Classification of European Union Countries in the Context of Tax Burden: Cluster Analysis

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Abstract
The tax burden affects a number of areas, including the economic and financial behavior of both legal entities and individuals. The aim of the article is to classify EU countries into groups based on selected tax burden indicators. The sample consists of 27 states of the European Union and the indicators used include direct taxes, indirect taxes, social contributions, taxes on consumption, on labor, on capital and implicit tax rate. In addition, the aim of the article is achieved through correlation and cluster analysis. Through cluster analysis, a total of 4 clusters were created for the period 2009-2021. The countries that joined the EU at the latest belong to the group of countries characterized by a lower tax burden. In contrast, most of the states that joined the EU earlier belong to the group of countries with a higher tax burden. In general, it can be said that countries also cluster on the basis of geographical or political characteristics. Through the cluster analysis, it was proven that there are significant differences between the states in the tax area and harmonization is not taking place, and there is thus further scope for tax harmonization. The contribution of the article is in the current assessment of the tax burden in EU countries and their classification according to similar tax systems for their discussion.

Keywords
Cluster analysis, European Union Countries, Tax burden, Taxes

JEL Codes
H21, H77, C38

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Introduction

Taxes are a factor that affects a whole range of areas, primarily the economic behavior of entities subject to the payment of taxes. They also influence the financial behavior of these entities. Taxes have an impact on the costs or profits of both legal and natural persons (Brezaniova, 2013).

The tax burden is a factor that affects a number of measurable, as well as immeasurable variables, which are constantly evolving and simultaneously influencing each other. These are, for example, the tax rate, tax base, gray economy, government support through tax expenditures, gross domestic product (GDP), or the effect of the GDP growth rate, as well as fiscal imbalance and debt service, the level of the business environment, the

state of economic development, but also for example geographic location (Mihokova, Andrejovska & Martinkova, 2016).

In the European Union (EU), tax harmonization is a priority for individual governments, which is taking place to a certain extent at the level of indirect taxes, but this is not the case for direct taxes. There are significant differences in tax rates between countries, which can cause capital outflows (Contell, Climent-Serrano & Labatut-Serer, 2018). At the same time, however, some countries are characterized by similar tax systems. According to Banović, Blažić & Drezgić (2020), the tax burden on companies affects the decisions regarding the choice of their investments, as a secondary factor emphasizing the advantage of gross domestic product. On the other hand, the tax burden is not the only factor that determines capital movements. Different countries can be characterized by comparative advantages from the point of view of the macroeconomic environment, the infrastructure of public services, and at the same time it should be noted that the tax burden does not always automatically mean the profitability of the capital used (Mihokova, Andrejovska & Martinkova, 2018). However, the inflow of foreign capital is an important factor influencing the development of some economies, especially in Central and Eastern Europe (Andrejovska & Glova, 2022).

The tax systems of individual EU countries are exposed to competition due to the mobile tax base under the weight of globalization. The growth of competition between individual countries is a result of the growth of globalization. Potential competition affects the size and changes in the tax bases of these countries. For that reason, it is appropriate for countries to be characterized by flexibility and modernization of tax systems (Podviezko Perfenova & Pugachev, 2019).

This article contributes to the literature examining the tax burden of EU countries by analyzing, comparing and evaluating groups of EU countries. Awareness of the individual differences, or similarities, in the tax system of EU countries enables the deepening of tax harmonization.

The aim of the article is to classify EU countries into groups based on selected tax burden indicators. The content of the presented article is as follows. The introduction is followed by the theoretical background, in which the results of various authors dealing with the tax burden of the EU, individual European countries, and other countries are identified. The methodology part describes the data and methods used, which are then applied in the empirical part, within which the individual EU states are combined into similar clusters. The discussion and conclusion sections summarize the main findings of the article, including a description of limitations and future research.

1 Literature review

Reed & Rogers (2006) examined the relationship between changes in the tax burden and changes in tax policy over the period 1987–2000. These authors found that revenues induced by non-tax policy changes are an important determinant of changes in the

tax burden and also estimate that about 50% of the total changes in the tax burden are caused by changes in non-tax policy factors. Bustos-Contell et al. (2017) examined the historical development for the period 2006–2014 and the development of convergence or divergence of the tax burden for 15 EU member states, based on changes in the effective tax rate. Through cluster analysis, they found that if a country is prosperous, effective tax rates tend to converge. Otherwise, the effective tax rates differ, due to differences in the tax policies of the Member States and offshoring is encouraged. Braunerhjelm, Eklund & Thulin (2021) argue that the administrative tax burden has an effect on business support. According to their research, the influence of the tax administrative burden changes during the business life cycle. Negativity manifests itself in the beginnings of business. Similarly, in Roman et al. (2023), who analyzed the relationship between taxes paid by small and medium-sized enterprises and their performance for the period 2008 and 2021 in 27 member countries of the European Union. These authors argue that the taxes that small and medium-sized enterprises have to pay are considered obstacles that limit the improvement of performance, taking into account the specifics of the country's economy.

Through a cluster analysis that included countries in the EU27 for the period 1995–2012, Šimková (2015) came to the conclusion that the newly acceding countries with regard to their tax burden (countries that joined the EU in 2004 and 2007) are in the group of countries with low tax burden and identified clusters of countries based on their historical development, geographical and demographic characteristics. Similar conclusions were made in Korecko, Bacik & Voznakova (2019), when a similar development in tax systems in terms of their geographical location was revealed through cluster analysis. At the same time, significant differences in the tax burden and income tax rates were found in the countries.

According to Podviezko, Perfenova & Pugachev (2019), the convergence process of new EU members is strengthened with the increasing tax competitiveness of these countries. Banovic, Blazic & Drezgic (2020) examined the impact of corporate income taxation on attracting FDI flows in EU member countries in the period from 1998–2017 for 28 EU member countries. These authors argue that tax policy significantly affects the FDI flows of companies in the new EU member states (which are characterized by a lower tax burden). Mihokova, Andrejovska & Martinkova (2018) investigated whether the 27 EU countries are competitive in the field of corporate taxation in 2004–2014 and whether the "new member states" are considered more competitive than the states that joined the EU earlier. Through cluster analysis, they found a significant and positive effect of tax competitiveness on the growth of company profits, and at the same time, tax competition between countries is not clearly associated with a decrease in tax rates. Dubrovina et al. (2019) dealt with the analysis of tax revenues and social contributions in EU countries and through correlation analysis found that the ratio of total tax revenues to gross domestic product is correlated in many EU countries. Furthermore, it was found that some EU countries have common features of total income and some groups of countries differ.

Lukacova et al. (2020) analyzed the harmonization of income taxes in the European Union and through cluster analysis it follows that the process of tax harmonization could take place within countries that are geographically and politically close. Llopis & Martí (2016) based on the analysis of the nominal and effective tax rate in the EU countries in the years 2000–2013 claim that the development of corporate income tax is increasingly distant

and countries do not tend to harmonize this tax. Elschner, Heckemeyer & Spengel (2011) looked at the tax burden of corporate tax in the EU. According to their analysis from 1998–2009, based on effective average tax rates, there is no harmonization of the tax burden of individual countries. Liapis, Rovolis & Galanos (2014) in their study dealing with the tax regimes of the EU states, based on the analysis of the countries from 1995–2009, that there are some differences between the tax regimes of the EU countries and that the EU has not introduced any policy that will lead to tax harmonization. A similar conclusion was made, for example, by Andrejovská & Hudáková (2016).

Rudy (2021) examined changes in the tax burden in election and post-election years in 121 countries, including EU countries, between 1991 and 2019. It was found that in developed countries, government spending was higher in election years than in other periods, and governments were motivated to increase rather than reduce the tax burden. Krajňák (2022) dealt with changes in personal income taxation in the Czech Republic in 2022 and, on the basis of regression and correlation analysis, found that the tax burden from 2022 in the case of applying the basic tax reliefs for taxpayers have decreased, and at the same time, the tax burden increases slightly for taxpayers who, in addition to tax reliefs, also apply for tax relief for children. Furthermore, Krajňák (2020) found that the income tax between 1993–2018 was progressive in most cases (the exception was the period 2008–2012). Tanchev (2021) analyzed the effect of a proportional income tax without a tax-free minimum on inequality in Bulgaria in the period 2008-2019. The results of this study show that an increase in gross average income and net average income leads to an increase in inequality. After taxing income with a proportional income tax, inequality does not decrease, but further deepens. In countries such as Belgium, Estonia, Ireland, Malta, the Netherlands, Portugal, Romania, Spain and the United Kingdom, the tax burden does not affect how business entities perceive their business environment. According to Vintilă, Onofrei & Ţibulcă (2018), this may be due to the fact that the tax policy in these countries is very stable or, on the contrary, very unstable.

According to Konôpková (2021), the biggest tax burden in Slovakia is personal income tax, corporate income tax, and property tax. The lowest tax burden is value added tax. According to Bunescu (2015), countries in northern Europe (Denmark, Finland and Sweden) have the highest tax burden. Vlachy (2017), based on an analysis of the tax burden on variable incomes for private sector employees in the countries of the Visegrád Four, claims that the system in the Czech Republic is inefficient and lacks horizontal and vertical fairness. Higher income risk in all countries except Hungary using a flat tax result in less progression (existence of a minimum wage).

Bona-Sanchez, Perez-Aleman & Santana-Martin (2023) investigated the relationship between media coverage and corporate tax burden in non-financial Spanish listed firms for the period 2003-2016, with the result that media coverage reduces the tax burden of legal entities. In Belgium, according to Buyl & Roggeman (2019), it was found that tax incentives for SMEs are not at a high level to compensate for the tax advantages of large and internationally operating companies, or that domestic SMEs face a higher effective tax burden compared to large domestic and large multinational enterprises.

Authors from outside the European Union also deal with the tax burden. Lykova (2015)

claims that in Russia the tax burden on various bases is sufficiently different compared to European countries. For example, the corporate and labor tax burden is lower than in European countries, but the difference between statutory and implicit corporate tax rates is not very large. On the other hand, the tax burden on consumption is very close to the highest in Europe. Based on a regression analysis, Paientko & Oparin (2020) claim that the reduction of the tax burden in Ukraine has a significant positive impact on the level of fiscal freedom, while it has no effect on the level of economic freedom.

Lu et al. (2023) looked at the impact of corporate tax reduction on investment efficiency in China in 2015–2021. These authors argue that reducing the tax burden can improve the efficiency of corporate investment by reducing corporate tax avoidance, especially for non-state enterprises, low corporate governance and low marketization. Niyazmetov (2023) estimates that for the period 2000–2019 the optimal tax burden in Uzbekistan reaches 19%, at the same time it was found that in the period 2010–2020 the government of Uzbekistan failed to collect on average half of the potential tax revenue. In Georgia, according to Kbiladze (2016), the tax burden is uneven according to the types of businesses and their activities, even though according to the tax code, businesses regardless of their size and type of activity pay the same interest rate. In Turkey, according to Nacar & Karaback (2022), it was found that for the period 2006–2019 the effective tax burden on labor is higher than the effective tax burden on capital and consumption, and at the same time that taxes on capital fluctuate according to changes in tax laws. Grubert & Altshuler (2016) looked at the tax burden of legal and natural persons in the USA and propose several variants that lead to a reduction of the tax burden of corporate tax. The most robust proposed option represents a reduction in the corporate tax rate and further taxation of dividends and capital gains as ordinary income.

2 Research methods

The aim of the article is to classify EU countries into groups based on selected tax burden indicators. In order to combine individual countries into several similar clusters, the article is based on two hypotheses based on a literature review:

- Hypothesis 1: European Union countries differ in tax burden indicators.
- Hypothesis 2: The countries of the European Union are characterized by similar levels of tax burden indicators.

The article draws on the literature that deals with tax burden in the countries of the European Union. The empirical part uses data and selected indicators (see table 1) from Eurostat. The empirical analysis was carried out for the period 2009–2021. The year 2021 is the last year for which all values of the selected indicators are available.

The selected set consists of 27 countries of the European Union, namely: Austria; Belgium; Bulgaria; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italians; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Romania; Spain; Slovakia; Slovenia; Sweden.

Tax burden is measured as the ratio of taxes to gross domestic product Dubrovina et al. (2019).

Table 1: Definition of Variables

Indicators	Definition	Unit	Source
Total Taxes (TTB)	They are defined as taxes on production and imports, taxes on income and wealth, taxes on capital and mandatory real social contributions	Index (0–100%)	Eurostat
Direct taxes (DT)	They are defined as income and property taxes and capital taxes (personal income tax, corporate income tax, inheritance tax, gift tax and others)	Index (0–100%)	Eurostat
Indirect taxes (INT)	They are defined as taxes related to production and imports (VAT, import duties, excise duties and others)	Index (0–100%)	Eurostat
Social contributions (SC)	They represent social contributions of employers, social contributions of employees and social contributions of the self-employed and the unemployed	Index (0–100%)	Eurostat
Taxes on consumption (TC)	They are defined as taxes imposed on transactions between final consumers and producers and on final consumption goods	Index (0–100%)	Eurostat
Taxes on labor (TL)	They include taxes related to wages and transfer income of unemployed persons and mostly deducted at source, paid by employers and employees, including mandatory social contributions	Index (0–100%)	Eurostat
Taxes on capital (TCL)	They include taxes on business income in a broad sense - profit tax and taxes that could be considered a necessary condition for entry into production (real estate tax, motor vehicle tax). Capital is defined as physical capital, intangible assets, financial investments and savings	Index (0–100%)	Eurostat
Implicit tax rates on labor (ITRL)	Measure the actual or effective average tax burden levied on labor	Index (0–100%)	Eurostat
Implicit tax rates consumption (ITRC)	Measure the actual or effective average tax burden levied on consumption	Index (0–100%)	Eurostat

Source: European Commission (2023); European Commission (2023a)

The evaluation of selected indicators in EU countries for the period 2009–2021 is carried out using correlation analysis and cluster analysis.

Correlation analysis is used to assess the degree of relationship between the selected indices, see the formula (1):

$$r = \frac{\sum_{i=1}^{n}(x_i - x)\,(y_i - y)}{\sqrt{\sum_{i=1}^{n}(x_i - x)^2 \;\sum_{i=1}^{n}(y_i - y)^2}} \tag{1}$$

where: r represents Pearson's correlation coefficient, x_i a y_i represent the values of x and y for the ith individual (Mukaka, 2012). The significance level is chosen at 5%.

An F-test is used to determine whether the selected criteria are statistically significant at the 5% significance level.

Cluster analysis refers to the field of multivariate statistics that involves grouping objects based on some degree of proximity defined between those objects. Cluster analysis focuses on the classification of objects based on their proximity with respect to measurement variables (Brusco et al. 2012). Clustering methods are mostly divided into two categories. These are hierarchical clustering and non-hierarchical clustering methods.

Hierarchical clustering methods have two different classes. These are agglomerative and divisive approaches. On the basis of hierarchical analysis, individual objects are gradually combined until finally a single cluster containing all cases is created. This clustering method leads to the same number of solutions as the number of objects and at the same time it is not necessary to know the exact number of final clusters. For non-hierarchical methods of cluster analysis, the classification of objects into a predetermined number of clusters is typical. This method starts by dividing the objects into the required number of clusters, calculating the centroids of the cluster and moving the objects to their closest cluster centroid, until all objects are closer to their own cluster centroid (Clatworthy et al., 2010; Trebuňova & Halčinova, 2013).

By means of hierarchical cluster analysis (Ward´s method), a dendrogram is created in graphic form that shows how individual clusters are related to each other and on the basis of which the final number of clusters can be derived. The final number of clusters is performed by the middle K-means algorithm based on the squared Euclidean distances. K-means is used to refine preliminary results based on hierarchical analysis (Franke, Reisinger & Hoppe, 2009).

K-means obtains clusters considering the distances between i-points and cluster centers (Gülağız & Şahin, 2017). The basis of K-means is that the cluster centers are used as the basis for the cluster, comparing the data objects with each center and dividing the data objects into clusters according to the closest center. Next, the center of each cluster is calculated as the new cluster center until (2) converges:

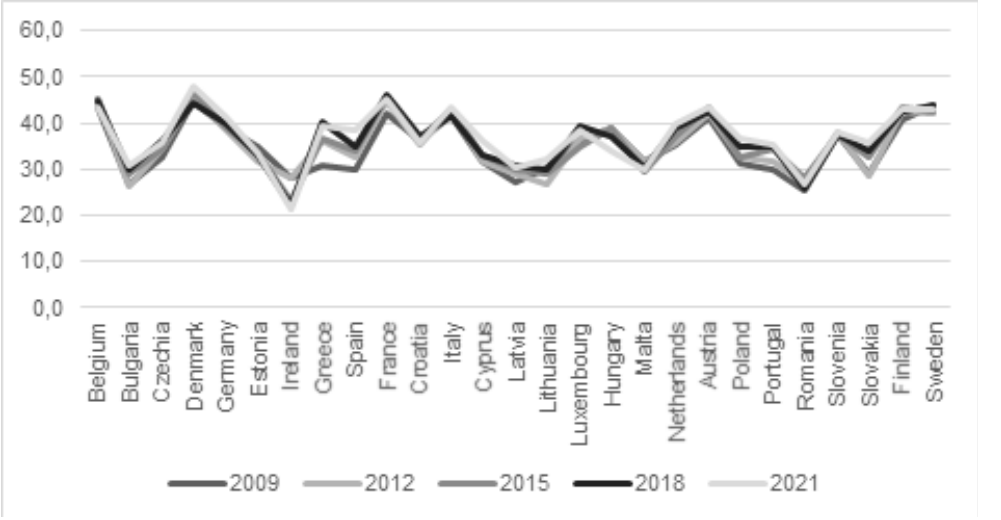
$$E = \sum^{K}_{k=1} \sum_{i \in Cl} [x - \mu_i]^2 \tag{2}$$

where E is the sum of the distance differences between the data objects (x) and the center of the cluster (μ_i), to which it belongs (Ding et al., 2021).

3 Solutions and Results

Figures 1-4 show the development of tax burdens in EU countries in the years 2009–2021.

Figure 1: Tax burden in EU countries

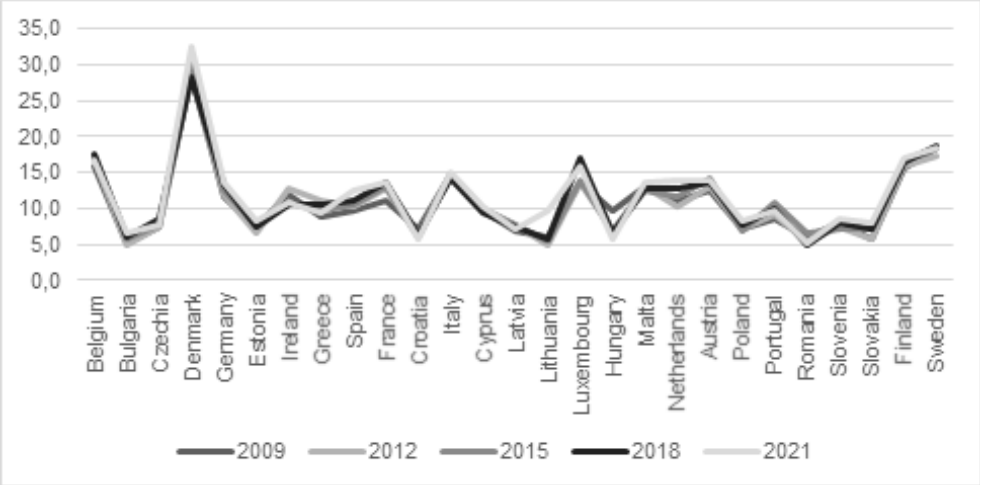


Source: European Commission, own processing (2023)

The average value of the total tax burden in EU countries increased by 2.4% between 2009–2021. The range of variation has increased by around 7.2%, which may indicate that the differences between EU countries have increased over the years. The average value of the total tax burden in 2009 was 38%, in 2012 it was 39.3%, in 2015 it was 39.7%, in 2018 it was 40% and in 2021 it was 40.7%. The countries that do not reach the average value are mainly from Eastern Europe. These are, for example, Romania, Bulgaria, Latvia or Lithuania. Other countries are Malta in the south of Europe and Ireland in the west. On the contrary, the countries that reach higher than average levels are mainly the countries in the north and west of the European Union (the exception is Ireland, which differs from most of the countries of Western Europe because it reaches very low values. These are, for example, Denmark, France and Finland.

The average value of the tax burden of direct taxes in EU countries increased by 1.5% between 2009–2021. The range of variation has increased by around 4%, which may indicate that the differences between EU countries have also increased over the years. The average value of direct tax burden in 2009 was 12.1%, in 2012 it was 12.6%, in 2015 it was 12.9%, in 2018 it was 13.2% and in 2021 it was 13.6%. The countries that do not reach the average value are mainly from Eastern Europe. Countries with low values are, for example, Romania, Hungary, Croatia or Bulgaria. On the contrary, the states that achieve higher than average levels are mainly states in the north and west of the European Union. These are, for example, Sweden, Finland or Belgium. In most countries, a higher proportion of the tax burden on natural persons prevails than on legal persons (the exception is Cyprus). The biggest difference between the tax burden of individuals and legal entities is in Denmark, Italy, Finland and Sweden).

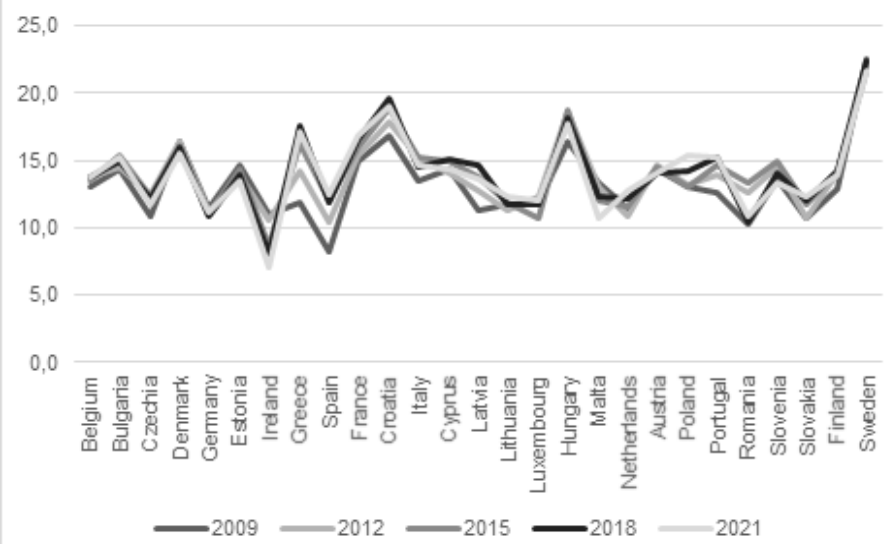
Figure 2: Tax burden of direct taxes in EU countries



Source: European Commission, own processing (2023)

The average value of the tax burden of indirect taxes in EU countries increased by 0.6% between 2009–2021. The range of variation increased again, but only by about 0.3%. The average tax burden of indirect taxes in 2009 was 12.8%, in 2012 it was 13.5%, in 2015 it was 13.7%, in 2018 it was 13.7% and in 2021 it was 13.8%. States, usually reach an average value. However, Ireland achieves low values, and on the contrary, Croatia, Sweden and Hungary achieve very high values. In all states, a higher proportion of the tax burden of VAT prevails compared to consumption tax. The biggest difference between the tax burden of VAT and consumption taxes is in Estonia.

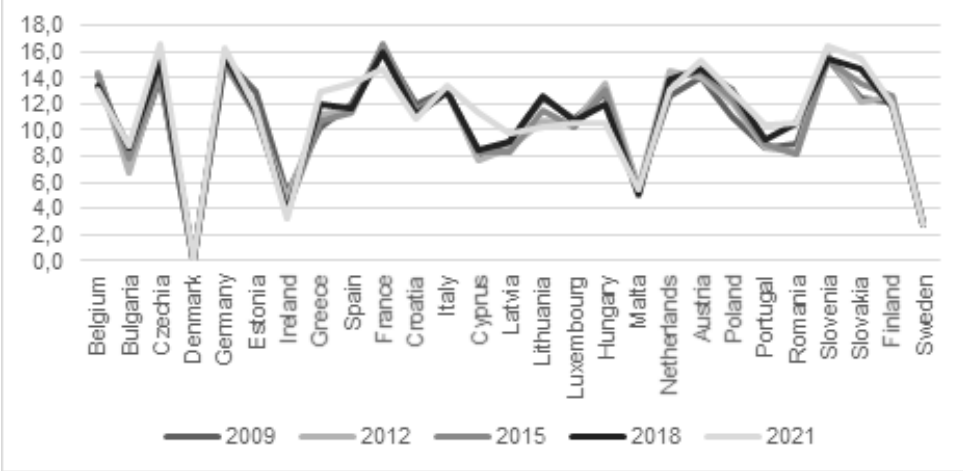
Figure 3: Tax burden of indirect taxes in EU countries



Source: European Commission, own processing (2023)

The average value of the social security tax burden in EU countries was the only one to decrease by 0.1% between 2009-2021. The range of variation increased slightly again, by approx. 0.3%. The average tax burden of indirect taxes in 2009 was 14.8%, in 2012 it was 14.6%, in 2015 it was 14.5%, in 2018 it was 14.6% and in 2021 it was 14.5%. Countries that usually achieve rather lower values are primarily Denmark and Sweden, as well as Ireland, Malta, Cyprus and Latvia. On the contrary, the Czech Republic, France, Germany, Slovenia, and Slovakia achieve higher values.

Figure 4: Tax burden of social security in EU countries



Source: European Commission, own processing (2023)

4.1 Correlation analysis

A correlation analysis was performed to identify the correlation between selected indicators that characterize the tax system. The results of the correlation analysis in individual years can be seen in Table 2.

Table 2: Correlation analysis

Indicators	TTB	DT	INT	SC	TL	TC	TCL	ITRL	ITRC
TTB	1	,703	,502	,189	,911	,191	,567	,698	,298
DT	,703	1	,217	-,439	,644	-,072	,569	,307	,358
INT	,502	,217	1	-,226	,330	,664	,054	,231	,457
SC	,189	-,439	-,226	1	,253	-,072	,037	,452	-,343
TL	,911	,644	,330	,253	1	-,033	,353	,800	,224
TC	,191	-,072	,664	-,072	-,033	1	-,301	-,097	,521
TCL	,567	,569	,054	,037	,353	-,301	1	,262	-,132
ITRL	,698	,307	,231	,452	,800	-,097	,262	1	,049
ITRC	,298	,358	,457	-,343	,224	,521	-,132	,049	1

Source: Own processing

Through correlation analysis, a strong and statistically significant positive correlation was found between the total tax burden and the majority of tax indicators. Another statistically significant positive correlation was found for direct taxes and taxes on labor and capital and indirect taxes and taxes on consumption. Then there is the labor tax and the implicit labor rate and the consumption tax and the implicit consumption rate. These correlations are inferable.

4.2 Evaluation of the similarities of EU countries using cluster analysis

First, it was determined whether all the selected criteria are considered statistically significant differentiations. Based on the results (Table 3), it can be claimed that only one indicator was statistically insignificant. On the contrary, Labor Tax, Tax Burden and Social Insurance are of greatest importance within the framework of differentiation according to the F-Test.

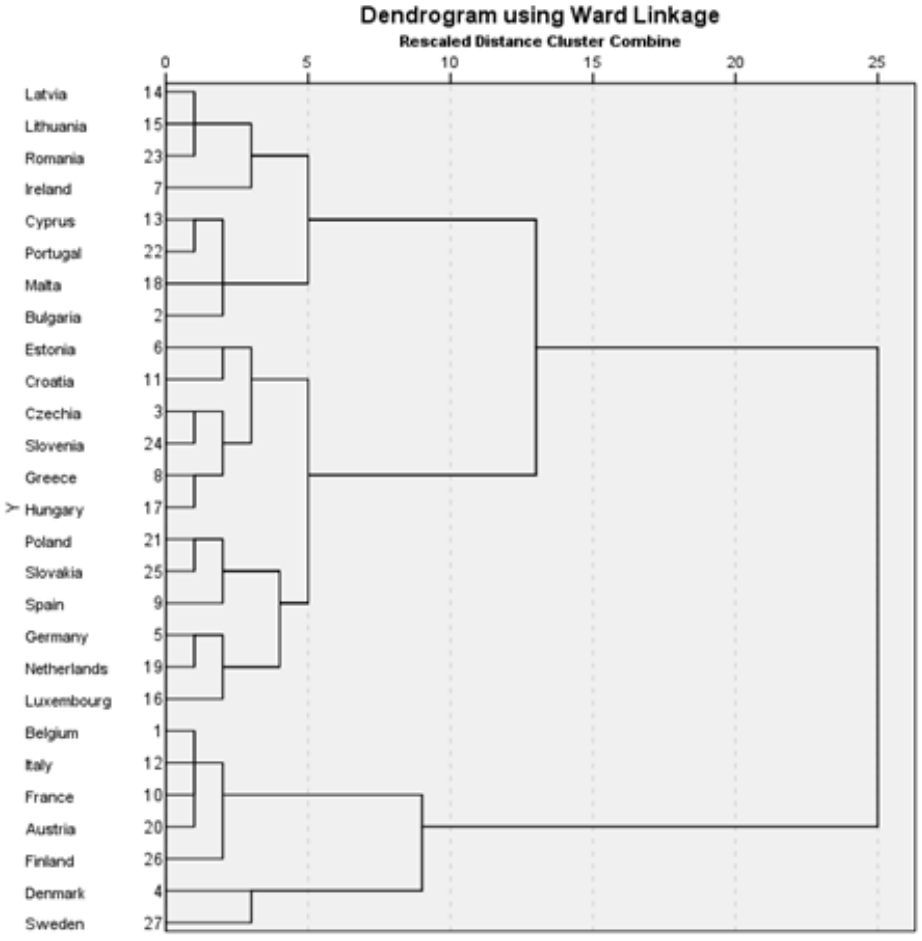
Table 3: One-way Anova

Indicators	F	Sig.
TTB	43,898	0,001
DT	18,583	0,001
INT	3,922	0,021
SC	35,009	0,001
TL	51,675	0,001
TC	0,624	0,607
TCL	2,394	0,094
ITRL	17,751	0,001
ITRC	3,670	0,027

Source: Own processing

As most of the indicators in the model were found to be statistically significant. Hierarchical cluster analysis was first used to create clusters of EU countries. The indicators direct taxes, indirect taxes, social contributions, taxes on consumption, on labor, on capital and implicit tax rate were used as inputs for hierarchical cluster analysis. Through cluster analysis, all 27 EU states were divided into groups characterized by similar behavior. The result of the hierarchical clustering process is shown in a dendrogram (Figure 5), according to which it can be assumed that the probable number of clusters will be between 2–6.

Figure 5: Dendrogram



Source: Own processing

The final number of clusters was finally selected as four through non-hierarchical clustering (K-means).

Cluster 1 includes 6 countries (Belgium, Germany, France, Italy, Austria and Finland). These are primarily Western European countries (Belgium, Germany and France), but also southern (Italy), central (Austria) and northern (Finland). It is therefore a very heterogeneous group. All countries are also Eurozone countries and joined the EU before 2004. These are states that are characterized by a very high overall tax burden. The tax burden of direct and indirect taxes and social insurance is equally represented. States are characterized by high taxes on labor and the associated high implicit tax rate on labor. The implicit rate on labor exceeds the implicit rate on consumption just as taxes

on labor exceed taxes on consumption and capital. France has the highest overall tax burden, while Germany has the lowest. The highest share of direct taxes is in Belgium and the lowest in Germany. The highest share of indirect taxes is in France and the lowest again in Germany. France achieves the highest values also within the framework of social security, and Finland shows the lowest values. The biggest difference is within the implicit consumption rate, where Finland achieves the highest values and Italy the lowest.

Cluster 2 includes 8 countries (Bulgaria, Ireland, Cyprus, Latvia, Lithuania, Malta and Portugal, Romania). These are mainly the states of Eastern Europe (Bulgaria, Latvia, Lithuania and Romania), Southern (Cyprus, Malta and Portugal) and Western Europe (Ireland). From a geographical point of view, these are rather smaller states. These are the states with the lowest tax burden, where the share of indirect taxes prevails. Most of these countries joined the EU after 2004. These are the states characterized by the lowest overall tax burden. These are the states characterized by a similar tax burden of direct taxes and social insurance and a slightly increased share of indirect taxes, but compared to the other clusters it has the lowest share of the tax burden of indirect taxes. The implicit rate on labor exceeds the implicit rate on consumption just as taxes on labor exceed taxes on consumption and capital. Portugal has the highest total tax burden, the lowest is Ireland. The highest share of direct taxes is in Malta and the lowest is in Bulgaria. The highest share of indirect taxes is in Bulgaria and the lowest in Ireland. Lithuania has the highest values in social security and the lowest values in Ireland. The biggest difference is in implicit rates from work, where Romania has the highest values and Malta the lowest.

Cluster 3 includes 11 countries (Czechia, Estonia, Greece, Spain, Croatia, Luxembourg, Hungary, Netherlands, Poland, Slovenia and Slovakia). This is the largest group of countries, which are mainly from Central Europe (Czechia, Poland and Slovakia), then from the East (Estonia, Croatia, Slovenia), from the South (Greece, and Spain) and West (Luxembourg and the Netherlands). Rather, these are states with a lower tax burden, where the share of indirect taxes and social security prevails. Most of these countries joined the EU after 2004. These are states that are characterized by a lower overall tax burden. These states are characterized by a lower tax burden of direct taxes compared to indirect taxes and social insurance. At the same time, however, the share of social insurance is largely high. The fact that these countries have a high implicit rate for work is also related to the higher share of social insurance. The implicit rate on labor exceeds the implicit rate on consumption just as taxes on labor exceed taxes on consumption and capital. Within that cluster, Hungary has the highest overall tax burden, while Slovakia has the lowest. The highest share of direct taxes is in Luxembourg and the lowest in Croatia. The highest share of indirect taxes is in Croatia and the lowest in Spain. The Czech Republic achieves the highest values in terms of social security, and Luxembourg shows the lowest values. The biggest difference is within the implicit consumption rate, where Estonia achieves the highest values and Spain the lowest.

Cluster 4 includes 2 countries (Denmark and Sweden). These are the states that are characterized by the highest total tax burden, due to the high proportion of the burden of direct and indirect taxes and at the same time the lowest burden of social insurance. These are the states with a high tax burden on labor and the implicit rate on labor, as

well as the highest implicit rate on consumption and also the highest share of taxes on consumption. The implicit rate on labor exceeds the implicit rate on consumption just as taxes on labor exceed taxes on consumption and capital.

The average values of the clusters can be seen in the table 4.

Table 4: Average cluster values

Cluster	TTB	DT	INT	SC	TL	TC	TCL	ITRL	ITRC
1	42,53	14,45	13,90	14,19	22,57	11,46	8,48	40,68	17,64
2	29,45	8,62	12,76	8,07	12,24	11,60	5,61	28,18	17,40
3	35,37	8,81	13,84	12,72	16,82	12,38	6,17	34,52	19,11
4	44,56	24,11	19,05	1,40	24,26	13,18	7,12	36,67	23,15

Source: Own processing

4 Discussion and conclusions

Based on the cluster analysis, a total of 4 clusters were created, see Table 5.

Table 5: Cluster analysis

Cluster	Countries in cluster
1	Belgium, Germany, France, Italy, Austria and Finland
2	Bulgaria, Ireland, Cyprus, Latvia, Lithuania, Malta and Portugal, Romania
3	Czechia, Estonia, Greece, Spain, Croatia, Luxembourg, Hungary, Netherlands, Poland, Slovenia and Slovakia
4	Denmark and Sweden

Source: Own processing

Based on the results of the cluster analysis, differences between countries in terms of their taxation are identified, especially between countries that joined the EU earlier or later. It can be stated that most of the countries in the 2nd and 3rd clusters, i.e., with the lowest tax burden, joined the EU in 2004 and later. A high tax burden can be found in countries in the west and north of Europe. The lower tax burden of these states can make their economic environment much more interesting for foreign investors, thereby increasing their tax revenues. However, as already mentioned, the tax system is not the only factor that affects the movement of capital. Similar results were obtained, for example, in Andrejovská

& Hudáková (2016); Korecko, Bacik & Voznakova (2019) or Mihokova, Andrejovska & Martinkova, (2018).

The article revealed clusters of countries in the EU27 with similar tax systems according to various tax burden indicators. At the same time, gaps and differences in the tax burden were identified.

The results of the correlation analysis showed a strong and statistically significant positive correlation between the total tax burden and most of the tax indicators. Furthermore, the results show that between 2009–2021 there was a slight increase in the tax burden, especially direct taxes. Significant differences in tax indicators within the EU were found. It was found that the countries that joined the EU after 2004 are characterized by a lower tax burden than the countries that joined the EU before 2004. All clusters show the largest implicit labor rate and at the same time the largest labor taxes. Among the clusters in which the countries with the highest tax burden appeared were Sweden and Denmark, and on the contrary, Bulgaria, Ireland, Cyprus, Latvia, Lithuania, Malta, Portugal and Romania were in the cluster with the lowest tax burden.

By means of a cluster analysis, states were found that could cooperate in this area within the framework of tax harmonization, and based on this cooperation, opinions and recommendations for uniform EU tax rules could be included. Fewer proposals from only a few clusters would facilitate the adoption of uniform rules. The countries that have been grouped are characterized by similar historical, political or geographical features (for example, larger countries show a higher tax burden and the opposite is the case in smaller states).

The limit of this research is that not all indicators that describe the tax burden in individual countries were used. Future research could expand the sample set by adding more countries or analyze individual countries more intensively.

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