How Government Size Optimization affect on European Economies?

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Abstract: The issue of optimal size of the general government sector is analyzed by researchers using various methods, most often through the prism of a specific goal. The article is an attempt to determine the optimal size of the general government sector from the perspective of EU economies. To achieve this goal, the innovative decision tree technique - the c5.0 method was used. The study covered data describing 28 EU member states in the years 2000-2017 and 16,632 input data were analyzed.
The results of the conducted research showed that despite the fact that there is no single optimal and universal solution, a series of dependencies can be observed. Knowing the impact of individual actions on the economy, you can choose such instruments, as well as such a configuration that will help in a given area without harming others. Thus, the technique used, combined with specific priorities in terms of impact on the economy, may show which values of specific variables in the general government sector level should be pursued in order to model the desired effect.

Key-Words: government size, economy, decision tree, public finance, data mining, European economies

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1 Introduction

The impact of the general government sector (GGS), in particular its size, on the economy remains beyond discussion [1]. At the same time, it should be noted that the relationship between government size and economy is not clear and fully explained. Authors usually use both: the size and structure of government as a factor affecting the pattern, shape of governance, and growth of an economy [2]. According to R. Ram [3], larger government size is more likely to reduce economic growth. On the other hand, J.M. Henreksonz-Paramo and D. Martinez [4] proved that government spending could improve the relationship between private and social interests and commercial openness. As a result, public investment can favor economic growth. Just as the views on the impact of the government size on the economic situation of a country differ, so do the ways in which government policies could affect on the country's economy.

S.A.Y. Lin [5] found that government can affect positively on economic growth through provision of public goods and infrastructure, social services and targeted intervention. A. Fölster and M. Henrekson [6], claims that at low levels of both: government spending and taxation, the productive effects of public goods are likely to exceed the social cost of raising funds. V. Tanzi and H.H. Zee [7] notes that the positive impact of the size of government (measured by the size of spending) on the economy only takes place up to a certain level. After it is exceeded, the economic growth is likely to be negatively affected by further increases in public expenditure.

The analysis of the literature on the optimization of the size of the government sector with the use of expenditure measures allowed for the formulation of several conclusions. A literature review suggests that the government sector in small countries is bigger than in a large ones [8][9]. The results of empirical analyzes are subject to differentiation depending on the period used for the analysis, which countries (or groups of countries) are studied, as well as the sources of data used in the estimates [10]. Finally, based on the share of government expenditure in GDP, it is possible to divide studied countries on three groups: countries with small government sector - about 30% of GDP, countries with medium government sector - 40% of GDP and countries with big government sector more than 50% of GDP [11].

The obtained results allow us to conclude that with the discrepancies in the optimal size of the government sector for the same countries demonstrated by various authors (sometimes very large), it is justified to look for alternative solutions that would allow not only to measure the size of the government sector, but also its impact on the economies of the analyzed countries. Considering the above, the main goal of the article is to fill the diagnosed research gap by examining how the optimal size of GGS influences the development of the economies of the European Union (EU) countries and analyze how the selection of an appropriate structure and size of the GGS, should depend on the adopted priorities for economic development. For achieving the research objective it is extremely important to determine the answers on two questions. The first one concerns the identification of the most frequent measures describing the size of the government sector. While the second refers to indication of economy measures, allowing to identify the influence of GGS on the economies of studied countries. To achieve this goal, the decision tree technique - the c5.0 method was used. The study covered data from 28 EU member states in the years 2000-2017. The stages of the analysis are presented in Figure 1. In the first stage, it comprised 16 632 input data. Applied analysis made it possible to indicate recommendations for economic practice. Such a large and complex structure as the EU countries, characterized by a different level of economic development, is a good sample for analysis. Thus, this knowledge can be used by policy makers, helping them to make decisions about the size of the public finance sector and apply a policy in this respect that meets the adopted economic goals.

level 1	selection of variables describing general government sector
	selection of variables describing economies
level 2	1.correlation analysis
	selection of variables and periods for further analysis
1.level 3	1.analysis using a decision tree
	identification and description of value ranges (quartiles)
1.level 5	1.decision on the variables that havethe best influence on the economies
	1.systematization and description of the results

Fig. 1: The stages of the analysis.
Source: own study

The paper has four parts. First, it reviews previous studies on the quantifying the GGS and economic growth. Then in the next section we discuss decision tree technique. In the third part, we present a description of research methodology. Findings discussion and a summary are in section four. The article concludes with discuss of the theoretical and practical implications of the study results.

2 Literature Review: The Indicators of Quantifying the Government Sector Size and Economic Development

L. Di Matteo points out, in contemporary economic theory there is no single, universal measure of government size that would fully reflect all relations resulting from both, the function and role of government [12]. As shown in section 2.1. the most common approach to expressing government size is measures based on public spending. At the same time, these measures reflect a relatively

simple view of how government affects the economy. In particular, if this impact is not reduced only to the amounts of funds spent but taking the influence of the state from the regulatory side, such as income redistribution, and indirect spending via tax expenditures [13]. For this reason, inter alia, Pathirane and Blades [14] argue that measuring government size should also consider a number of measures, including final public sector demand, generated value added, public sector employment, and even net lending. Such a differentiated approach is important primarily because different measures of government size can lead to diametrically opposed conclusions. A similar view is expressed by R. Hjerppe [15]. This approach is also supported by H. Handler, B. Koebel, J.P. Reiss & M. Schratzenstaller [16]. Authors arguing that the public sector is difficult to measure with a single indicator and recommends using several measures to express government size. They recommend using public employment (as a proxy for the production of public services by government), the ratio of government expenditure to GDP (as a measure of the volume of transactions that involve the public sector), as well as the ratio of total taxes to GDP (to reflect the financing side of the government size).

L. Peters & J. Verrinder [17] believe that the measures used to quantify the size of government should depend on the analyzed role of the government in the economy. The government plays many roles in the economy and fulfills a number of functions. These include the production of goods and provision of services, consumption, management of public funds (in terms of expenditure and income), or being an employer. The role of government as producer in the economy should be expressed as a percentage relation between the total value added produced by the public sector of the total value added produced by the country [18]. In contrast, the measurement of government as a consumer is made by referring the percentage of public spending on consumption to GDP [17][19]. Government is also a spender. In this role, the government's expenditure activity is not limited only to consumer spending (as in the case of: Landau [20][21]; ; Hsieh & Lai [22]; Chiou-Wei, et. al. [23]. In a wider meaning, it considers public expenditure on investments, interests, public procurement, social transfers and subsidies for the private sector. Therefore, government size can be expressed as a percentage share of total public expenditure of GDP. This approach is suggested by L. Peters & J. Verrinder [17], B. Fakin & A. De Crombrugghe [24], as well as Y.V. Samusevych & A. Shamaelh [25].

The role of the government as a revenue-raiser is connected with tax policy. In this case, there are two possible approaches to measuring government size. The first covers the cumulation of public tax revenues and social security contributions and their percentage of GDP [17]. While the second approach considers the percentage of total public revenues (without division divided into tax and non-tax revenue sources), in GDP [26][27][28].

The role of government as a borrower relates to borrowing money from the private sector to finance its activities [29]. In this case, just like before, two approaches are used to measure government size. The first one is the percentage ratio of the state budget deficit or surplus in GDP, while the second covers the percentage of government debt to GDP (see: [17][18].

Government as a re-distributor refers to the activity in the field of social protection and covers all interventions intended to relieve households and individuals of the burden of a defined set of risks and needs [30][31]. Social transfers do not require any return actions from the recipient entities. It's just redistribution [18]. Redistribution is measured by social protection benefits expenditure expressed as a proportion of GDP [32][17]. This measure is also used in other configurations. For example, A. Meltzer & S. Richard [33] use the share of income redistributed by government as a relative measure of it's size.

Government is also an employer [34][35]. To measure this government activity, it is needed to estimate the percentage of state employees in the total number of employed people in the country (see: [36][37][38][39][40]). According to F. M. Häge [41], a measure of government size based on public employment are also a wages and salaries of public employees being a major part of government consumption expenditure. B.J. Clements, S. Gupta, I. Karpowicz & S. Tareq [42] expand and catalog the measures of government employment into three groups. The first group is "compensation of employees". These measures include following configurations: as a share of GDP, as a share of total expenditure, as a share of domestic revenue, and comparison to spending on non-wage outlays. The second group includes "government employment". These measures include percentage of: private sector employment, total employment, and population. Third group of measures "wage level", includes: average government wages relative comparator private sector wages, average government wages relative

to GDP per capita, and ratio of the highest government wage to the lowest (compression ratio). The view of the necessity to use different measures of government size depending on its role in the economy is supported by L. Di Matteo [12]. The author distinguishes the following roles and fields of governments' activity: goods production and provision of services, consumption of resources, employer, capital investor, provider of social transfers and subsidies, regulator and the beneficiary of funds. A similar position is presented by N. Gemmell, D. Gill & L. Nguyen [18].

When analyzing alternative approaches to expressing the size of government in the economy, it should be noted that nowadays measures based on the impact of public sector regulation on various macroeconomic variables are playing an increasingly important role. I. A. Kahn [43] states that the Index of Economic Freedom is the best way to quantify government size in the context of regulation. His research proves that countries with smaller governments have higher GDP per capita. F. L. Pryor [44], while examining the degree of regulation of a given country, indicated two variables as statistically significant. The first is the size of the economy, and the second is the income inequality of the population. According to its findings, the degree of regulation is directly proportional to the size of the economy and indirectly proportional to the income inequality of the population. J.S. Ferris [45], indicates three other measures used in determining the size of government. The first one is consumption expenditure divided by GDP. Government consumption is the sum of expenditure on wages and salaries and other non-wage consumption expenditure. The second measure takes into account current disbursements defined as government consumption plus subsidies, social benefits, current transfers, and property income paid by government. This measure adds subsidies and transfers to the service dimension of governments activities. The third measure of government is total disbursements. This measure adds government investment expenditures and consists of current disbursements plus government gross investment minus both consumption of fixed capital and net capital transfers received.

The analyzes presented above demonstrate the multitude of measures that can be used to express the size of a government. Their study leads to the conclusion that the variation in the ways government influences the economy is not adequately represented by measures based solely on government spending or employment. The costs and benefits of establishing indirect subsidies such as tax credits, and the power of government to contract as employer and consumer allow government for a significant impact on economic resources with relatively little reflection in expenditure or employment data [46]. The presented conclusion is not only an extremely important summary of the above-presented overview of approaches to measuring the size of the government, but also unequivocally justifies the use of not one, but several complementary measures covering all the spheres of its activity discussed above in research on the optimization of the size of the government sector.

Economic development in the simplest terms, is understood as a process of positive changes comprising both quantitative growth and qualitative progress [47]. Among the measures of economic development, the most popular are those based on the system of national accounts (GDP, GNP, PNN), the value of GDP per capita is still the basic and commonly used measure of socio-economic development [48]. At the same time, Pater, Harasym and Skica [49] indicate that economic development measured by GDP per capita does not take into account many aspects other than economic growth, including structural, social and ecological changes. Many attempts have been made to construct a synthetic measure that takes into account all identified aspects of development, but due to the impossibility of standardizing and identifying all determinants influencing the level of socio-economic development, these attempts were abandoned [50]. The literature review clearly shows that the authors use these two different approaches based on GDP/GDP per capita or integrated assessment of development based on multi-criteria approaches [51]. Remeikienė et al. [52] concludes that the main reason that GDP per capita to be used to measure countries' economic development is its complexity - it combines all economic performance, both sectoral and territorial. From the point of view of this publication, a long going debate on the relationship between financial development and economic growth is crucial. As noted by Škare et al. [53], financial development stimulates economic growth through five channels: facilitating risk management, allocating resources, exerting corporate control, mobilizing savings and ease trading of goods and services, leading to capital accumulation and technological innovation and growth. In this context, when examining the

size of the government, we analyze variables relating to the public finance sector in practice.

The literature is dominated by studies showing a variety of approaches to determine the government's size (see: [54][55], but despite of this, a kind of monotony is noticeable in the ways of describing the size of the GGS. The approaches to the GGS optimization, concentrates (with some exceptions) on measure expressed share of public expenditure in GDP [56]. R. J. Barro [57], using the data for the period 1970-1985, determined that the average, optimal size of government for OECD countries is 14% of GDP (+/- 4%). G. Karras [58] established the optimal size of government for 20 EU countries. Based on data for the years 1950-1990, he found that this size is 16% of GDP (+/- 3%). R. Vedder & L.E. Gallaway [59], focused their research on the optimization of the government sector on selected countries. Contrary to other studies, the authors used a long time series of data in the estimates. Among the European countries for which they estimated optimal size of the government were: Denmark (1854-1988) 26.14% of GDP, Italy (1862-1988) 22.23% of GDP, Sweden (1881-1988) 19.43% of GDP as well as Great Britain (1830-1988) 20.97% of GDP.

P. Pevcin [60] also dealt with optimization of the government sector in the EU countries. Based on the data for the years 1970-2007, he found that the optimal GGS, in terms of expenditure, looks as follow: for Italy 37.09% GDP, France 42.90% GDP, Finland 38.98% GDP, Sweden 45.96% GDP, Germany 38.45% GDP, Ireland 42.28% GDP, the Netherlands 44.86% GDP and Belgium 41.91% GDP. D. Chobanov & A. Mladenova [61] based their research on the size of the government sector on the period 1970-2007. Using the expenditure measure, they found that the optimal government size for OECD countries is 25.00% of GDP. The studies related to selected European countries showed that in the case of Austria it is 18.00% of GDP, Belgium 23.00%, Denmark 25.90%, United Kingdom 22.00% of GDP, and Sweden 27.00% of GDP.

M. Mutaşcu & M. Milo [62] in their research focused on the optimal size of the government sector in the old and new EU member states. Using statistics for 1999-2008, they found that the optimal GGS (measured by the level of expenditure) for new EU countries is 30.42% of GDP, while for the old member states it is 27.46% of GDP.

F. Forte & C. Magazzino [63] and C. Magazzino [64] also analyzed the issue of the optimal size of the government sector. The research was based on data for the years 1970–2009 and 1960–2008. The analysis revealed that, for the EU27 member states, the optimal expenditure level is 37.29% of GDP, while the average effective ratio is 47.90%. Their estimations for individual EU countries indicate the following values of optimal public expenditure levels: Belgium 35.39% of GDP, Netherlands 35.52% of GDP, UK 43.50% of GDP, Ireland 44.47% of GDP, Austria 38.21% of GDP, Denmark 38.63% of GDP, Finland 40.38% of GDP, France 39.49% of GDP, Germany 41.99% of GDP, Greece 39.33% of GDP, Italy 37.68% of GDP, and Portugal 42.28% of GDP. Their later research [65] for 30 European countries found that the optimal total expenditure level is 39.65% of GDP, the optimal current expenditure level is 30.03% of GDP, while the optimal capital expenditure is 10.50% of GDP. For the euro area countries, these values were respectively 38.43% of GDP, 29.41% of GDP and 10.96% of GDP, while for non-euro area countries: 39.71% of GDP, 30.11% of GDP, and 10.69% of GDP.

M. Boór [66], conducted research for EU countries in 1995-2013. According to the findings, the optimal size of government spending was within 45.49% of GDP and 52.06% of GDP, while the average value of the government expenditures for that time period was equal only to 45.65% GDP. In his latest research [67] determined, based on data for 1995-2017, that the optimal government size as the ratio of total government expenditure to GDP for EU countries is 51.11% of GDP.

3 Decision Tree

In our research regarding general government sector size optimization we used the decision tree technique – the c5.0 method [68][69][70]. Decision trees are a tool used by economists, including representatives of the European Commission, who use tree-based approaches for understanding growth patterns in the European regions [71]. This method is also used to analyze Structural Similarities of Economies for Innovation and Competitiveness [72] and to study various aspects of economic development [73][74]. Generally, the procedure of the c5.0 is as follows:

1. import of input data,
2. for each attribute a, calculate the normalized information gain ratio from splitting on a,
3. find the attribute with the highest normalized information gain best_a,
4. create a node that splits on best_a,

5. repeat the procedure on the sublists obtained by splitting on best_a and add child nodes to the node created in previous step.

Data from which we induced tree were expressed in the form of decision table. Rows of the decision table represent cases (values of the selected countries variables), while columns represent variables describing GGS (attributes). A decision represents values of the economic indicators of member countries respectively. The set of all cases is denoted by U. The set of all cases labeled by the same decision value is called a concept. A simple example of the decision table is presented as Table 1 in which attributes are: Total tax revenue, Public administration employment and General government gross fixed capital formation and decision is GDP in current prices.

Table 1. Example of decision table

Case	GGS size (Variable value)			Economy (Impact on the economy)
	Total tax revenue (% of GDP)	Public administration employment (no of employees)	General government gross fixed capital formation (% of GDP)	GDP in current prices (% change)
1	low	low	high	positive
2	high	low	low	negative
3	high	high	low	negative
4	high	high	high	negative
5	low	low	low	positive
6	low	high	low	negative

Source: own elaboration.

Attributes are independent variables while the decision is a dependent variable. The set of all cases is denoted by U. In Table 1, U = {1, 2, 3, 4, 5, 6}.
Applied algorithm c5.0 uses the concept of information entropy to choose the most informative variables. Let *a* be variable (attribute or decision) with a domain $a_1,..,a_n$. The entropy of variable *a* is defined as follows:

$$H(a) = -\sum_{i=1}^{n} p(a_i) * log\, p(a_i) \quad (1)$$

where $p(a_i)$ is relative frequency of the value a_i of the attribute *a*. A conditional entropy for the decision *d* given an attribute *a* is defined as follows:

$$H(d|a) = -\sum_{i=1}^{n} p(a_i) * \sum_{j=1}^{m} \mathrm{p}\left(d_j \middle| a_i\right) * \log p(d_j|a_i) \quad (2)$$

where $\mathrm{p}\left(d_j \middle| a_i\right)$ is conditional probability of the value dj of the decision d given the ai of the attribute a, and all values of decision d are d1,…,dm.

The information gain ratio is defined as:

$$\text{Gain ratio}(a) = \text{Gain}(a)/H(a) \quad (3)$$

where Gain(a) = H(d) – H(d|a). All logarithms are binary.
The process of computing the conditional entropy H(GDP in current prices|Total tax revenue) is illustrated on Figure 2.

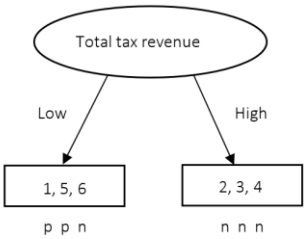

Fig. 2: Computing of the conditional entropy H (GDP in current prices|Total tax revenue)
Source: own elaboration.

H(GDP in current prices|Total tax revenue) = 3/6*(-2/3*log(2/3)-1/3*log(2/3))+3/6*0 = 0.459.
Similarly, the two remaining conditional entropies are computed as follows: H(GDP in current prices|Public administration employment) = 0.459; H(GDP in current prices|General government gross fixed capital formation) = 0.874.
Next, the information gain ratio is determined:
Gain ratio(Total tax revenue) = Gain(Total tax revenue)/H(Total tax revenue) = 0.459/0.918 = 0.5
where Gain(Total tax revenue) = H(GDP in current prices) - H(GDP in current prices|Total tax revenue)
Similarly, the two remaining gain ratios are calculated: Gain ratio(Public administration employment) = 0.5 and Gain ratio(General government gross fixed capital formation) = 0.048.
The attribute with the highest value of normalized information gain (gain ratio) is chosen as a node. Gain ratio Total tax revenue and Public administration employment have the same values. The first one should be chosen. The attribute Total tax revenue is placed in the root of the tree. All the samples for value *high* of the attribute Total tax revenue belong to the decision *negative* and thus the leaf node is created (Figure 3).

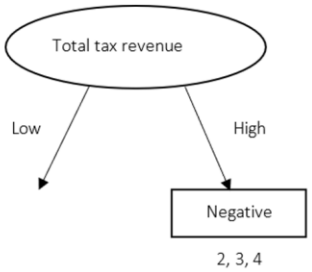

Fig. 3: The root of decision tree
Source: own elaboration.

Next, the algorithm is repeated recursively on the partitioned sub lists – for value *low* of the attribute Total tax revenue. In result the attribute Public administration employment with the highest value of normalized information gain ratio is chosen as the second node. The completed decision tree for Table 2 is shown on Figure 4.

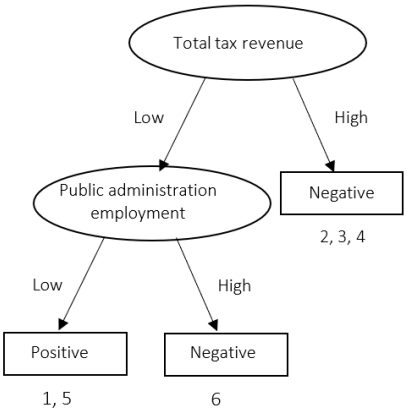

Fig. 4: The decision tree
Source: own elaboration.

4 Data and Methods

The research was conducted for EU Member States. The timeframe covered the years from 2000 to 2017 (at the research stage, 2017 was the last year for which a complete set of input data was available). Sources of data for the purpose of this research were publicly available including: Eurostat, OECD, as well as the World Bank. In the first stage of the research, 15 variables describing public finance sector and 18 variables describing the economy were selected. The correlation analysis applied at this stage made it possible to determine the relationship between variables describing the public finance sector and the economy, and to select variables that are of significant importance. The variables expressed in nominal sizes were also removed. As a result, 11 variables describing the economy and 10 variables representing the GGS were qualified for further research.

The variables describing the size of the general government sector correspond to three dimensions needed to identify the relationship between the GGS and the economy: employment, the government sector output and financial effects of government activity (see Table 2 for a complete summary of the data describing these measures).

Table 2. The variables describing the size of the general government sector

1	The tax revenue (% GDP)
2	Public administration employment (no of people)
3	Government consolidated gross debt (% GDP)
4	General government sector output (% GDP)
5	Gross value added (% GDP)
6	Total general government expenditure (% GDP)
7	General government gross fixed capital formation (% GDP)

Source: own study

The variables describing the EU economies covered several complementary aspects: the situation on the labor market, the EU economies include indices expressing changes in prices and the exchange rate, foreign economic contacts of individual countries and their effects, (as well as the accompanying financial flows) and the overall mapping of the state of EU economies (a summary of data describing these measures is included in Table 3).

Table 3. The variables describing the economies

1	Activity rate (%)
2	Balance of the current account (%)
3	Inward FDI flows (%GDP)
4	Outward FDI flows (%GDP)
5	FDI - foreign direct investment (%GDP USD) Saldo. Inward.and. Outward.
6	Gross domestic product in current prices per inhabitant (GDP per inhabitant)
7	Gross domestic product in current prices per inhabitant - dynamic (percentage change)
8	Harmonized indices of consumer prices (HICPs) (annual average rate of change)
9	Potential output of total economy (%)
10	Real Effective Annual Rate (%)
11	Unemployment rate (%)

Source: own study

Due to the fact that the variables had a constant character, they have been subjected to a discretization process. The values of each variable have been divided into four intervals. An interval criterion was an equal number of occurrences in every interval, so there were exactly the same number of countries belonging to the EU in every single interval. Every variable and every interval were studied for impact on the variables that describe a condition of the economy. In these analyses' decision tree were used. The analysis has been implemented in the R language. A separate program has been developed for the needs of data preprocessing (ie data preparation for research,

cleaning, discretization), additional validation and interpretation of the results. The C50 package available in the R system was used in the process of generating decision trees.

The decision trees were generated considering each year separately (i.e. the first set was generated on the basis of data from the year 2000, the second from the year 2005, etc.). Next, decision trees were analyzed in order to identify the most informative attributes (variables GGS) describing economies of the countries chosen. A detailed analysis of the nodes and split of data according to the attributes with the highest value of normalized information gain ratio, provided relevant information on intervals values of variables describing size of the GGS which affect the economy and validate their overall importance.

Due to the large number of variables and data accepted for the study, six periods were selected for the analysis. These were the years 2000, 2005, 2010, 2013, 2015 and 2017. The choice of years was not accidental as the authors aimed to show the impact of public finance variables on the economy in various phases of the business cycle. There were significant differences in the border values of the individual variables adopted for the study between the individual years, it was assumed that in each research period (year) the values of the variables would be divided into quartiles. In the case of variables describing the GGS, if the values of the variable fell within the first quartile, the range was described with the letter "A", if in quartile II it was described with the letter "B", if in quartile III - with the letter "C", and in quartile IV the letter "D".

In the case of variables describing the economy, it is of great importance which direction of the volatility of the variables will be adopted, because for some variables, the higher its value (stimulants), the better the situation should be assessed, while in the case of others, the opposite is true (destimulants). The table 4 shows which direction of volatility has been adopted.

Table 4. Direction of volatility favourable for the economy

Variables describing the economy	Direction of volatility favourable for the economy
Activity rate (%)	ascending
Balance of the current account (%)	ascending
Inward FDI flows (% of GDP)	ascending
FDI outflow (% of GDP)	descending
FDI - foreign direct investment (% of GDP USD)	ascending
Gross domestic product in current prices per inhabitant (GDP per inhabitant)	ascending
Gross domestic product in current prices per inhabitant - dynamics (% change)	ascending
Harmonized index of consumer prices in % (HICPs) (annual average rate of change)	descending
Potential output of total economy (%)	ascending
Real Effective Annual Rate (%)	descending
Unemployment rate (%)	descending

Source: own study

In the case of seven variables, marking of ranges was used exactly as in the case of the variables describing public finance sector (I quartile - A, II quartile - B, III quartile - C, IV quartile - D), and in the case of four variables describing the economy, which were considered that the lower the value of the variable, the better for the economy the reverse designation of ranges was used: (1st quartile - D, 2nd quartile - C, 3rd quartile - B, 4th quartile - A). Such provision allowed for uniform interpretation of obtained results, as it made it possible to uniformly name the ranges positively indicating the condition of the economy (table 5).

Table 5. Approved titles of variables' ranges describing the economy

Designation of the range of variable's value	Titles of variables ranges
D	Optimal
C	Very good
B	Acceptable
A	Undesirable

Source: own elaboration.

In the further analysis, it was assumed that the authors' area of interest will only include situations where the variables describing the economy took values from the optimal range. The idea was to find an answer to the questions: Is there an optimal GGS size for the development of EU economies and which variables describing the GGS and in which value ranges cause the variables describing the economy to take values from the best range for the economy, i.e. the range defined as "optimal"?

5 Results and Discussion

For the purposes of this study, it was assumed that the analysis will concern the optimal impact on variables describing the economy will be exerted

by variables describing the public finance sector. The variables describing the economy and the variables describing the public finance sector that affect the optimal level of economic variables are listed below. Ranges in which the variables describing the public finance sector should be included were also indicated, so that the variables on the side of the economy took value from the optimal range for the economy (range D).

A detailed summary of the results of the analysis is presented in the Appendix, the analysis of these data showed that seven variables representing the GGS affect eleven variables on economy's side with different strength and in different configurations. The greatest positive impact (calculated as the number of relations that take values in the D range) on the economy of the analyzed countries has total general government revenue and public administration employment, the variable total general government expenditure had a slightly smaller impact on the economy. For the remaining variables, the observed effect is visible, although it is weaker. At the same time, it was observed that the occurrence (or lack thereof) and the strength of the relationship between particular variables differed from year to year. Only the relationship between the total general government expenditure and GDP in current prices always takes values from the expected range (D). Thus, it is not possible to unequivocally indicate the optimal data set with best value ranges for the variables describing the GGS from the point of view of the economy. However, dependencies between them can be indicated, e.g., by appropriately shaping the size of the GGS described by the variable named the share of the GGS sector in GDP, decision-makers can influence the level of foreign direct investment. In order for this type of investment to flow into the economy, share of the public finance sector should be rather high. The research shows that the share of general government sector in GDP should be in the second or fourth quartile. However, for the balance of foreign direct investment to be the highest, the share of general government sector in GDP should be rather low. The research shows that it should be in the first to the third quartile. Consolidated public debt as % of GDP is important for the economy. Its low level (in quartile I or II) has a positive effect on the economic activity index, the outflow of foreign direct investment and unemployment rate. It is worth noting that higher debt levels (in quartile III or IV) have a positive effect on the current account balance, the real effective interest rate and the dynamics of potential production.

Gross fixed capital formation describing the public finance sector should be kept at a low level. Then they influence the optimal levels of such indicators describing the economy as: the current account balance, the inflow of foreign direct investment (in relation to GDP), the value of GDP in current prices per capita, the real effective interest rate and a lower level of unemployment.

The tax burden in relation to GDP have a positive impact on the balance of foreign direct investment, as well as the value of potential production. High expenditures of the public finance sector positively affect the activity rate, the current account balance, GDP dynamics in current prices and the level of unemployment. Low spending positively affects the inflow of foreign direct investment, the dynamics of the harmonized index of consumer prices (expressing the level of inflation), the dynamics of GDP in current prices and the level of the real effective interest rate. The high level of revenues of the public finance sector has a positive effect on activity rate, the current account balance, the inflow of foreign direct investment and the unemployment rate. It has not been observed to indicate the direction of the impact on the variable GDP growth in current prices per capita.

It is obvious that some recommendations may seem contradictory. In some cases, it is proposed to keep a given variable describing the economy at a high level, in other at a low level. It is difficult to indicate the universal level of the variables describing GGS that optimizes the EU economies. There are no simple solutions in the economy, and it is not justified to jump to too radical conclusions. Despite the fact that the result of the research conducted negates the question posed in the title, it highlights a number of dependencies. Knowing the impact of individual actions on the economy, you can choose such instruments, as well as such a configuration that will help in a given area without harming others. The decision about the choice of instruments rests with the decision-makers who know best the condition and needs of specific economies.

6 Conclusion

This study gives policymakers two suggestions. On the one hand, it suggests which variables on the GGS side and in what direction should be “steered” in order to positively influence a specific variable on the side of the economy. The second suggestion is to indicate the effects on the economy of "controlling" the level of the GGS. Due to the

impact analysis of a specific variable on the GGS side on the variables on the economy, policymakers got a hint about the behavior in specific configurations describing GGS. The used data mining decision tree technique allows to perform simulations for specific data sets and the selection of an appropriate structure and size of the GGS, that should depend on the adopted priorities for economic development. The results of the study showed that it is not possible to indicate the preferred, best for the entire economy of the GGS description variable set.

The authors of this study realize that, as emphasized [75], governments differ substantially not only in size, but also in priorities, moreover, the role and size of governments around the world has changed drastically in the last couple of centuries. On the other hand, in line with the basic principles of economics, prudent policies favor economic growth in these economies, as confirmed by research findings [76].

This study is unique, as it is an unambiguous indication of economic success. It gives decision-makers who have an impact on shaping the size of the public finance sector a clear indication what should be done, how to influence the variables describing the public finance sector in order to lead the economy through its individual components to optimal level. An additional added value is the data mining technique used in this context. In the next stage, the study can be extended to more countries and group them, e.g. in terms of the level of economic development, thus looking for a relationship.

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