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IS THERE ANY OBVIOUS RELATIONSHIP BETWEEN TAXATION AND ECONOMIC GROWTH?

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Abstract:

In an economy facing multiple crises (economic, pandemic, energy crisis, political and security crises) becomes necessary to determine the implications of fiscal changes on the economy's evolution. This paper aimed to assess the link between taxation and economic growth in the European Union Member States, considering panel data for the period 2000-2021 to identify taxation's specific implications on economic growth. The methodological endeavour encompassed both qualitative and quantitative research approaches. The qualitative analysis of the study involved a bibliometric analysis of the existing literature and visual mapping of the bibliographic data employed to highlight the differences between the values of the variables recorded in the EU countries. The quantitative research methodology assumed the empirical analysis through a panel data regression with fixed and random effects to identify the reaction of the growth rate of the gross domestic product to changes in direct and indirect taxes. Our results indicate a relationship between taxation and economic growth, depending on the tax type. We have identified a direct relationship in the case of taxes on the income or profits of corporations, including holding gains and value-added taxes and an indirect relationship in the case of taxes on individual or household income including holding gains and other taxes on production. In addition, the impact of indirect taxes is more significant. These specific relationships influence the change in fiscal policies in response to economic shocks.

Keywords: *taxation, economic growth, fixed and random effects, European Union, bibliometrics*

1. Introduction

The multiple theories of economic growth aim to analyse the influences of different factors, from management (Nie and Lei, 2004), the structure of the organic growth of the

economy (Yamamoto, 2012), growth poles (Dobrescu and Dobre, 2013) and up to the influence of technological changes for profit maximisation (Jones, 2019) or tax burden (Koltan, 2010). Approaching economic growth from several perspectives has led to important discoveries for today's economy. However, this study treats the relationship between taxation and economic growth.

The frequency with which specialised studies began to appear, whose subject is the analysis of the relationship between taxation and economic growth, began to grow starting from 2007. The maximum interest was reached in 2021 (according to the bibliometric analysis of the articles on this subject). The justification for choosing this research topic in this article results from the fact that the economic implications caused by the two analysed variables are difficult to measure fully. From an economic point of view, they influence each other. Thus, low taxation encourages the entrepreneurial environment and even foreign direct investments, generating an impulse for economic growth. In contrast, a high degree of tax reduces such investments but ensures the necessary resources for investments in infrastructure, education, health and other sectors, which, in the long term, could generate sustainable economic growth. Furthermore, in this context and conditions in which the economy does not have a constant evolution and without shocks, it is essential to identify the implications of taxation on the economy in general, and on economic growth in particular. The economic crisis of 2008, the rapid adoption of digital technologies and the implementation of IT systems in most public administrations (Aivaz and Tofan, 2022), the pandemic crisis and, more recently, the war in Ukraine have left their mark on Europe. Nowadays, the countries of the European Union have established as a primary objective the development and implementation of public policies that maintain the financial and economic balance taking into account the current economic situation, but economic growth remains the long-term objective. (Lobonț et al., 2022).

The present study aims to identify results that will support governments in adopting fiscal policies to combat the negative effects generated by economic disruptions. In order to carry out this study, a bibliometric analysis of the specialised literature was carried out to identify the principal authors who previously studied the relationship between taxation and economic growth, the primary sources that provide articles based on this topic and the keywords that are most used in the existing literature in the field. The bibliometric analyses led to the identification of current trends regarding the research of this topic and are identified as a method of reviewing the current state of the knowledge. In addition, alongside the bibliometric analysis, a brief systematic review highlighted the main previous findings. The second part of the paper, represented by methodology and data, focuses on the empirical analysis of data collected for the 27 countries of the European Union from 2000-2021. The main discoveries made following the empirical research can be found in the results and then conclusions.

The particularity of this study is rendered through the empirical analysis that studies the relationship between each type of tax and economic growth. The paper's contributions to the existing scientific literature stand out by establishing a specific relationship between taxation and economic growth, depending on the type of taxes considered. Thus, indirect taxes significantly influence economic growth, but how they exert their influence is specific. While the value-added tax has a positive impact, other

production taxes have a negative influence. Taking this aspect into account, fiscal policies can be modified knowing the effects of the changes beforehand, and thus, economic growth or stability objectives can be achieved. As for direct taxes, they also produce different effects depending on their type. Taxes on individual or household income, including holding gains, negatively affect economic growth, and taxes on corporations' income or profits positively influence economic development.

The paper is structured into five sections: introduction, literature review, data and methodology, results, and conclusions. The first section, the introduction, is the one that presents the research idea and the main results of the analysis. The second section, the literature review, included the two types of qualitative analysis of the subject's state of knowledge. The bibliometric analysis highlights the prominent authors, articles and sources that addressed the relationship between taxation and economic growth, while the systematic analysis reveals the essential findings found as a result of the bibliometric investigation. The third section, data and methodology, details the data set and empirical analysis method. The section dedicated to the results of the empirical analysis reveals the relationships that form between the studied variables and identifies the best model for their research. The last section, the conclusions, summarises the study's most important aspects, usefulness, and recommendations for fiscal policies.

2. Literature review

The specialised literature includes many works that analyse the relationship between taxation and economic growth, using various research methods, models and variables, the research results being diverse and even contradictory (Vison, 2022; Gancev and Todorov, 2021; Che et al., 2021). In order to analyse the specialised literature in a visual form and to identify the connections between keywords, authors, articles, countries and institutions that are involved in research on this topic, we performed a bibliometric analysis on the selected articles from the Web of Science, which was later employed in a systematic analysis. For this purpose, we considered the same research methodology as Lobonț et al. (2020) , Costea et al. (2022), and Vătavu et al. (2022) in their paper. The selection of articles was made in the Web of Science (WoS) Core Collection database using the terms "taxation", "economic growth", and "analysis". By choosing these terms, we identified the leading networks of authors, the most cited keywords, citations and prolific sources from the selected documents relevant to the research theme. We captured the relationship between taxation and economic growth using different analysis methods. After entering the search words, the database returned a number of 621 relevant documents whose topic included the elements used as search words. All documents published until 2022, including early access articles, were included in the final sample. Before performing the two types of analysis on the sample, we limited the selection of documents by employing different filters, such as the language, the type of document and the year of publication. As stated in Table 1, most documents were written and published in English, followed by those in Czech and Russian. The preponderance of articles written in English indicates the international importance of studying the relationship between

taxation and economic growth. In addition, the overall documents production and the intensity of exploring this relationship have increased over time, the point of maximum interest being reached in 2021, when a series of events with a higher significance has occurred, such as the pandemic, the lock-down period, the energy crisis and the beginning a financial crisis. Regarding the type of documents, most were articles, being the most accessible form of submission for publication to international journals and magazines.

Table 1. Characteristics of the documents in the analysed sample

Parameter	Observation
The language in which the document was written	570 English 14 Czech 37 in 15 other languages
Year of publication	64 in 2021 59 in 2019 52 in 2018 466 in the period 1966-2022
Document type	455 articles 99 proceedings paper 18 early access articles 49 book chapters, review, books, editorial material

Source: authors' processing using the VOSviewer software and data from the Web of Science database

The bibliometric analysis of the 621 documents in the sample was carried out employing the VOSviewer software. The Web of Science data was downloaded in plain text format with the full citation selection and the documents' abstract. The documents were processed into the VOSviewer software in order to perform the analysis. In achieving the analysis and interpreting the results, it was necessary to identify the specific terms for this type of analysis, as found in Table 2.

Table 2. Terms specific to bibliometric analysis

Terminology	Meaning
items	The objects of interest on which the bibliometric analysis is carried out include authors, countries, keywords, and publications.
link	The connection between two or more items, for example, co-authorship between authors or countries, co-occurrence of keywords.
strength	A positive number indicates the strength of a link, for example, the number of joint citations of articles by two authors.
network	Grouping between items and links can form groups.
cluster	The grouping of items with common characteristics is part of a network.

Source: authors' processing using the VOSviewer software

We started the bibliometric analysis by analysing the co-occurrence of keywords. This indicates the most frequently encountered keywords the authors used in the abstract. As can be seen from Figure 1, the essential words and connections between words are represented by "taxation" and "economic growth", also found in the form of "economic-growth", "growth", and "policy", being the most obvious keywords. Also, the considerable distance between the words indicates a weak connection. In figure 1, we can identify 4 clusters, each represented by a different colour. They suggest that between the keywords inside a cluster, there is a link that groups them like this. The first cluster (red) consists of 12 words, "taxation", "growth", "impact", and "tax policy", being the ones with the highest link strength. The red cluster is characterised by words of a macroeconomic nature, the joining of them showing the implications of taxation. The second cluster (green) also consists of 12 items and is led by "economic growth", "model", "taxes", "panel data", and "fiscal policy". The words that form the green cluster refer to elements of practical analysis of the relationship between taxation and economic growth. The articles contain those that study the implications of fiscal policies and develop analysis models. The third cluster (blue) includes 8 items, the most persistent of which are "economic growth", "policy", "co2 emissions", and "countries". Considering this cluster's composition, we can state that these keywords indicate new research areas, such as the impact of carbon emissions taxation and the reform of the tax system. In conclusion, the fourth cluster (yellow), consisting of 7 items, is dominated by the occurrence of the words "income", "investment", and "corruption". This cluster includes taxation elements that address non-compliance issues or heavy tax regimes.

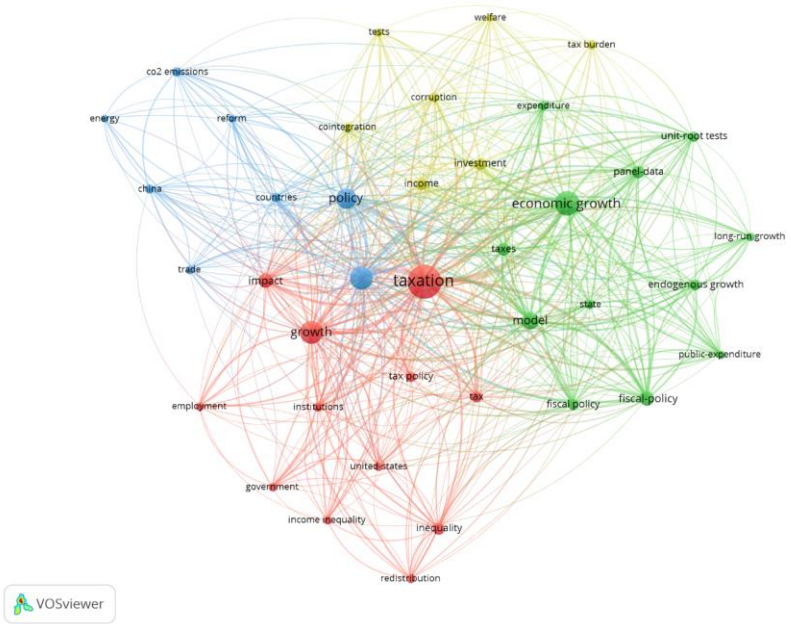


Figure 1. Co-occurrence of keywords regarding the relationship between taxation and economic growth

Source: authors' processing using the VOSviewer software and data from the Web of Science database

The following analysis refers to the number of citations, and we chose documents, sources and authors as units of study. Regarding the citations of the documents, our analysis did not identify a link between them. An analysed document is cited in different documents, so a group of documents used to elaborate on another document is not created. These aspects can be seen in Figure 2. However, the highest number of citations belong to the work developed by Quinn (1997), followed by that of Docquier (2012), Folster (2001) and Chirinko (2008). Quinn (1997) involved in his work a multivariate regression analysis to identify the links between the modification of the financial regulations and the measures of economic growth, corporate tax, government expenses and the inequality of revenues, using several methods found in the specialised studies. The study results have shown that the liberalisation of capital has positive implications for economic growth, corporate taxation, and the redistribution of taxes to corporations. Docquier and Rapopport (2012) analysed the works of four decades of research regarding the exodus of qualified human capital, emphasising the problems that caused this exodus. Through a stylised growth model, the researchers identified how the effects of exodus are transmitted to the countries from which human capital leaves. This research indicates that the countries affected by emigration have slower economic growth, and the fiscal policies addressed to the specialised workforce do not encourage the population to remain in the country. In their study, Folster and Henrekson (2001) conducted an econometric analysis on a group of rich countries for data from 1970-1995 to identify the relationship between government size and economic growth. The results of the authors indicate that it is pretty challenging to solve all robustness problems within the analysis models and that there is a robust negative relationship between government spending and economic growth in developed countries; an increase of 10 percentage points causes a decrease in the rate of increase by 0.7-0.8 percentage points. Chirinko (2008) addressed an econometric problem that refers to the value given to the sigma parameter in the analysis of economic growth. The importance of the contributions brought by the results of this study emerges from the fact that sigma is used in many analysis models, and its value strongly influences the short-term fluctuations of fiscal policies. Thus, the simulation of the effects of fiscal policies can be erroneous if a wrong value of sigma is used. The research conclusions highlighted that the value of sigma should be between 0.4 and 0.6 for the econometric model to estimate the impact of the changes correctly, and the long-term model is preferred compared to the short-term models.

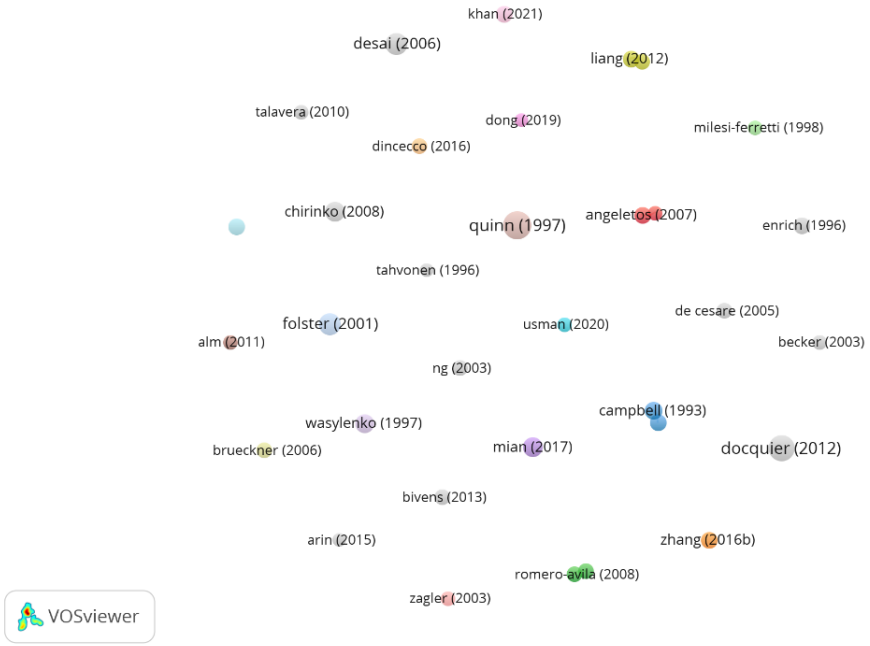


Figure 2. The most cited documents that study the relationship between taxation and economic growth

Source: authors' processing using the VOSviewer software and data from the Web of Science database

The most cited sources are highlighted in Figure 3. This analysis allowed us to identify the most relevant journals, magazines and publications that have given a high interest in the study of the relationship between taxation and economic growth and, at the same time, indicate which sources benefit from the trust of researchers. Most of the sources are strictly on the economic field, such as "Economic Modelling", "European Economic Review", and "Journal of Public Economics", and others are from other research fields but which also have a section dedicated to economic research, such as "sustainability" and "climate policy". In this analysis, we can identify 8 clusters, the most significant number of items in the red cluster, with 5 sources, which means that the sources in this cluster were cited most often in standard articles. Between the items of each of the orange, purple, blue, turquoise, yellow and brown clusters, the links are solid based on the minimal distance between the sources, which means that the sources of a cluster are often cited together.

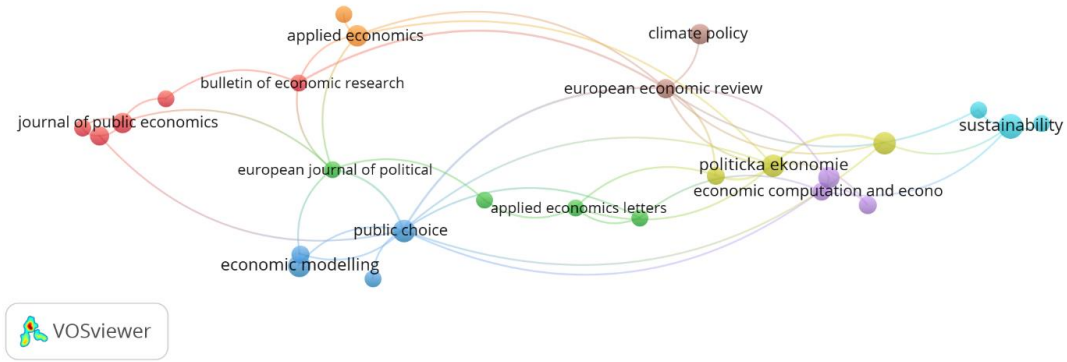


Figure 3. The most cited sources that study the relationship between taxation and economic growth

Source: authors' processing using the VOSviewer software and data from the Web of Science database

Regarding the analysis of citations by authors, 1347 authors were identified within the 621 documents. Since their number is vast, only authors with at least two documents and at least 10 citations were selected for analysis. Out of 1347, 48 met the threshold chosen. The most cited authors are Folster and Henrekson, both with 234 citations. However, the highest link strength between the citations belongs to Kotlan, with 164 total link strengths, followed by Machova, with 155 total link strengths, both of which can be identified in the yellow cluster. Kotlan has 18 works, of which 12 are written in English and 6 in Czech. In all his works, the main topic addressed was the influence of taxation or the tax burden on economic growth in OECD member countries. The main results of his studies are: (i) taxes on corporate incomes or profits have a negative effect on economic growth if they are analysed from the perspective of the fiscal burden (Koltan, 2012), (ii) by using the VAR model and the generalised method of moments the influence of taxation on economic growth can not be determined if the tax quota variable is used in the analysis because the econometric results are not statistically significant (Macek et al., 2013), (iii) the use of the World Tax Index (WTI) in the VAR model confirms the negative relationship between taxation and economic growth (Macek et al., 2013), (iv) the uncertainty of fiscal policies has a negative effect on economic growth (Koltan et al., 2015). Machova also has 18 works, of which 12 are written in English and 6 in Czech. Most of the papers are written in collaboration with Kotlan, which means that the research interests of the two authors and, consequently, the results are very similar. The arrangement of the 18 clusters formed in Figure 4 reveals the fact that the most robust connections are found between the yellow, red and green clusters. In contrast, the others have no connection; the only elements that qualify them for inclusion in the analysis are the selection criteria and the subject joint research.

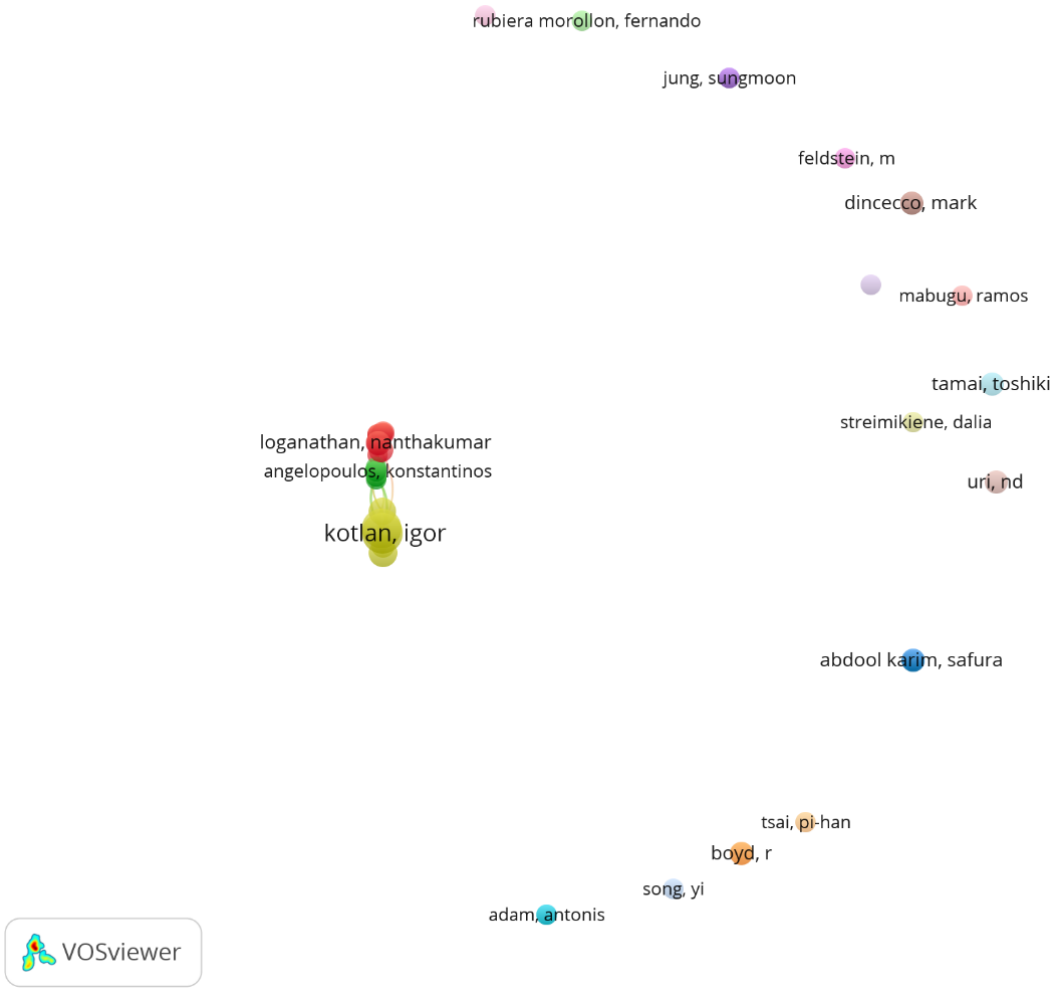


Figure 4. The most cited authors who addressed the relationship between taxation and economic growth in their papers

Source: authors' processing using the VOSviewer software and data from the Web of Science database

The bibliometric analysis results helped us identify the most cited works, the most cited authors, the most relevant publications and the keywords that have an essential role in determining the most relevant articles related to our research theme.

Furthermore, after processing the bibliometric analysis, we extended the research of the existing literature by employing a systematic review. For this purpose, we chose the most pertinent articles to determine the trends in researching the relationship between taxation and economic growth, the primary analysis methods and the most important results obtained. In order to process this analysis, we selected only a part of the documents included in the sample, using the language as an exclusion criterion on the one hand and, on the other hand, only the documents written in the English language are selected.

Researchers have always paid an increased interest in studying economic growth, but its main determinants have yet to be analysed from the beginning. Kim (1998) approached economic growth through the lens of the effects that tax reform can produce. In the initial studies, models were developed that were mainly based on the implications of technological progress because fiscal policy cannot affect economic growth. Thus, the most representative model in this sense is the Solow model. The authors developed a model that determines the link between the long-term growth rate of GDP per capita and various fiscal variables, including inflation. The model thus grew attributes 30% of the variation in economic growth rates to differences between countries' tax systems, while differences in preferences explain 4% of the variation. In addition, differences between countries for labour taxation, debt-to-equity ratio and inflation also have a significant impact.

Johansson et al. (2008) analysed in their paper the effects of changes in the structure of taxes on the gross domestic product per capita. The results indicated that certain tax categories produce long-term changes while others have immediate and temporary effects. Among the taxes that produce long-term effects, those that influence innovation and entrepreneurship activities were mentioned. Investment taxes also belong to this category, only that the impact loses intensity over long periods. On the other hand, a change in taxes that affects labour supply will generate immediate effects, affecting the level of the gross domestic product and propagating harder over time.

Vermeer (2022) studied the impact of personal income taxation on economic growth by conducting a literature review. Based on previous research reviewed, Vermeer (2022) identified increased emigration, decreased internal employee mobility, decreased gross domestic product, and decreased investment as the main effects of increasing the tax burden on individuals. Alfo et al. (2020) developed an augmented Barro model analysing data from 1965-2010 from 21 OECD countries. The researchers concluded that taxation negatively affects growth, even if the magnitude of the change is modest. The results of their analysis indicate that a 10% tax cut would increase GDP per capita by about 1%.

Yilmaz (2013) analysed the link between labour market competition, taxation and economic growth. In this study, the final goods sector, the intermediate goods sector and the research sector were considered vertically integrated into the economy. In addition to the negative effects that imperfect competition in the intermediate goods sector has on economic growth, the financing of the research sector based on the taxation of capital has a U-shaped effect on growth and causes the migration of labour from the research sector to that of final goods. Research innovation is given by the results obtained regarding the effects of competitiveness. Tax increases would positively affect economic growth if competitiveness were greater between economic sectors.

Other researchers have addressed the effects of taxation, and implicitly of public governance, on economic growth and development from new research perspectives. Thus, the impact of digitalisation of the public sector on the efficiency of the tax system was proven in the work of Doran et al. (2022). Research results indicate that the level of broadband network penetration and data download speed positively impacts the level and amount of charges. Implementing digital systems for managing public finances thus

became a general objective within the European Union through programs such as the Digital Agenda.

A positive impact of digitisation on public services was also discovered in the work of Crăciun et al. (2023), who studied the effects of digitisation on public governance using the Digital Economy and Society Index (DESI) and World Governance Indicators (WGIs). The analysis method was complex, using both structural equation modelling and Gaussian and Mixed-Markov Graphical Models, being applied to the countries of the European Union. Following the analyses, the results indicate that adopting digital technologies stimulates compliance and increases citizens' trust in public governance. Extrapolating this result to the effects that digitisation can produce on taxation, it determines the increase in the degree of tax compliance among citizens and the level of control of the tax administration. Dima et al. (2016) reached a similar result in their research, namely that citizens have greater trust in the state if the government creates a stable framework for economic development by issuing public policies characterized by predictability. Moreover, the effectiveness of policies and institutions stimulates entrepreneurial activity.

Another result indicating that economic growth is influenced by the quality of governance and public policies belongs to Dima et al. (2013). The results of the analyses carried out on a data set related to the 27 member countries indicate changes in the governance indicators' values of 0.03-0.05 times of the income per capita.

Vătavu et al. (2019) involve in their study, in addition to the classic analysis of the relationship between taxation and economic growth, the implications of tax on the general well-being of people. The investigation concerned the countries of central Europe and the most developed European countries. Through Granger causality, research results indicate that taxes stimulate economic growth but do not significantly impact human development. However, the citizens of the countries with a higher human development index are subject, over time, to higher taxation values.

Gu et al. (2020) attributed economic development to the financial sector, but with technological and human capital development implications. Supporting the research and development sector through fiscal policies that ensure the allocation of constant funds can generate the transfer of available resources to sectors that can create added value.

Considering the multitude of studies, we can group the specialised literature into studies that analysed the impact of taxation on economic growth and studies that examined the impact of tax structure on economic growth. In addition, the results obtained from the analyses can be classified according to the long-term or short-term effects and the nature of the impact (negative or positive). Nevertheless, the results obtained by researchers over time indicate a relationship between taxation and economic growth which, in most cases, has been shown to have a negative impact on economic growth.

3. Data and methodology

After reviewing the specialised existing literature regarding the relationship between taxation and economic growth through two advanced qualitative methods, we can state that the analysed research topic has been intensively discussed. The novelty of our study refers to the fact that the analysis of this relationship between taxation and economic growth was processed by using the weight of direct and indirect taxes as a percentage of

the gross domestic product and not using the World Tax Index (WTI) or tax quota indicators as found in most studies (Vybiralova, 2016; Macek et al., 2013; Kotlan, 2013). By involving in the analysis of direct and indirect taxes by types of taxes, we can capture what effect each one has on economic growth and thus make suitable recommendations for the development of fiscal policies according to the objectives to be achieved.

Data

The analysed sample includes annual data from 2000-2021 for the 27 European Union Member States. Data on taxes are expressed as a percentage of gross domestic product and include the following variables: value-added type taxes (ITVAT), taxes and duties on imports excluding VAT (IT_TDI), taxes on imports excluding VAT and import duties (IT_TI), other taxes on production (IT_OT), taxes on individual or household income including holding gains (DT_TIH), taxes on the income or profits of corporations including holding gains (DT_TIPC), capital taxes (DT_CT), other taxes on income (DT_OT). The GDP growth rate is also expressed as a percentage and represents the year-on-year growth of GDP. In the analysis, we also used as control variables agriculture, forestry, and fishing, value added (AGR) and industry (including construction), value added (IND), both expressed as a percentage of GDP. In addition, a dummy variable indicating crisis periods is used in the model construction to capture their impact on the evolution of economic growth and is expressed as binary values of 1 and 0, with 1 representing crisis periods. The values of the fiscal variables were extracted from the Eurostat database, while the rest of the variables were collected from the World Bank database. The data analysis was carried out employing the EViews software.

Before starting the empirical analysis, we performed the descriptive statistics of all the variables we intended to include in the model, which can be found in Table 3.

Table 3. Descriptive statistics of the variables included in the econometric analysis

Variables	N	Mean	Standard deviation	Minimum	Maximum
ITVAT	576	7.669965	1.450751	3.4	13.3
IT_TDI	549	0.606375	0.905345	0	5
IT_TI	515	0.563107	0.90302	0	5
IT_OT	576	1.783507	1.975402	0.1	11
DT_TIH	576	7.651042	4.820023	2.3	29
DT_TIPC	576	2.722569	1.10025	0.2	6.5
DT_OT	357	0.116246	0.171131	0	1
CT	543	0.159484	0.205769	0	1.3
GDP_GR	594	2.40601	3.90151	-14.84	25.18
AGR	594	2.494108	1.679351	0.2	13.1
IND	594	23.70926	5.675235	10	40.2
CRISIS	594	0.227273	0.419423	0	1

Source: authors' processing using EViews software

In order to observe and identify the particularities between countries regarding the proportionality of taxes in the gross domestic product, we used a graphical representation of the variables for the data collected in 2020. We selected the year 2020 motivated by the

fact that this year is the most recent in which the most data was recorded and the year with significant data that allowed us to compare the selected countries.

As regards the value-added tax (5a), it has the lowest share of GDP in Ireland, Luxembourg and Italy. At the same time, Hungary, Denmark and Croatia registered the highest values, the last two exceeding 10%. Taxes and duties on imports excluding VAT (5b) are insignificant or close to 0% in 13 of the 27 countries analysed, but Denmark, Luxembourg and Estonia stand out by recording values of 1.6%, 2.2%, respectively 3.3%. Taxes on imports excluding VAT and import duties (5c) are again insignificant in 12 countries, with high levels recorded in Denmark, Luxembourg and Estonia. Other taxes on production (5d) have values of 0.2%, 0.4% and 0.5% in Finland, Lithuania and Malta, and values of 3.3% are recorded in Austria and Greece, 5.1% in France and 9.8% in Sweden.

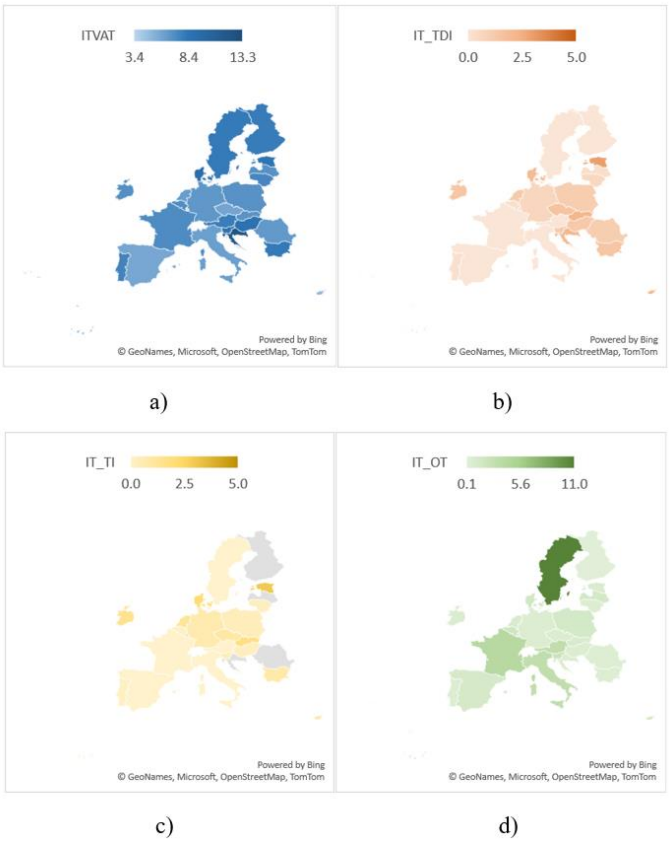


Figure 5. Graphic representation, by country, of the values of indirect taxes recorded in the 2020 year

Source: authors' processing using Microsoft Excel

Direct taxes are characterised by a greater share of the gross domestic product than indirect taxes. Taxes on individual or household income, including holding gains (6a), have the lowest values in the Balkan countries, namely Romania, Cyprus and Bulgaria, and the highest in Italy, Sweden, and Denmark. Taxes on the income or profits of

corporations, including holding gains (6b), register the lowest values in Lithuania, Hungary and Greece, while Malta, Luxembourg and Cyprus lead the ranking. Capital taxes (6c) are insignificant in 12 of the 27 countries of the European Union, but Spain, France and Belgium registered the highest values compared to the other states. Other taxes on income (6d) are again insignificant in 11 states, Austria, Slovakia, Germany, and Belgium recorded a percentage of 0.3%, and Greece recorded the highest value of 0.4%.

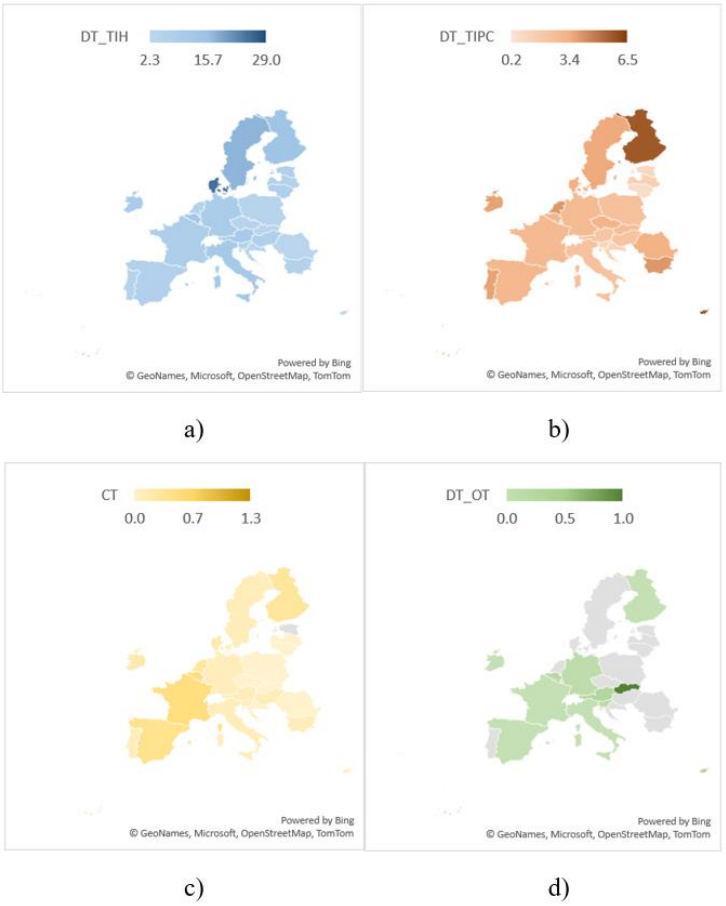


Figure 6. Graphic representation, by country, of the values of direct taxes recorded in the 2020 year

Source: authors' processing using Microsoft Excel

Research Methodology

Based on the specialised literature, we identified previous studies (Szarowska, 2010; Kobbi-Fakhfakh and Bougacha, 2023; Formanova and David, 2016) that carried out the empirical analysis using fixed effects econometric models to test the relationships between the variables. This model type (1) represents the most suitable analysis framework when the analysed countries have specific characteristics correlated with the

independent variables because fixed effects eliminate the effect of these characteristics. The basic form of this model can be found in the following equation:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \varepsilon_{it} \quad (1)$$

where,

- i represents the country (i=1...n);
- t represents the year;
- Y_{it} is the dependent variable;
- X_{it} is the independent variable;
- β_1 is the coefficient of the independent variable;
- α_i is the constant specific to each country;
- ε_{it} the standard error.

However, it can not be affirmed from the beginning whether the fixed effects model fits our data set, therefore, it is advisable to analyse the set using a random effects model as well. The random effects model indicates (2) the existence of variations that are due to specific characteristics of the independent variables, but they appear randomly. And within this type of analysis, the random effects model eliminates these variations to be able to identify the relationship between the studied variables. The general equation of this model can be found in the following form:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it} \quad (2)$$

where,

- i represents the country (i=1...n);
- t represents the year;
- Y_{it} is the dependent variable;
- X_{it} is the independent variable;
- β_1 is the coefficient of the independent variable;
- α is constant;
- u_{it} is the sr error between countries;
- ε_{it} is the within-country error.

In order to determine the most suitable model between fixed effects and random effects, we will apply the Hausman test, where accepting the null hypothesis will consist of choosing random effects, rejecting the null hypothesis and adopting the alternative hypothesis will consist of selecting the fixed effects model (Torres-Reyna, 2017).
The dataset was processed in Eviews software. In order to obtain the robustness of the results, the stationarity of the data was tested, and where necessary, the first difference was performed. In the present case, the first difference was performed for the variables AGR, DT_TIH, DT_TIPC, IND, IT_OT, IT_TDI, IT_TI and ITVAT. Furthermore, no further data processing was necessary because they were all expressed in the same unit of measure.

4. Results

We constructed the econometric model by introducing all the independent variables, including the control ones related to industrial activity and agricultural activity, alongside the dummy variable. Moreover, the results of the fixed effects model are presented in Table 4, and the results of the random effects model are presented in Table 5.

Table 4. Results of the fixed effects model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.075716	0.147843	20.80388	0.0000
DT_TIH	-0.697646	0.269398	-2.589647	0.0099
DT_TIPC	1.909477	0.321914	5.931631	0.0000
IT_OT	-2.824755	0.743931	-3.797066	0.0002
ITVAT	1.286877	0.337041	3.818161	0.0002
IND	1.287530	0.123675	10.41059	0.0000
CRISIS	-2.653166	0.304777	-8.705270	0.0000

Source: authors' processing using Eviews

Table 5. Results of the random effects model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.096952	0.252825	12.24940	0.0000
DT_TIH	-0.706843	0.268169	-2.635808	0.0086
DT_TIPC	1.900485	0.319959	5.939781	0.0000
IT_OT	-2.871425	0.740217	-3.879167	0.0001
ITVAT	1.271831	0.336150	3.783524	0.0002
IND	1.298901	0.123164	10.54614	0.0000

Source: authors' processing using Eviews

In the case of both models, it can be observed that both direct taxes and indirect taxes can have a positive or negative impact on economic growth. Taxes on individual or household income, including holding gains and other indirect taxes, have a significant negative impact on economic growth, while taxes on the income or profits of corporations, including holding gains and value-added taxes, have a significant positive impact on economic development. Crisis periods were also identified with a negative impact through the dummy variable, a result that was expected. Our results agree with those obtained by Vinson (2022) and Ganchev and Todorov (2021). Furthermore, we performed the Hausman test to identify the best econometric model for interpreting the results.

Table 6. Hausman test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	5.961906	6	0.4275

Source: authors' processing using Eviews

Based on the obtained results, the null hypothesis is accepted with a probability of 42.75%, which means that the random effects model is preferred over the fixed effects model.
Table 7 also highlights the differences between the coefficients of the variables obtained through the two models. Although the differences are insignificant, the random effects model is considered correct.

Table 7. The value of the coefficients estimated according to the fixed effects and random effects model

Variable	Fixed	Random	Var(Diff.)	Prob.
DT_TIH	-0.697646	-0.706843	0.000661	0.7205
DT_TIPC	1.909477	1.900485	0.001255	0.7996
IT_OT	-2.824755	-2.871425	0.005512	0.5296
ITVAT	1.286877	1.271831	0.000600	0.5390
IND	1.287530	1.298901	0.000126	0.3115
CRISIS	-2.653166	-2.631125	0.000245	0.1588

Source: authors' processing using Eviews

The results of the random effects model indicate the existence of a strong relationship between taxation and economic growth, thus confirming the results obtained by Vătavu et al. (2019), Vermeer (2022), Adolfo et al. (2020) or Yilmaz (2013). Unlike the previously mentioned works and due to the variables used in the analysis, we can say what impact each type of tax has on economic growth and how strong it is.

5. Conclusions

Our study focused on identifying the relationship between taxation and economic growth using the fixed and random effects models. Given the economic situation in Europe and the events that have taken place in recent years, we are again facing an economic crisis. Thus, the results of our study are an essential reference point when adopting some fiscal policy changes to combat the crisis is necessary. The empirical analysis, comprising the 27 countries of the European Union, was carried out for the period 2000-2021, being a study that captures a period that benefited from many global events, including the economic crisis of 2008 and the pandemic crisis of 2020.
The results of the bibliometric analysis indicate that researchers intensively study the relationship between taxation and economic growth. The co-occurrence of keywords associated with the research of this relationship is part of categories such as fiscal policy and taxation, public governance, welfare and inequality, carbon emissions and the energy sector, and investment and development. The bibliometric analysis also highlighted the most cited scientific works that made the most significant contributions to the state of knowledge, and the results indicate the works of Quinn (1997), Docquier (2012), Folster (2001) and Chirinko (2008) as being basic in the field. Regarding the sources, the results reveal that the journals "Economic Modelling", "European Economic Review", and "Journal of Public Economics" are the most reliable and are preferred among sources of information on the subject of taxation.

The systematic analysis of the specialised literature complements the results obtained from the bibliometric analysis. It highlights many methods and models to identify the relationship between taxation and economic growth. Most econometric models are regression models or specific panel data analyses. Following the systematic analysis, we can affirm that the relationship between taxation and economic growth is obvious but different in meaning depending on the variables analysed. Tax quotas or World Tax Indicators are the most frequently encountered indicators in tax analysis.

The most important results obtained from the empirical analysis are: (i) the same type of taxes, direct or indirect, can have different effects on economic growth with variations in intensity, (ii) indirect taxes are the ones that have the most significant impact on economic growth, (iii) periods of crisis have a significant negative impact on economic development, (iv) stimulating the industrial sector by adopting favourable fiscal policies can generate an essential boost to the economy, (v) additional taxation of the income of individuals or households has negative effects for economic growth, (vi) taxes on corporate income or profits have positive effects on the economy, (vii) other indirect taxes have significant negative effects on economic development, and value-added tax stimulates economic growth.

In addition, using the proposed research method, we can state that the countries studied have specific characteristics that generate random effects on the dependent variable, which means that, in the case of adopting fiscal policies, the first step must be to identify the specific characteristics that influence economic growth and are independent of the studied variables.

The study results emphasise that the increase in the tax burden on the incomes of individuals does not counteract the effects produced by a crisis but intensifies them. Conversely, increasing corporate income or profits taxes can combat the crisis's negative impact. Although it is easier to obtain budget revenues through indirect taxes because they are better perceived by taxpayers, the increase in their level negatively affects economic growth. On the contrary, increasing the value-added tax can be a necessary stimulus in achieving growth targets.

Moreover, we identified the main types of taxes that significantly impact economic growth and how they influence growth. The existing scientific literature (Szarowska, 2010; Koltan, 2012; Macek et al., 2013) engages variables such as tax quota or World Tax Indicator in their analysis, the approach of our study being different and offering other possibilities for further research.

Our results indicate a relationship between taxation and economic growth that differs by type of tax. We identified a direct relationship in the case of taxes on corporate income or profits, including holding gains and value-added taxes, and an indirect relationship in the case of personal or household income taxes, including holding gains and other production taxes. Also, our analysis reveals that indirect taxes have a more substantial influence. The existence of these specific relationships influences the change of fiscal policies in response to economic shocks, thus increasing the rates of taxes with a positive impact and granting fiscal facilities in the case of taxes with a negative influence, the negative effects generated by periods of crisis can be counteracted.

Considering the scientific literature and the results obtained from this research, we can affirm that taxation can be used as a lever to achieve economic growth objectives. Thus, decision-makers can identify the most appropriate measures depending on the economic context, taking into account the following guidelines: (i) the tax system must be viewed as a whole, but the effects of each type of tax on economic growth are different, which is why must be treated differently, (ii) when a faster result is desired, the most appropriate fiscal policy changes must target indirect taxes, (iii) the granting of fiscal facilities in the industrial sector can apply economic growth, (iv) they must a balance of the level of taxes is maintained, especially in the case of the incomes of individuals because the shocks caused by the crisis periods have negative effects on the disposable income, and an increase in taxes only propagates this effect on economic growth.

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