflation (CPI)</th>
<th>Final consumption expenditure</th>
<th>Investmen t (FDI)</th>
<th>Gen Govern. Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate y-o-y</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>-.490**</td>
<td>.359**</td>
<td>-.393**</td>
<td>.077**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.001</td>
<td>.000</td>
<td>.497</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Tax revenue</td>
<td>Pearson Correlation</td>
<td>-.490**</td>
<td>1</td>
<td>-.156</td>
<td>.775**</td>
<td>.165</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.168</td>
<td>.000</td>
<td>.143</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>CPI</td>
<td>Pearson Correlation</td>
<td>.359**</td>
<td>-.156</td>
<td>1</td>
<td>.113</td>
<td>-.219</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.001</td>
<td>.168</td>
<td>.318</td>
<td>.050</td>
<td>.110</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Gen. Government Expenditure</td>
<td>Pearson Correlation</td>
<td>-.393**</td>
<td>.775**</td>
<td>.113</td>
<td>1</td>
<td>.022</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.318</td>
<td>.844</td>
<td>.000</td>
</tr>
</tbody>
</table>
As shown in the table 6, the variables, “Tax revenue” and the “Gen. Government Revenue” have a high correlation coefficient with each other, as it has the value 0.887. This value is explained as tax revenues are included in general government revenues. Also these variables have a high correlation with the “Gen. Government Expenditure”, with correlation coefficient values of 0.775 and 0.712 respectively. In this case, too, the high correlation is explained as the higher the revenues of the Greek state for the period 1999-2009 that concerns the study, the higher its costs. While for the rest of the study period 2010-2019, expenditures are reduced and government revenues are reduced accordingly.

Therefore, due to the high correlations between these three variables, the variables “Tax Revenue” και “Gen Government Revenue” removed from the group while the variable “Gen. Government Expenditure” remains.

From the initial group consisted of nine variables, there are four that still have to be examined,

1. Government spending
2. Investment
3. Inflation
4. GDP growth rate

After Principal Component Analysis method is used the most significant variable will arise.

Using SPSS, the results by the PCA method are shown in the tables 7-11.
Table 7. Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>Growth rate y-o-y (EL.STAT.)</th>
<th>CPI (OECD)</th>
<th>Final consumption expenditure (EL.STAT.)</th>
<th>FDI (%GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate y-o-y (EL.STAT.)</td>
<td>1,000</td>
<td>0.359</td>
<td>-0.393</td>
<td>0.077</td>
</tr>
<tr>
<td>CPI (OECD)</td>
<td>0.359</td>
<td>1,000</td>
<td>0.113</td>
<td>-0.219</td>
</tr>
<tr>
<td>Final consumption expenditure (EL.STAT.)</td>
<td>-0.393</td>
<td>0.113</td>
<td>1,000</td>
<td>0.022</td>
</tr>
<tr>
<td>FDI (%GDP)</td>
<td>0.077</td>
<td>-0.219</td>
<td>0.022</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Table 8. Communalities

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate y-o-y (EL.STAT.)</td>
<td>1,000</td>
<td>0.807</td>
</tr>
<tr>
<td>CPI (OECD)</td>
<td>1,000</td>
<td>0.779</td>
</tr>
<tr>
<td>Final consumption expenditure (EL.STAT.)</td>
<td>1,000</td>
<td>0.670</td>
</tr>
<tr>
<td>FDI (%GDP)</td>
<td>1,000</td>
<td>0.451</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

Table 9. Total Variance Explained

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>1,485</td>
<td>37,129</td>
<td>37,129</td>
</tr>
<tr>
<td>2</td>
<td>1,222</td>
<td>30,556</td>
<td>67,684</td>
</tr>
<tr>
<td>3</td>
<td>0.934</td>
<td>23,361</td>
<td>91,046</td>
</tr>
<tr>
<td>4</td>
<td>0.358</td>
<td>8,954</td>
<td>100,000</td>
</tr>
</tbody>
</table>
It is important to note that the four variables of the final group, have low correlation coefficient values, as shown in the table 7 of Correlation Matrix. Also in the table 9 of Total Variance are shown two values higher of 1, for the initial eigenvalues, which means that these two variables are the main components of the group and they are also able to replace all the rest variables in the study that will follows. From the Component matrix (table 10), which is also verified by the Rotated Component Matrix (table 11), are emerged the variables with the higher value of component at 0.882 and -0.584. These values correspond to the variables, GDP growth rate and Final Consumption Expenditure.

Therefore, as it emerges from the study, the variables “GDP growth” and “Final Consumption Expenditure” satisfactorily reflect the action of interest groups in the Greek economy. These findings can be used in future research, considering that in other countries the action of interest groups can be represented by these two variables.

### Table 10. Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>Component 1</th>
<th>Component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate y-o-y (EL.STAT.)</td>
<td>0.882</td>
<td>-0.171</td>
</tr>
<tr>
<td>Final consumption expenditure (EL.STAT.)</td>
<td>-0.584</td>
<td>0.773</td>
</tr>
<tr>
<td>CPI (OECD)</td>
<td>0.585</td>
<td>0.661</td>
</tr>
<tr>
<td>FDI (%GDP)</td>
<td>-0.152</td>
<td>-0.654</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

a. 2 components extracted

### Table 11. Rotated Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>Component 1</th>
<th>Component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate y-o-y (EL.STAT.)</td>
<td>0.862</td>
<td>0.255</td>
</tr>
<tr>
<td>Final consumption expenditure (EL.STAT.)</td>
<td>-0.783</td>
<td>0.239</td>
</tr>
<tr>
<td>CPI (OECD)</td>
<td>0.214</td>
<td>0.856</td>
</tr>
<tr>
<td>FDI (%GDP)</td>
<td>0.167</td>
<td>-0.650</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.
These variables can be used as input variables in forecasting models or in multi-criteria analysis studying the action of interest groups. Also, following the same methodology can be found the variables that reflect the action of interest groups for each country.

All data generated or analysed during this study are included in this published article.

REFERENCES


