
The Relationship between the Structure of Tax Revenues and the Structure of Public Expenditure in the Member States of the European Union

Submitted 10/06/21, 1st revision 24/07/21, 2nd revision 26/08/21, accepted 30/09/21

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Abstract:

Purpose: The primary goal of the paper is to identify the relationship between the structure of tax revenues and the structure of public expenditure in the EU-28.

Design/Methodology/Approach: Linear regression was used to estimate the correlation between the share of indirect and direct tax revenues in total tax revenues and the share of expenditure for specific purposes in total public expenditure in the EU-28. Then, using the sign of the slope as the criterion, the EU-28 was classified by dividing the set into countries with a positive dependence (+), for which the lower and upper bound of the confidence interval of the slope are positive, and countries with a negative dependence (-), for which both the lower and upper bound of the confidence interval is negative. Countries classified as positive or negative are also countries for which the F test confirmed the linear dependence.

Findings: Based on the conducted research, it was found that the relations between the structure of tax revenues and the structure of public expenditure varied in the EU Member States in the years 2004-2019. Very strong or strong correlations between the share of a given tax group in total tax revenues and the share of specific expenditure in total public expenditure were observed only in relation to indirect taxes. In the case of direct taxes, no such relations were observed.

Practical Implications: The results of the research are important from the point of view of the implementation of fiscal policy in the EU Member States, including the need to shape tax systems that not only provide revenues necessary to cover public expenditure, but also take into account tax fairness.

Originality/value: The research adds value to the knowledge of contemporary tax systems, in particular to their redistributive function in relation to tax fairness.

Keywords: Tax revenue, direct taxes, indirect taxes, public expenditure, fiscal policy.

JEL classification: H3, H7.

Paper Type: Research study.

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1. Introduction

The basic function of taxes is the fiscal function, i.e., providing the funds necessary to carry out the tasks of public authority. This means that the accumulation of tax revenues is not an end in itself, but is related to the demand for money reported by the public authority in connection with its tasks, and more specifically – with the need to finance specific expenditure. It is clear that, taken together, tax revenue is closely related to public expenditure. An interesting research area, however, is the search for more detailed reports in this regard (Famulska *et al.*, 2020). It should be emphasized that it is not about linking specific tax revenues with specific public expenditure, as this would be contrary to the principle of budget unity respected today. The authors, after examining the state of knowledge in the field of the tax function, in particular the redistributive function, associated with the functions of the state, identified a research gap regarding the relationship between the distribution of tax burdens and the directions of spending public funds.

One of the possible characteristics of the distribution of the tax burden in society is the decomposition of the tax system into direct and indirect taxes. It is assumed that direct taxes burden more affluent entities/social groups than those less wealthy, while indirect taxes – vice versa. The domination of direct taxes over indirect taxes in a specific tax system allows for its positive assessment from the point of view of tax fairness. However, this is not the only element of the redistributive function of public finances. The distribution of public spending is equally important. It is assumed that the beneficiaries of public expenditure for social purposes, including social protection benefits, are to a greater extent social entities/groups that are less affluent than the more affluent ones.

Therefore, only – in relation with fair taxation – the high importance of this expenditure in public spending can be considered a determinant of the correct implementation of the redistributive function of public finances. On the other hand, expenditure for purposes related to state activities, national defense, security and public order, environmental protection, as a rule, is not dedicated to social entities/groups determined by the level of wealth. Thus, this expenditure, as well as largely economic expenditure, serves society as a whole. It cannot be viewed as a reflection of the redistributive function of public finances. However, by linking it with the structure of tax revenues, an attempt may be made to answer the research question: which – more or less affluent – social entities/groups are burdened with financing the implementation of tasks for the benefit of the society as a whole.

The main purpose of the paper was to identify the relationship between the structure of tax revenues and the structure of public expenditure in the EU-28. The research procedure involved the analysis of the structure of tax revenues broken down into direct and indirect taxes as well as the structure of public expenditure broken down in accordance with the COFOG classification. The research covered the EU-28 on the basis of data for the years 2004-2019. The justification for the adopted

research period from 2004 is the fact that this year saw a significant enlargement of the EU. In turn, 2019 is the last year for which a complete data set is available.

2. Theoretical Background

The literature on public finance and financial law defines a tax as compulsory collection by public authorities, the main purpose of which is to cover public burdens, taking into account the taxpaying capacity of citizens (Gaudemet and Molinier, 2000). Taxes have always been an indispensable tool to carry out specific tasks of the state, i.e., a source of financing public expenditure. Public authority, by establishing and modifying taxes, attains certain public goals, causing certain social and economic effects (Ofiarski, 2010). The contemporary tasks of the state in the market economy are reduced to three functions: allocating, stabilizing, and redistributing. Taxes are one of the most important economic instruments thanks to which public authorities can achieve their intended objectives (Denek, Sobiech, and Wolniak, 2001).

Thus, the functions of taxes should be understood as public goals that will be implemented with their help within the function of public finances (Sokołowski, 2005). The contemporary literature attributes two main functions to taxes, fiscal and non-fiscal. In addition to the basic fiscal function, which is to cover the state's demand for public income, taxes result in certain consequences of a social and economic nature, (Vaz da Fonseca and Nascimento Juca, 2020), which are referred to as non-fiscal consequences (Gomułowicz and Małecki, 2016). Therefore, it is important that the tax structures adopted in a given system are designed with the possibility of long-term coverage of budgetary needs in mind. Additionally, the structure of the tax system should aim at a kind of compromise between the fiscal, economic, and social goals of taxation.

Taking into account the taxpaying capacity of the burdened entity, taxes can be divided into (Famulska, 2007):

- direct taxes, where an attempt is made to determine taxpaying capacity,
- indirect taxes for which the taxpaying capacity is not determined, but is claimed on the basis of certain facts, events and activities (so-called presumed taxpaying capacity).

To distinguish between direct and indirect taxes, the following three criteria are most often used:

- Criterion 1: the relationship of the taxable object with the tax source,
- Criterion 2: the time and the related method of taxation,
- Criterion 3: possibility of passing on the tax burden.

Both criterion 1 and criterion 2 are related to the tax levying technique (Gaudemet and Molinier, 2000). According to Atkinson (1977), direct taxes can be adjusted to the individual characteristics of the taxpayer. Indirect taxes, on the other hand, are levied on the transaction performed, regardless of the situation of the buyer or seller. Direct taxes include income taxes and most taxes on assets and property. For example, property tax on owner-occupied dwellings may be tailored according to the personal characteristics of the owners. On the other hand, property taxes, e.g., on commercial buildings, motor vehicles, are almost never tailored to the personal characteristics of the owners or households and can therefore be considered as indirect taxes.

According to Atkinson (1977), taxpayers may show a preference for paying indirect taxes because indirect taxes may be perceived by society as voluntary and less visible. Indirect taxes are comprised mainly of consumption taxes, including VAT and excise duties. Atkinson (1977) argued that there are “transitional” types of taxes between these two categories; in particular, a single general sales tax can be easily transformed into a general consumption tax or an expenditure tax that can be adapted to the personal characteristics of the owner.

Reduction of revenues from direct taxes is a consequence of the implemented tax rate reductions, in particular, it concerns legal persons. Such measures are aimed at improving the condition of the economy and supporting investments. Wider basis of public revenues on proceeds from consumption taxes favors investment, economic growth, economic efficiency, and thus leads to increased competitiveness and creation of new jobs (Denek *et al.*, 2001). In practice, the choice of individual forms of taxation depends on many factors, including, fiscal efficiency, tax fairness, costs of the fiscal apparatus, taxpayers’ response to taxation, and entities’ sensitivity to the economic situation. The lack of clear trends in fiscal policy is an expression of the search for optimal solutions in a given place and time.

The EU-28 takes into account the structure of a specific system of public revenues and the advantages and disadvantages of direct and indirect taxation that also emerge in this particular system. In most general terms, direct taxes outweigh indirect taxes in terms of tax fairness. Linking the burden of direct taxation with the taxpaying capacity of the burdened entities allows for a greater burden on social entities/groups that are more affluent than less wealthy. In turn, indirect taxes outweigh direct taxes from the point of view of fiscal efficiency. Indirect taxes are much more certain, they constitute a more stable and systematic source of public income (Owsiak, 2017). It should be pointed out that indirect taxes are less complicated, easier to use for taxpayers and tax services. Furthermore, they are also more convenient to plan income from them, which is an important advantage in the context of planning public expenditure.

The choice of direct and indirect taxes is essential for the optimal shaping of tax revenue structures, as these forms of taxation can affect tax efficiency and fairness

objectives in different ways. For practical and financial reasons, it is extremely difficult to create a tax system that takes into account only the individual characteristics of taxpayers, therefore it is necessary to search for an effective solution that allows to maximize social welfare and/or minimize deadweight loss caused by burdens. Current economies use various forms of direct and indirect taxation to optimize individual tax systems (Kenny and Winer, 2006).

The first works on tax systems were dominated by theoretical optimization models that maximized social welfare or minimized deadweight loss (Ramsey, 1927; Diamond and Mirrlees, 1971; Corlett and Hague, 1953; Harberger, 1964; Atkinson and Stiglitz, 1976). Initially, the literature focused on the use of separate forms of direct or indirect taxes and emphasized their advantages and disadvantages (Ramsey, 1927; Diamond and Mirrlees, 1971). Then, there were more and more studies showing the advantage of direct taxes over indirect taxes under strictly defined conditions (Hicks, 1939). These studies took into account numerous assumptions and often referred to a single tax, at first mainly to a consumption tax, with time they were also extended to the taxation of household or corporate income (Mirrlees, 1971; Stern, 1976). In 2003, Salanié argued that it was enough to optimize only direct taxation and to abandon the indirect burden. With this statement, he contradicted the then dominant theory about the more beneficial effects of a stronger taxation of consumption. In 1976, Atkinson and Stiglitz presented the use of both direct and indirect taxes to optimize tax revenues and obtain benefits from them in an efficient and fair manner for the first time.

Successively, the impact of direct and indirect taxation on economic growth was examined with the help of exogenous and endogenous models of economic growth (Lucas, 1990; King and Rebelo, 1990; Pecorino, 1993). In addition to simulation analyses, econometric studies have also gained importance, which were often limited to a specific tax, most often household income tax (Easterly and Rebelo, 1993), personal tax (Wildman, 2001), corporate tax (Lee and Gordon, 2005; Schweltnus and Arnold, 2008), or country-specific tax systems (New Zealand: Branson and Lovell, 2001). Influential research for considering the structure of tax revenues was carried out in 2008 by Arnold (2008), where he positioned tax burdens depending on the strength of their impact on the development of individual countries. Most of the authors in the presented research focused mainly on the estimation of the impact of individual variables, including tax ones, directly on economic growth. Prior analyses of the structure of tax revenue did not take into account its translation into the structure of expenditure, which is one of the basic elements of the implementation of the tax redistributive function.

Public expenditure is an important instrument for the performance of political, economic, and social tasks as part of the implemented fiscal policy of the state. The amount of public spending depends on the current economic situation. The increase in public expenditure may contribute to the creation/increase of the budget deficit. This situation is particularly undesirable in conditions of budget

imbalances or limited economic growth. For example, Talvi and Vegh (2005) proved that an expansionary fiscal policy is characteristic of most developed countries. In addition, Afonso and Furceri (2008) confirmed that most European Union countries are characterized by an excessively high level of expenditure, which often exceeds the breaking point. On the other hand, insufficient public expenditure is unsatisfactory to guarantee public order and safety, as well as hampers economic development.

State expenditure is considered an important element of the development of society and the economic stability of the state. According to Keynes, the role of public spending is to stabilize the economy, promote anti-cyclical, and counteract negative effects on the economy (Szarowska, 2013). According to Serven, procyclical fiscal policy may have a negative impact on the economy, favor macroeconomic destabilization, lower the level of investments in the country, and thus may inhibit economic growth and contribute to a decline in the wealth of the society. Serven (1998) argued that in order to optimize fiscal policy, states increase spending in times of crisis and reduce spending in times of economic prosperity. Abbott and Jones (2011) tested the cyclicity of public expenditure in 20 OECD countries in relation to the functions of the state. The procyclicality of state expenditure was also investigated by Hercowitz and Strawczyński (2004), Kaminsky *et al.* (2004), Alesina *et al.* (2008), Rajkumar and Swaroop (2008), Ganelli (2010), and Szarowska (2012).

In order to determine the optimal amount of public expenditure, it is necessary to determine the structure of such expenditure. Lane (2003) argued that the structure of public expenditure differs in individual OECD countries. Ferreiro, Garcia-Del-Valle, and Gomez (2013) confirmed that the amount and functional structure of public expenditure varies significantly in the EU Member States. Budzyński (2014) confirmed that the structure of public expenditure is limited due to the rigid nature of social and administrative expenditure. Sawulski (2016) proved that public expenditure in the countries of Central and Eastern Europe, in connection with the functions of these states, varies significantly. Owsiak (2017) thought that effective impact on the economy through public spending requires analyzing not only the cyclicity, structure, efficiency and effectiveness of such expenditure, but also the structure of taxes and budget constraints. Empirical research shows that all these factors are interrelated and interact with each other. Therefore, this paper focuses on the identification of the dependence between the structure of tax revenues broken down into direct and indirect taxes and the structure of expenses broken down by individual functions.

3. Research Sample

The study uses data from the Eurostat database on revenues from indirect and direct taxes as well as total tax revenues, on the basis of which measure a1 – share of indirect tax revenues in total tax revenues and measure a2 – share of direct tax

revenues in total tax revenues – were calculated to identify the structure of tax revenues in the EU-28. The study covers data from the period of 2004-2019.

First, measures a1 and a2 were analyzed in terms of minimum values, maximum values, and their average level. The lowest share of indirect tax revenues in total tax revenues, amounting to 27.08%, was characteristic for Germany in 2019. The highest level of this measure was 56.16% in Bulgaria in 2012. In 2004-2019, the lowest average share of revenues from indirect taxes in total tax revenues, with a proportion of 28.45%, was recorded in Germany. Correspondingly, the highest level of this measure, 53.36%, was recorded in Bulgaria. The difference between the highest and the lowest average share of indirect tax revenues in total tax revenues was very large, the spread was 24.91 p.p.. In turn, the lowest share of direct tax revenues in total tax revenues, amounting to 15.70%, was characteristic of Bulgaria in 2005. The highest level of this measure was 67.05% in Denmark in 2014. In 2004-2019, the lowest direct tax revenue in total tax revenue, with a proportion of 17.85%, was recorded in Croatia. The highest level of this measure, 64.06%, was recorded in Denmark. The difference between the highest and the lowest average share of direct tax revenues in total tax revenues was very large, the spread was 46.21 p.p.

Then, absolute variations in the values of measures a1 and a2 were analyzed by comparing their values between the end and the beginning of the studied period. These variations were given in percentage points (p.p). Over the analyzed period, the largest increase in the share of indirect tax revenues in total tax revenues, amounting to 6.24 p.p., was recorded in Hungary. In turn, the largest decrease in this measure, by 8.60 p.p., was recorded in Cyprus. The largest increase in the share of direct tax revenues in total tax revenues, by 9.12 p.p., was recorded in Malta. The largest decrease in this measure, by 5.73 p.p., was recorded in Hungary.

Measures a1 and a2 were sequentially ranked according to the criterion of their average level in the years 2004-2019, in order from the lowest to the highest values. On this basis, four measures of the observation location (4 quartiles) were determined, to which the EU-28 were assigned. Ultimately, this allowed for the specification of four quartiles – each consisting of seven countries. The first quartile (Q1) proves that 25% of the population units have average values of measures a1 and a2 less than or equal to the first Q1 quartile, and 75% equal to or greater than this quartile. The second quartile divides the set of observations into half, the third quartile divides the set of observations into two parts, 75% of the population units have mean values of measures a1 and a2 less than or equal to the third quartile Q3, and 25% equal to or greater than this quartile, respectively (Table 1). It should be noted that in the fourth quartile for measure a1 there is only one country from the “Old European Union” functioning before the accession of new members in 2004, while the fourth quartile for measure a2 includes six such countries. This means that direct taxes dominate in wealthier countries.

Table 1. Characteristics of EU Member States by measures a1 and a2 in 2004-2019

<i>a1 sorted</i>					<i>a2 sorted</i>						
Region/State	QnT	a1 _m	a1 _{max}	a1 _{min}	a1 _x	Region/State	QnT	a2 _m	a2 _{max}	a2 _{min}	a2 _x
EU-28	NC	34.73	35.21	33.66	-0.19	EU-28	NC	34.03	35.35	33.14	0.84
Germany	Q1T	28.45	29.59	27.08	-1.32	Croatia	Q1T	17.85	20.06	16.20	1.07
Belgium		30.52	31.65	29.94	1.55	Bulgaria		19.41	24.47	15.70	0.80
Netherlands		32.05	34.30	30.56	-2.64	Hungary		20.71	26.20	16.99	-5.73
Finland		32.40	33.65	30.40	1.73	Slovakia		20.82	22.83	19.24	0.81
Luxembourg		33.13	36.10	29.74	-6.36	Slovenia		21.10	23.81	18.64	-0.45
Spain		33.14	35.31	27.53	-1.47	Poland		21.85	24.47	19.70	2.89
Czechia		33.82	36.46	30.82	1.80	Romania		22.05	24.88	18.59	-4.81
Austria		Q2T	34.30	35.11	33.02	-1.88		Estonia	Q2T	22.46	25.40
Italy	34.81		36.51	32.47	-0.88	Lithuania	22.70	31.71		15.99	-1.00
France	35.25		37.28	34.31	1.28	Czechia	23.38	26.03		21.50	-2.23
Denmark	35.84		37.92	32.80	-3.74	Latvia	26.70	32.38		22.82	-4.48
Slovakia	37.26		40.10	35.16	-3.46	Greece	27.17	30.44		24.97	-2.03
United Kingdom	37.30		39.70	33.14	1.82	France	28.26	30.09		26.04	2.99
Slovenia	38.70		41.40	36.69	-4.45	Portugal	29.04	33.27		26.00	1.15
Ireland	39.09		44.10	35.41	-7.59	Cyprus	29.71	32.94		24.90	2.32
Lithuania	Q3T	40.29	43.37	38.23	0.19	Netherlands	Q3T	30.88	34.05	28.25	5.45
Greece		41.26	45.09	37.60	5.75	Germany		31.55	33.64	28.10	5.28
Poland		41.64	44.21	39.85	-2.55	Austria		31.75	33.39	30.70	0.23
Malta		42.03	45.60	39.10	-5.70	Spain		31.85	35.79	30.17	-0.08
Estonia		42.77	44.32	38.97	1.53	Italy		34.63	35.84	33.20	0.06
Portugal		44.07	47.57	40.60	-2.18	Belgium		38.32	39.44	36.52	-1.11
Latvia		44.18	46.67	39.21	3.46	Luxembourg		38.33	42.96	35.10	7.63
Romania		44.26	47.65	40.49	-1.93	Finland		39.18	41.63	37.16	-2.79
Hungary	Q4T	45.64	49.64	39.83	6.24	Malta	Q4T	40.36	44.22	35.10	9.12
Cyprus		46.02	51.20	42.60	-8.60	Sweden		42.90	46.09	41.19	-1.49
Croatia		50.27	52.70	46.65	1.20	United Kingdom		44.00	48.54	41.94	-2.56
Sweden		50.75	52.21	48.17	2.38	Ireland		44.49	47.23	42.54	3.02
Bulgaria		53.36	56.16	50.20	1.41	Denmark		64.06	67.05	61.92	3.55

a1 - indirect taxes as a percent of total tax revenue (%); a2 - direct taxes as a percent of total total tax revenue (%); max - maximum level (%); min - minimum level (%); m - mean level (%); x - change of level from 2004 to 2019 (p.p.); QnT - quartile n in terms of indirect and direct taxes as a percent of total tax revenue; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_taxag&lang=en.

The study also includes data from the Eurostat database on individual groups of public expenditure in the European Union countries. For this purpose, the expenditure was decomposed into categories consistent with COFOG. Thanks to the introduction of a uniform Classification of the Functions of Government (COFOG) in international statistics, it is possible to combine a rigid structure of budgetary expenditure with the implementation of specific state goals. COFOG was introduced in 1999 by the OECD and published by the United Nations Statistical Division as the international standard for measuring state activity. This is one of the four commonly used classifications of public expenditure in national accounts.

This classification is made in the system of functions, groups and subgroups, along with an indication of the objectives at the level of functions that are planned to be attained. The classification breaks down public spending into the following functions: CF01: General public services, CF02: Defense, CF03: Public order and safety, CF04: Economic affairs, CF05: Environmental protection, CF06: Housing and community amenities, CF07: Health, CF08: Recreation, culture and religion, CF09: Education, CF10: Social protection (OECD, 2019). The study

analyzed public expenditure included in COFOG according to the following functions, CF01-03, CF04, CF05, CF06-10. The grouping was made taking into account the link between individual expenditure and the redistributive function of public finances. It was assumed that such a relationship exists with expenditure on social goals (COFOG06-10). For other expenditure, no such relationship is identified, because, as a rule, it is not dedicated to social entities/groups determined given the level of wealth, since it serves to ensure the functioning of state institutions, as expressed in CF01-03, and to implement such tasks as, economic (CF04) and environmental protection (CF05).

Determining its significance in the structure of public expenditure is, however, important for linking with the structure of tax revenues in the aspect of identifying social groups that are most heavily burdened with financing the implementation of tasks for the benefit of the general public.

In the years 2004-2019, all EU-28 was dominated by social spending (COFOG06-10), it amounted to an average of 65.94% of the total expenditure. 6 out of 7 countries in the fourth quartile for measure a2, which are dominated by direct taxes, recorded a higher share of social expenditure in total expenditure, exceeding the EU-28 average (Table 2).

Table 2. Average share of individual categories of public expenditure according to COFOG in total expenditure in EU-28 in 2004-2019

Region/State	CF01 _m	CF02 _m	CF03 _m	CF04 _m	CF05 _m	CF06 _m	CF07 _m	CF08 _m	CF09 _m	CF10 _m	CF01-03 _m	CF06-10 _m
EU28	13.66	2.99	3.74	9.34	1.70	1.57	14.79	2.38	10.44	39.39	20.38	68.57
Austria	13.83	1.31	2.65	12.65	0.90	0.72	15.35	2.50	9.62	40.46	17.80	68.66
Belgium	15.94	1.77	3.34	12.55	2.21	0.72	14.20	2.42	11.44	35.41	21.04	64.20
Bulgaria	11.92	3.64	7.01	14.37	2.17	3.31	12.72	2.25	10.10	32.50	22.57	60.88
Croatia	11.22	2.81	4.91	17.49	1.33	4.76	12.81	3.38	10.02	31.28	18.94	62.24
Cyprus	21.03	4.39	4.64	10.68	0.69	5.07	7.03	2.49	14.25	29.73	30.07	58.56
Czechia	11.47	2.28	4.43	15.24	2.34	2.11	17.60	3.35	10.77	30.42	18.18	64.24
Denmark	13.46	2.45	1.85	6.22	0.87	0.53	15.40	3.24	12.48	43.50	17.76	75.15
Estonia	9.49	4.58	5.40	11.88	1.73	1.03	12.92	5.59	15.94	31.44	19.48	66.92
Finland	14.51	2.65	2.40	8.83	0.50	0.70	13.52	2.41	11.58	42.90	19.56	71.11
France	12.14	3.23	2.87	9.26	1.71	2.15	14.22	2.64	9.84	41.93	18.25	70.78
Germany	13.85	2.19	3.44	7.90	1.24	1.30	15.26	2.40	9.29	43.14	19.47	71.38
Greece	20.68	5.08	3.65	10.73	2.14	0.51	11.39	1.34	8.07	36.42	29.41	57.72
Hungary	18.79	2.03	4.15	14.25	1.37	1.70	10.32	4.33	10.75	32.32	24.97	59.42
Ireland	11.99	1.00	3.77	11.92	1.97	2.65	17.41	1.92	11.53	35.85	16.76	69.36
Italy	18.26	2.61	3.79	8.41	1.70	1.20	14.24	1.46	8.49	39.85	24.67	65.23
Latvia	11.25	3.41	5.56	17.02	1.59	3.02	10.24	4.10	15.12	28.69	20.21	61.18
Lithuania	12.17	3.69	4.59	11.04	1.79	0.97	15.77	2.71	14.83	32.43	20.45	66.71
Luxembourg	12.26	0.78	2.44	13.06	1.91	1.48	12.22	2.91	11.32	41.62	15.48	69.55
Malta	16.66	1.77	3.31	12.57	3.60	1.16	13.70	2.19	13.37	31.69	21.74	62.10
Netherlands	11.77	2.75	4.20	9.69	3.37	1.07	16.39	3.03	11.81	35.92	18.71	68.22
Poland	12.21	3.78	5.15	11.74	1.37	1.84	10.87	2.82	12.52	37.69	21.14	65.74
Portugal	16.52	2.45	3.97	9.78	1.33	1.20	14.56	2.19	11.95	36.05	22.94	65.95
Romania	12.19	4.19	5.98	17.24	1.70	3.64	10.97	2.74	9.59	31.76	22.37	58.69
Slovakia	12.26	2.19	5.68	12.55	2.10	1.51	16.79	2.33	9.79	34.80	20.13	65.22
Slovenia	12.28	2.47	3.62	11.29	1.58	1.29	13.88	3.27	12.74	37.58	18.36	68.76
Spain	13.58	2.29	4.52	11.80	2.22	1.60	14.23	3.13	9.72	36.91	20.39	65.60
Sweden	14.69	2.78	2.57	8.49	0.92	1.15	13.34	2.52	12.99	40.55	20.05	70.55
United Kingdom	10.69	5.13	4.95	7.63	1.95	2.12	16.76	1.87	12.76	36.14	20.77	69.65

m-mean level (%)

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

4. Research Methodology

The aim of the research is to identify and estimate the correlation between the share of direct and indirect taxes in total tax revenues and the share of expenditure CF01-03, CF04, CF05, CF06-10 in total expenditure. To estimate the correlation (more in Aczel, Sounderpandian, 2009), the following parameters of linear regression were used: the regression slope (b1) and the regression intercept (b0). The slope, the sign of which is unbiased with the 95% confidence level, was considered binding for the estimation of the direction of correlation. For each of the 8 correlations analyzed, the 28 studied countries were divided into countries:

- with a positive dependence (+), in which an increase (decrease) in the share of taxes is accompanied by an increase (decrease) in the share of expenditure;
- with a negative dependence (-), in which an increase (decrease) in the share of taxes is accompanied by a decrease (increase) in the share of expenditure;
- with a biased dependence (\pm), in which an increase in the share of taxes may well be accompanied by an increase or decrease in the share of expenditure.

The linear dependence was tested with the F test with a 5% significance level, estimating the level of the p-value (the lower the p-value is, the stronger the linear dependence is). At the same time, the determination coefficient was estimated, showing the extent to which the variation in the share of direct and indirect taxes in total taxes is explained by the variation in the share of expenditure CF01-03, CF04, CF05, CF06-10 in total expenditure. It was assumed that the coefficient of determination exceeding 50% is worth attention. Correlations with the coefficient not exceeding 50% indicate that a given share of expenditure is largely influenced by factors other than the share of direct or indirect taxes in total tax revenues.

5. Research Results

In the case of CF01-03 expenditure (Table 3) covering General public services, defense, public order and safety, a positive correlation was found with the share of indirect taxes in total tax revenues in 7 out of 28 analyzed countries: Netherlands, Germany, Austria, Spain, Denmark, Malta and Estonia. For the Netherlands, a very strong correlation was found ($r^2 = 86.27\%$, $p = 0.0000$). In the remaining 6 countries, a positive correlation was noticeable, but the share of indirect taxes was not the dominant factor ($r^2 < 50\%$). A negative correlation between the share of indirect taxes and expenditure CF01-03 was found in 4 out of 28 countries: Portugal, Finland, Hungary, Greece, and in none of them was it strong enough to be considered worthy of attention ($r^2 \in [34.56\%, 41.78\%]$).

A positive correlation between the share of direct tax revenues in total revenues and the share of CF01-03 expenditure in total expenditure (Table 4) was observed in only 3 out of 28 countries: Portugal, Hungary and Ireland. In the case of Portugal, the dependence turned out to be moderate ($r^2 = 54.63\%$, $p = 0.0011$). In other

countries, the determination coefficient did not exceed 50%. A negative correlation was also observed in the case of 3 out of 28 analyzed countries: France, Malta, Denmark. In none of the countries with a negative correlation did the coefficient of determination exceed 50%.

Table 3. Correlation between the share of indirect taxes in total tax revenues and the share of CF01-03 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	ρ	r2	s	F	df	F crit.	p			
EU28	-0.31	0.31	0.54	0.19	1.16	0.40	-1.47	0.85	±	-0.09	0.71	-0.15	2.25%	0.01	0.32	14.00	4.60	0.58
Belgium	-1.89	0.79	1.04	0.32	2.24	0.68	-4.13	0.35	±	0.10	1.47	-0.43	18.89%	0.02	3.26	14.00	4.60	0.09
Bulgaria	-0.21	0.34	0.57	0.31	1.23	0.66	-1.44	1.02	±	-0.32	0.99	-0.10	0.97%	0.04	0.14	14.00	4.60	0.72
Czechia	-0.14	0.23	0.14	0.05	0.30	0.10	-0.44	0.16	±	0.13	0.33	-0.26	6.59%	0.01	0.99	14.00	4.60	0.34
Denmark	0.42	0.03	0.16	0.06	0.35	0.12	0.07	0.76	+	-0.10	0.15	0.57	32.16%	0.01	6.64	14.00	4.60	0.02
Germany	0.65	0.01	0.17	0.05	0.37	0.11	0.28	1.02	+	-0.10	0.12	0.71	49.77%	0.01	13.87	14.00	4.60	0.00
Estonia	0.30	0.07	0.14	0.06	0.30	0.13	0.00	0.60	+	-0.06	0.19	0.50	25.22%	0.01	4.72	14.00	4.60	0.05
Ireland	-0.35	0.30	0.20	0.08	0.43	0.17	-0.78	0.08	±	0.14	0.47	-0.42	17.73%	0.02	3.02	14.00	4.60	0.10
Greece	-0.76	0.61	0.28	0.12	0.60	0.25	-1.36	-0.16	-	0.36	0.86	-0.59	34.56%	0.03	7.39	14.00	4.60	0.02
Spain	0.26	0.12	0.10	0.03	0.21	0.07	0.05	0.47	+	0.05	0.19	0.58	34.04%	0.01	7.23	14.00	4.60	0.02
France	-0.26	0.28	0.48	0.17	1.02	0.36	-1.28	0.76	±	-0.08	0.64	-0.15	2.14%	0.01	0.31	14.00	4.60	0.59
Croatia	0.34	0.02	0.27	0.13	0.57	0.29	-0.23	0.91	±	-0.27	0.31	0.32	10.41%	0.02	1.63	14.00	4.60	0.22
Italy	0.21	0.17	0.40	0.14	0.85	0.30	-0.64	1.06	±	-0.12	0.47	0.14	1.94%	0.02	0.28	14.00	4.60	0.61
Cyprus	0.43	0.10	0.25	0.11	0.53	0.24	-0.10	0.96	±	-0.14	0.35	0.42	17.81%	0.02	3.03	14.00	4.60	0.10
Latvia	0.26	0.09	0.20	0.09	0.43	0.19	-0.17	0.70	±	-0.11	0.28	0.33	10.86%	0.02	1.71	14.00	4.60	0.21
Lithuania	-0.20	0.28	0.23	0.09	0.50	0.20	-0.69	0.30	±	0.08	0.48	-0.22	4.78%	0.01	0.70	14.00	4.60	0.42
Luxembourg	0.06	0.13	0.06	0.02	0.13	0.04	-0.07	0.19	±	0.09	0.18	0.26	6.62%	0.01	0.99	14.00	4.60	0.34
Hungary	-0.15	0.32	0.06	0.03	0.12	0.06	-0.28	-0.03	-	0.26	0.38	-0.59	34.61%	0.01	7.41	14.00	4.60	0.02
Malta	0.32	0.08	0.13	0.06	0.29	0.12	0.03	0.61	+	-0.04	0.20	0.54	28.78%	0.01	5.66	14.00	4.60	0.03
Netherlands	1.13	-0.18	0.12	0.04	0.26	0.08	0.87	1.39	+	-0.26	-0.09	0.93	86.27%	0.01	88.00	14.00	4.60	0.00
Austria	1.04	-0.18	0.39	0.13	0.83	0.28	0.22	1.87	+	-0.46	0.10	0.59	34.29%	0.01	7.31	14.00	4.60	0.02
Poland	0.38	0.05	0.19	0.08	0.42	0.17	-0.04	0.79	±	-0.12	0.23	0.46	21.28%	0.01	3.78	14.00	4.60	0.07
Portugal	-0.45	0.43	0.14	0.06	0.31	0.14	-0.76	-0.15	-	0.29	0.56	-0.65	41.78%	0.01	10.05	14.00	4.60	0.01
Romania	-0.12	0.28	0.17	0.08	0.37	0.16	-0.49	0.25	±	0.11	0.44	-0.18	3.39%	0.02	0.49	14.00	4.60	0.50
Slovenia	0.18	0.11	0.23	0.09	0.49	0.19	-0.31	0.67	±	-0.08	0.30	0.21	4.27%	0.01	0.63	14.00	4.60	0.44
Slovakia	-0.06	0.22	0.13	0.05	0.27	0.10	-0.32	0.21	±	0.12	0.32	-0.12	1.39%	0.01	0.20	14.00	4.60	0.66
Finland	-0.25	0.28	0.09	0.03	0.19	0.06	-0.45	-0.06	-	0.21	0.34	-0.60	35.58%	0.00	7.73	14.00	4.60	0.01
Sweden	-0.25	0.33	0.18	0.09	0.38	0.19	-0.63	0.12	±	0.14	0.52	-0.36	12.82%	0.01	2.06	14.00	4.60	0.17
United Kingdom	0.00	0.21	0.11	0.04	0.23	0.09	-0.23	0.23	±	0.12	0.29	0.00	0.00%	0.01	0.00	14.00	4.60	1.00

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; ρ - correlation coefficient; r² - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

It should be noted that in the vast majority of countries it was not possible to find any dependence with a strong direction (in 17 countries for indirect taxes and in 22 countries for direct taxes).

Taking into account the correlation between the share of expenditure on CF04 on Economic affairs (Table 5) in total expenditure with the share of indirect taxes in total taxes, it should be noted that its positive nature was found in 5 out of 28 analyzed countries: Sweden, Hungary, Netherlands, Germany, Luxembourg. The correlation in Sweden should be considered very strong ($r^2 = 85.09\%$, $p = 0.0000$), and worth attention – the correlation found in Hungary ($r^2 = 63.21\%$, $p = 0.0002$).

In other countries, the share of indirect taxes cannot be considered as a decisive factor statistically influencing the share of expenditure on CF04 ($r^2 < 50\%$). A negative correlation was observed in 4 out of 28 countries, Finland, Czechia, Latvia, Croatia. Only in the case of Finland, this dependence can be considered decisive and strong ($r^2 = 71.82\%$, $p=0.0000$). In other countries it should be perceived as weak. It should be emphasized that a weak negative correlation was also observed for the EU-28.

Table 4. Correlation between the share of direct taxes in total tax revenues and the share of CF01-03 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. for b1	95% conf. for b0	ρ	r2	s	F	df	F crit.	p			
EU28	0.08	0.18	0.36	0.12	0.77	0.26	-0.69	0.84	±	-0.08	0.44	0.06	0.34%	0.01	0.05	14.00	4.60	0.83
Belgium	-0.02	0.22	0.69	0.26	1.48	0.57	-1.49	1.46	±	-0.35	0.78	-0.01	0.00%	0.02	0.00	14.00	4.60	0.98
Bulgaria	0.19	0.19	0.58	0.11	1.23	0.24	-1.05	1.42	±	-0.05	0.43	0.09	0.74%	0.04	0.10	14.00	4.60	0.75
Czechia	0.20	0.14	0.18	0.04	0.39	0.09	-0.20	0.59	±	0.04	0.23	0.27	7.53%	0.01	1.14	14.00	4.60	0.30
Denmark	-0.45	0.46	0.16	0.10	0.35	0.22	-0.79	-0.10	-	0.24	0.69	-0.59	35.05%	0.01	7.56	14.00	4.60	0.02
Germany	-0.09	0.22	0.12	0.04	0.26	0.08	-0.34	0.17	±	0.14	0.30	-0.19	3.48%	0.01	0.50	14.00	4.60	0.49
Estonia	0.23	0.14	0.12	0.03	0.26	0.06	-0.03	0.50	±	0.08	0.20	0.45	20.64%	0.01	3.64	14.00	4.60	0.08
Ireland	0.87	-0.22	0.37	0.17	0.80	0.36	0.06	1.67	+	-0.57	0.14	0.53	27.69%	0.02	5.36	14.00	4.60	0.04
Greece	-0.20	0.35	0.61	0.16	1.30	0.35	-1.50	1.09	±	0.00	0.70	-0.09	0.80%	0.03	0.11	14.00	4.60	0.74
Spain	-0.11	0.24	0.20	0.06	0.43	0.14	-0.53	0.32	±	0.10	0.37	-0.14	2.00%	0.01	0.29	14.00	4.60	0.60
France	-0.90	0.44	0.26	0.07	0.55	0.16	-1.45	-0.35	-	0.28	0.59	-0.68	46.53%	0.01	12.19	14.00	4.60	0.00
Croatia	-0.47	0.27	0.39	0.07	0.83	0.15	-1.30	0.36	±	0.12	0.42	-0.31	9.43%	0.02	1.46	14.00	4.60	0.25
Italy	0.03	0.24	0.59	0.21	1.27	0.44	-1.25	1.30	±	-0.20	0.68	0.01	0.01%	0.02	0.00	14.00	4.60	0.97
Cyprus	0.20	0.24	0.30	0.09	0.63	0.19	-0.43	0.84	±	0.05	0.43	0.18	3.26%	0.02	0.47	14.00	4.60	0.50
Latvia	0.15	0.16	0.20	0.05	0.43	0.12	-0.28	0.58	±	0.05	0.28	0.20	3.93%	0.02	0.57	14.00	4.60	0.46
Lithuania	0.09	0.18	0.05	0.01	0.12	0.03	-0.02	0.21	±	0.16	0.21	0.42	17.25%	0.01	2.92	14.00	4.60	0.11
Luxembourg	-0.05	0.17	0.06	0.02	0.13	0.05	-0.17	0.08	±	0.12	0.22	-0.21	4.48%	0.01	0.66	14.00	4.60	0.43
Hungary	0.17	0.22	0.05	0.01	0.11	0.02	0.06	0.27	+	0.19	0.24	0.67	44.45%	0.01	11.20	14.00	4.60	0.00
Malta	-0.27	0.33	0.09	0.04	0.20	0.08	-0.47	-0.08	-	0.25	0.41	-0.62	38.64%	0.01	8.82	14.00	4.60	0.01
Netherlands	-0.25	0.26	0.23	0.07	0.48	0.15	-0.73	0.24	±	0.11	0.41	-0.28	7.79%	0.01	1.18	14.00	4.60	0.30
Austria	0.02	0.17	0.41	0.13	0.89	0.28	-0.87	0.91	±	-0.11	0.45	0.01	0.02%	0.01	0.00	14.00	4.60	0.96
Poland	-0.10	0.23	0.24	0.05	0.51	0.11	-0.61	0.41	±	0.12	0.34	-0.11	1.18%	0.01	0.17	14.00	4.60	0.69
Portugal	0.52	0.08	0.13	0.04	0.27	0.08	0.25	0.80	+	0.00	0.16	0.74	54.63%	0.01	16.86	14.00	4.60	0.00
Romania	-0.20	0.27	0.22	0.05	0.46	0.10	-0.67	0.26	±	0.17	0.37	-0.24	5.76%	0.02	0.86	14.00	4.60	0.37
Slovenia	0.32	0.12	0.19	0.04	0.41	0.09	-0.08	0.73	±	0.03	0.20	0.42	17.28%	0.01	2.92	14.00	4.60	0.11
Slovakia	-0.04	0.21	0.20	0.04	0.42	0.09	-0.46	0.38	±	0.12	0.30	-0.06	0.31%	0.01	0.04	14.00	4.60	0.84
Finland	0.13	0.14	0.07	0.03	0.14	0.05	-0.01	0.27	±	0.09	0.20	0.48	23.17%	0.00	4.22	14.00	4.60	0.06
Sweden	0.22	0.10	0.16	0.07	0.34	0.15	-0.12	0.57	±	-0.04	0.25	0.35	12.07%	0.01	1.92	14.00	4.60	0.19
United Kingdom	0.03	0.19	0.10	0.05	0.22	0.10	-0.19	0.26	±	0.09	0.29	0.09	0.80%	0.01	0.11	14.00	4.60	0.74

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; ρ - correlation coefficient; r2 - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en

On the other hand, the positive correlation between the share of expenditure on CF04 on Economic affairs (Table 6) in total expenditure with the share of direct taxes turned out to be a phenomenon with a noticeably lower intensity. Although it was found in 7 out of 28 countries considered (Finland, France, Czechia, Greece, Slovakia, Croatia, Denmark), in only one of them the share of direct taxes turned out to be a slightly dominant factor – in Finland ($r^2 = 52.48\%$, $p = 0.0015$). In the remaining countries, a weak or very weak positive correlation was found ($r^2 \in$

[25.56%, 40.93%]). A negative correlation was found in 5 countries: Sweden, Hungary, Germany, Slovenia, Luxembourg. For Sweden and Hungary, we can risk a statement that this relationship is relatively strong and similar ($r^2 = 69.71\%$, $p = 0.0001$ and $r^2 = 65.75\%$, $p = 0.0001$, respectively). In the remaining 3 countries, the correlation should be perceived as weak ($r^2 \in [27.19\%, 31.81\%]$).

Table 5. Correlation between the share of indirect taxes in total tax revenues and the share of CF04 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	ρ	r2	s	F	df	F crit.	p			
EU28	-0.52	0.27	0.20	0.07	0.43	0.15	-0.95	-0.09	-	0.12	0.42	-0.57	32.44%	0.00	6.72	14.00	4.60	0.02
Belgium	0.25	0.05	0.67	0.21	1.44	0.44	-1.19	1.69	±	-0.39	0.49	0.10	0.95%	0.01	0.13	14.00	4.60	0.72
Bulgaria	-0.20	0.25	0.37	0.20	0.80	0.43	-0.99	0.60	±	-0.18	0.67	-0.14	1.99%	0.03	0.28	14.00	4.60	0.60
Czechia	-0.27	0.24	0.09	0.03	0.19	0.06	-0.45	-0.08	-	0.18	0.31	-0.64	40.75%	0.01	9.63	14.00	4.60	0.01
Denmark	-0.10	0.10	0.05	0.02	0.11	0.04	-0.21	0.01	±	0.06	0.14	-0.46	21.52%	0.00	3.84	14.00	4.60	0.07
Germany	0.62	-0.10	0.23	0.07	0.50	0.14	0.12	1.12	+	-0.24	0.04	0.58	33.97%	0.01	7.20	14.00	4.60	0.02
Estonia	-0.07	0.15	0.19	0.08	0.42	0.18	-0.48	0.35	±	-0.03	0.33	-0.09	0.83%	0.01	0.12	14.00	4.60	0.74
Ireland	0.12	0.07	0.66	0.26	1.42	0.56	-1.30	1.55	±	-0.49	0.63	0.05	0.25%	0.08	0.03	14.00	4.60	0.86
Greece	-0.40	0.27	0.47	0.19	1.01	0.42	-1.41	0.61	±	-0.15	0.69	-0.22	4.80%	0.05	0.71	14.00	4.60	0.41
Spain	-0.41	0.25	0.23	0.08	0.50	0.16	-0.91	0.08	±	0.09	0.42	-0.43	18.49%	0.02	3.18	14.00	4.60	0.10
France	0.46	-0.07	0.25	0.09	0.55	0.19	-0.09	1.00	±	-0.26	0.12	0.43	18.82%	0.01	3.25	14.00	4.60	0.09
Croatia	-0.68	0.52	0.29	0.15	0.63	0.32	-1.31	-0.05	-	0.20	0.83	-0.53	27.71%	0.02	5.37	14.00	4.60	0.04
Italy	0.27	-0.01	0.16	0.05	0.33	0.12	-0.07	0.60	±	-0.12	0.11	0.42	17.32%	0.01	2.93	14.00	4.60	0.11
Cyprus	-0.12	0.16	0.55	0.25	1.18	0.55	-1.31	1.06	±	-0.38	0.71	-0.06	0.35%	0.05	0.05	14.00	4.60	0.83
Latvia	-0.62	0.45	0.24	0.11	0.52	0.23	-1.14	-0.11	-	0.22	0.67	-0.57	32.24%	0.02	6.66	14.00	4.60	0.02
Lithuania	0.58	-0.12	0.38	0.15	0.82	0.33	-0.24	1.40	±	-0.45	0.21	0.38	14.20%	0.02	2.32	14.00	4.60	0.15
Luxembourg	0.21	0.06	0.09	0.03	0.19	0.06	0.02	0.39	+	0.00	0.12	0.54	28.66%	0.01	5.62	14.00	4.60	0.03
Hungary	0.59	-0.13	0.12	0.05	0.26	0.12	0.33	0.85	+	-0.24	-0.01	0.80	63.21%	0.02	24.06	14.00	4.60	0.00
Malta	0.00	0.13	0.17	0.07	0.37	0.16	-0.37	0.37	±	-0.03	0.28	0.00	0.00%	0.01	0.00	14.00	4.60	1.00
Netherlands	0.43	-0.04	0.12	0.04	0.25	0.08	0.18	0.68	+	-0.12	0.04	0.70	48.90%	0.01	13.40	14.00	4.60	0.00
Austria	0.48	-0.04	0.42	0.14	0.90	0.31	-0.41	1.38	±	-0.35	0.27	0.29	8.68%	0.01	1.33	14.00	4.60	0.27
Poland	0.32	-0.02	0.32	0.13	0.69	0.29	-0.37	1.00	±	-0.30	0.27	0.26	6.61%	0.02	0.99	14.00	4.60	0.34
Portugal	0.14	0.04	0.25	0.11	0.54	0.24	-0.40	0.68	±	-0.20	0.28	0.15	2.12%	0.02	0.30	14.00	4.60	0.59
Romania	0.34	0.02	0.31	0.14	0.66	0.29	-0.32	1.00	±	-0.27	0.31	0.28	8.06%	0.03	1.23	14.00	4.60	0.29
Slovenia	0.64	-0.14	0.71	0.28	1.53	0.59	-0.89	2.18	±	-0.73	0.46	0.23	5.44%	0.04	0.81	14.00	4.60	0.38
Slovakia	-0.40	0.28	0.22	0.08	0.48	0.18	-0.88	0.07	±	0.10	0.45	-0.44	19.01%	0.01	3.29	14.00	4.60	0.09
Finland	-0.56	0.27	0.09	0.03	0.20	0.07	-0.77	-0.36	-	0.21	0.34	-0.85	71.82%	0.00	35.68	14.00	4.60	0.00
Sweden	0.30	-0.07	0.03	0.02	0.07	0.04	0.23	0.37	+	-0.10	-0.03	0.92	85.09%	0.00	79.91	14.00	4.60	0.00
United Kingdom	-0.20	0.15	0.13	0.05	0.29	0.11	-0.49	0.09	±	0.04	0.26	-0.37	13.90%	0.01	2.26	14.00	4.60	0.15

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; ρ - correlation coefficient; r² - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

The correlation between the share of indirect taxes in total tax revenues and the share of CF05 expenditure on Environmental protection looks slightly different (Table 7). A positive correlation was found in 7 countries: Ireland, Greece, Netherlands, Slovakia, Austria, Poland, Denmark. In as many as 4 of them, the share of indirect taxes can be considered the decisive factor. However, in Ireland and Greece, the correlation is similar and very strong ($r^2 = 82.94\%$, $p = 0.0000$ and $r^2 = 82.56\%$, $p = 0.0000$, respectively) and in the Netherlands it is strong ($r^2 = 71.90\%$, $p = 0.0000$). In Slovakia, the share of indirect taxes turned out to be a slightly dominant factor in explaining possible variations in the share of CF05 expenditure ($r^2 = 50.46\%$, $p = 0.0020$). In other countries, the correlation was positive from weak

to moderate ($r^2 \in [26.76\%, 47.25\%]$). A negative relationship was established in 3 countries: Finland, Luxembourg, United Kingdom. In Finland, a very strong relationship was observed ($r^2 = 81.19\%$, $p = 0.0000$). It is much weaker ($r^2 < 50\%$) in the other two countries.

Table 6. Correlation between the share of direct taxes in total tax revenues and the share of CF04 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	ρ	r2	s	F	df	F crit.	p			
EU28	-0.06	0.11	0.16	0.05	0.34	0.12	-0.40	0.28	±	0.00	0.23	-0.10	1.03%	0.00	0.15	14.00	4.60	0.71
Belgium	-0.21	0.21	0.40	0.15	0.85	0.33	-1.06	0.64	±	-0.12	0.53	-0.14	1.95%	0.01	0.28	14.00	4.60	0.61
Bulgaria	0.19	0.11	0.37	0.07	0.80	0.16	-0.61	0.99	±	-0.05	0.26	0.13	1.82%	0.03	0.26	14.00	4.60	0.62
Czechia	0.32	0.08	0.12	0.03	0.26	0.06	0.06	0.57	±	0.02	0.14	0.58	33.27%	0.01	6.98	14.00	4.60	0.02
Denmark	0.11	-0.01	0.05	0.03	0.11	0.07	0.00	0.22	+	-0.08	0.06	0.51	25.56%	0.00	4.81	14.00	4.60	0.05
Germany	-0.30	0.17	0.12	0.04	0.25	0.08	-0.55	-0.05	-	0.09	0.25	-0.56	31.81%	0.01	6.53	14.00	4.60	0.02
Estonia	0.02	0.11	0.17	0.04	0.36	0.08	-0.34	0.38	±	0.03	0.20	0.03	0.08%	0.01	0.01	14.00	4.60	0.92
Ireland	-2.33	1.16	1.16	0.52	2.50	1.11	-4.83	0.17	±	0.04	2.27	-0.47	22.22%	0.07	4.00	14.00	4.60	0.07
Greece	1.69	-0.35	0.72	0.20	1.54	0.42	0.15	3.24	+	-0.77	0.07	0.53	28.33%	0.04	5.54	14.00	4.60	0.03
Spain	0.65	-0.09	0.40	0.13	0.86	0.27	-0.21	1.51	±	-0.36	0.18	0.40	15.82%	0.02	2.63	14.00	4.60	0.13
France	0.49	-0.05	0.16	0.04	0.34	0.10	0.15	0.84	±	-0.14	0.05	0.64	40.93%	0.01	9.70	14.00	4.60	0.01
Croatia	0.98	0.00	0.43	0.08	0.91	0.16	0.07	1.89	+	-0.16	0.16	0.52	27.39%	0.02	5.28	14.00	4.60	0.04
Italy	-0.13	0.13	0.25	0.09	0.54	0.19	-0.67	0.41	±	-0.06	0.32	-0.14	1.99%	0.01	0.28	14.00	4.60	0.60
Cyprus	-0.27	0.19	0.61	0.18	1.30	0.39	-1.57	1.03	±	-0.20	0.57	-0.12	1.36%	0.05	0.19	14.00	4.60	0.67
Latvia	0.20	0.12	0.28	0.07	0.59	0.16	-0.39	0.79	±	-0.04	0.27	0.19	3.64%	0.02	0.53	14.00	4.60	0.48
Lithuania	0.02	0.11	0.10	0.02	0.22	0.05	-0.20	0.25	±	0.05	0.16	0.06	0.37%	0.02	0.05	14.00	4.60	0.82
Luxembourg	-0.19	0.20	0.08	0.03	0.18	0.07	-0.37	-0.01	-	0.13	0.27	-0.52	27.19%	0.01	5.23	14.00	4.60	0.04
Hungary	-0.57	0.26	0.11	0.02	0.24	0.05	-0.81	-0.33	-	0.21	0.31	-0.81	65.75%	0.02	26.87	14.00	4.60	0.00
Malta	0.03	0.11	0.13	0.05	0.27	0.11	-0.24	0.30	±	0.00	0.22	0.07	0.47%	0.01	0.07	14.00	4.60	0.80
Netherlands	-0.07	0.12	0.12	0.04	0.25	0.08	-0.33	0.18	±	0.04	0.20	-0.16	2.71%	0.01	0.39	14.00	4.60	0.54
Austria	0.04	0.11	0.38	0.12	0.81	0.26	-0.77	0.86	±	-0.15	0.37	0.03	0.08%	0.01	0.01	14.00	4.60	0.92
Poland	0.61	-0.01	0.32	0.07	0.70	0.15	-0.09	1.30	±	-0.17	0.14	0.45	19.89%	0.01	3.48	14.00	4.60	0.08
Portugal	-0.16	0.15	0.25	0.07	0.54	0.16	-0.71	0.38	±	-0.01	0.30	-0.17	2.86%	0.02	0.41	14.00	4.60	0.53
Romania	0.38	0.09	0.40	0.09	0.85	0.19	-0.46	1.23	±	-0.10	0.28	0.25	6.31%	0.03	0.94	14.00	4.60	0.35
Slovenia	-1.28	0.38	0.55	0.12	1.19	0.25	-2.46	-0.09	-	0.13	0.63	-0.52	27.49%	0.03	5.31	14.00	4.60	0.04
Slovakia	0.76	-0.03	0.33	0.07	0.70	0.15	0.05	1.46	+	-0.18	0.11	0.53	27.60%	0.01	5.34	14.00	4.60	0.04
Finland	0.32	-0.04	0.08	0.03	0.17	0.07	0.14	0.49	+	-0.10	0.03	0.72	52.48%	0.00	15.46	14.00	4.60	0.00
Sweden	-0.25	0.19	0.04	0.02	0.09	0.04	-0.34	-0.15	-	0.15	0.23	-0.83	69.71%	0.00	32.22	14.00	4.60	0.00
United Kingdom	0.17	0.00	0.13	0.06	0.29	0.13	-0.12	0.45	±	-0.12	0.13	0.32	10.22%	0.01	1.59	14.00	4.60	0.23

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; ρ - correlation coefficient; r2 - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en

As in the case of the impact of the share of direct and indirect taxes on the share of CF01-03 expenditure, in the case of CF04 expenditure, even a weak positive or negative correlation cannot be found in most countries (in 19 countries in the case of indirect taxes and in 16 countries in the case of direct taxes).

Taking into account the correlation between the share of direct taxes in total tax revenues and the share of CF05 expenditure in total expenditure (Table 8), a positive or negative relationship was found in a smaller number of countries and turned out to be much weaker. A positive dependence was confirmed in 5 of the 28 examined countries: Finland, Estonia, Luxembourg, Spain, and United Kingdom. In the case of Finland and Estonia, the share of direct taxes turned out to be a slightly dominant

factor in terms of the impact on variations in the share of CF05 expenditure (r^2 slightly higher than 50%). In the remaining 3 countries, the positive correlation was definitely weaker ($r^2 \in [30.13\%, 47.56\%]$). A negative correlation between the share of direct taxes in total tax revenues and the share of CF05 expenditure in total expenditure was observed in 1 out of 28 countries – Ireland, and it turned out to be very weak ($r^2 = 25.41\%$, $p = 0.0465$).

Table 7. Correlation between the share of indirect taxes in total tax revenues and the share of CF05 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	p	r2	s	F	df	F crit.	p			
EU28	0.00	0.02	0.04	0.01	0.08	0.03	-0.08	0.08	±	-0.01	0.05	-0.01	0.00%	0.00	14.00	4.60	0.98	
Belgium	0.06	0.00	0.23	0.07	0.49	0.15	-0.43	0.55	±	-0.15	0.15	0.07	0.48%	0.00	0.07	14.00	4.60	0.80
Bulgaria	0.04	0.00	0.08	0.04	0.16	0.09	-0.12	0.20	±	-0.09	0.09	0.14	1.86%	0.01	0.26	14.00	4.60	0.61
Czechia	0.03	0.01	0.05	0.02	0.11	0.04	-0.08	0.14	±	-0.02	0.05	0.14	1.92%	0.00	0.27	14.00	4.60	0.61
Denmark	0.06	-0.01	0.03	0.01	0.06	0.02	0.00	0.12	+	-0.03	0.01	0.52	26.76%	0.00	5.12	14.00	4.60	0.04
Germany	-0.03	0.02	0.02	0.00	0.03	0.01	-0.06	0.01	±	0.01	0.03	-0.42	17.41%	0.00	2.95	14.00	4.60	0.11
Estonia	-0.03	0.03	0.20	0.09	0.43	0.18	-0.46	0.40	±	-0.15	0.21	-0.04	0.16%	0.01	0.02	14.00	4.60	0.88
Ireland	0.16	-0.04	0.02	0.01	0.04	0.02	0.12	0.20	+	-0.06	-0.03	0.91	82.94%	0.00	68.06	14.00	4.60	0.00
Greece	0.24	-0.08	0.03	0.01	0.06	0.03	0.18	0.30	+	-0.10	-0.05	0.91	82.56%	0.00	66.27	14.00	4.60	0.00
Spain	-0.03	0.03	0.02	0.01	0.05	0.02	-0.08	0.02	±	0.01	0.05	-0.29	8.68%	0.00	1.33	14.00	4.60	0.27
France	-0.02	0.02	0.02	0.01	0.05	0.02	-0.07	0.03	±	0.01	0.04	-0.21	4.58%	0.00	0.67	14.00	4.60	0.43
Croatia	0.02	0.00	0.01	0.00	0.02	0.01	0.00	0.04	±	-0.01	0.01	0.49	24.20%	0.00	4.47	14.00	4.60	0.05
Italy	-0.02	0.03	0.03	0.01	0.06	0.02	-0.08	0.03	±	0.01	0.05	-0.23	5.21%	0.00	0.77	14.00	4.60	0.40
Cyprus	0.01	0.00	0.01	0.00	0.02	0.01	-0.01	0.02	±	0.00	0.01	0.20	3.91%	0.00	0.57	14.00	4.60	0.46
Latvia	0.00	0.01	0.07	0.03	0.15	0.06	-0.14	0.15	±	-0.05	0.08	0.02	0.02%	0.01	0.00	14.00	4.60	0.95
Lithuania	0.07	-0.01	0.11	0.04	0.23	0.09	-0.16	0.30	±	-0.10	0.08	0.18	3.10%	0.01	0.45	14.00	4.60	0.51
Luxembourg	-0.04	0.03	0.01	0.00	0.02	0.01	-0.06	-0.01	-	0.02	0.04	-0.65	42.38%	0.00	10.30	14.00	4.60	0.01
Hungary	0.03	0.00	0.03	0.02	0.07	0.03	-0.05	0.10	±	-0.03	0.03	0.20	4.15%	0.00	0.61	14.00	4.60	0.45
Malta	0.03	0.02	0.07	0.03	0.16	0.07	-0.12	0.19	±	-0.04	0.09	0.12	1.50%	0.01	0.21	14.00	4.60	0.65
Netherlands	0.14	-0.01	0.02	0.01	0.05	0.02	0.09	0.19	+	-0.03	0.01	0.85	71.90%	0.00	35.83	14.00	4.60	0.00
Austria	0.10	-0.03	0.03	0.01	0.06	0.02	0.04	0.16	+	-0.05	0.00	0.69	47.25%	0.00	12.54	14.00	4.60	0.00
Poland	0.09	-0.02	0.03	0.01	0.07	0.03	0.02	0.16	+	-0.05	0.01	0.57	32.67%	0.00	6.79	14.00	4.60	0.02
Portugal	0.01	0.01	0.01	0.01	0.03	0.01	-0.01	0.04	±	0.00	0.02	0.30	9.00%	0.00	1.38	14.00	4.60	0.26
Romania	0.10	-0.03	0.06	0.03	0.13	0.06	-0.03	0.24	±	-0.09	0.03	0.41	17.14%	0.01	2.90	14.00	4.60	0.11
Slovenia	0.09	-0.02	0.06	0.02	0.12	0.05	-0.04	0.21	±	-0.07	0.03	0.38	14.30%	0.00	2.34	14.00	4.60	0.15
Slovakia	0.14	-0.03	0.04	0.01	0.08	0.03	0.06	0.22	+	-0.06	0.00	0.71	50.46%	0.00	14.26	14.00	4.60	0.00
Finland	-0.11	0.04	0.01	0.00	0.03	0.01	-0.14	-0.08	-	0.03	0.05	-0.90	81.19%	0.00	60.42	14.00	4.60	0.00
Sweden	-0.01	0.01	0.01	0.01	0.02	0.01	-0.03	0.01	±	0.00	0.02	-0.20	4.12%	0.00	0.60	14.00	4.60	0.45
United Kingdom	-0.10	0.06	0.04	0.02	0.09	0.03	-0.19	-0.01	-	0.02	0.09	-0.52	27.53%	0.00	5.32	14.00	4.60	0.04

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; p - correlation coefficient; r^2 - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

An unbiased direction of correlation could not be confirmed in 18 countries in the case of indirect taxes and in as many as 22 countries in the case of direct taxes.

Finally, the correlation between the share of direct and indirect taxes in total tax revenues and the share of the expenditure group CF06-10 on Housing and community amenities, Health, Recreation, culture and religion, Education, Social protection in total expenditure was considered (Table 9). In the case of indirect taxes, a positive correlation was observed in 6 out of 28 analyzed countries:

Finland, Croatia, United Kingdom, Greece, Czechia, Latvia. A moderate to strong correlation was observed only in Finland ($r^2 = 64.04\%$, $p = 0.0002$).

Table 8. Correlation between the share of direct taxes in total tax revenues and the share of CF05 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	ρ	r2	s	F	df	F crit.	p			
EU28	0.01	0.01	0.03	0.01	0.05	0.02	-0.05	0.06	±	0.00	0.03	0.07	0.43%	0.00	0.06	14.00	4.60	0.81
Belgium	-0.07	0.05	0.14	0.05	0.29	0.11	-0.36	0.23	±	-0.06	0.16	-0.13	1.65%	0.00	0.24	14.00	4.60	0.64
Bulgaria	0.05	0.01	0.08	0.01	0.16	0.03	-0.12	0.21	±	-0.02	0.04	0.16	2.62%	0.01	0.38	14.00	4.60	0.55
Czechia	-0.03	0.03	0.07	0.02	0.14	0.03	-0.18	0.11	±	0.00	0.06	-0.13	1.80%	0.00	0.26	14.00	4.60	0.62
Denmark	-0.05	0.04	0.03	0.02	0.06	0.04	-0.11	0.01	±	0.00	0.08	-0.45	20.41%	0.00	3.59	14.00	4.60	0.08
Germany	0.01	0.01	0.01	0.00	0.02	0.01	-0.01	0.03	±	0.00	0.01	0.36	13.10%	0.00	2.11	14.00	4.60	0.17
Estonia	0.47	-0.09	0.12	0.03	0.25	0.06	0.22	0.72	+	-0.14	-0.03	0.73	53.94%	0.01	16.40	14.00	4.60	0.00
Ireland	-0.18	0.10	0.08	0.04	0.18	0.08	-0.35	0.00	-	0.02	0.18	-0.50	25.41%	0.00	4.77	14.00	4.60	0.05
Greece	-0.14	0.06	0.12	0.03	0.25	0.07	-0.39	0.11	±	-0.01	0.13	-0.30	9.08%	0.01	1.40	14.00	4.60	0.26
Spain	0.09	-0.01	0.03	0.01	0.07	0.02	0.02	0.16	+	-0.03	0.02	0.58	33.64%	0.00	7.10	14.00	4.60	0.02
France	0.02	0.01	0.02	0.00	0.03	0.01	-0.01	0.06	±	0.00	0.02	0.38	14.68%	0.00	2.41	14.00	4.60	0.14
Croatia	0.00	0.01	0.02	0.00	0.03	0.01	-0.04	0.03	±	0.01	0.02	-0.05	0.26%	0.00	0.04	14.00	4.60	0.85
Italy	0.01	0.01	0.04	0.01	0.09	0.03	-0.07	0.10	±	-0.02	0.04	0.09	8.83%	0.00	0.12	14.00	4.60	0.74
Cyprus	-0.01	0.01	0.01	0.00	0.02	0.01	-0.03	0.01	±	0.00	0.01	-0.18	3.30%	0.00	0.48	14.00	4.60	0.50
Latvia	0.12	-0.02	0.06	0.02	0.12	0.03	0.00	0.24	±	-0.05	0.02	0.48	23.37%	0.00	4.27	14.00	4.60	0.06
Lithuania	0.00	0.02	0.03	0.01	0.06	0.01	-0.06	0.06	±	0.00	0.03	0.01	0.01%	0.01	0.00	14.00	4.60	0.97
Luxembourg	0.04	0.01	0.01	0.00	0.02	0.01	0.01	0.06	+	0.00	0.01	0.69	47.56%	0.00	12.69	14.00	4.60	0.00
Hungary	-0.04	0.02	0.03	0.01	0.07	0.01	-0.10	0.03	±	0.01	0.04	-0.30	9.28%	0.00	1.43	14.00	4.60	0.25
Malta	-0.01	0.04	0.05	0.02	0.12	0.05	-0.13	0.11	±	-0.01	0.09	-0.05	0.30%	0.01	0.04	14.00	4.60	0.84
Netherlands	0.01	0.03	0.03	0.01	0.07	0.02	-0.06	0.08	±	0.01	0.05	0.08	0.60%	0.00	0.08	14.00	4.60	0.78
Austria	-0.03	0.02	0.03	0.01	0.07	0.02	-0.10	0.04	±	0.00	0.04	-0.23	5.33%	0.00	0.79	14.00	4.60	0.39
Poland	0.02	0.01	0.04	0.01	0.09	0.02	-0.07	0.11	±	-0.01	0.03	0.13	1.62%	0.00	0.23	14.00	4.60	0.64
Portugal	-0.02	0.02	0.01	0.00	0.03	0.01	-0.04	0.01	±	0.01	0.03	-0.31	9.32%	0.00	1.44	14.00	4.60	0.25
Romania	-0.05	0.03	0.08	0.02	0.18	0.04	-0.23	0.13	±	-0.01	0.07	-0.16	2.63%	0.01	0.38	14.00	4.60	0.55
Slovenia	0.06	0.00	0.05	0.01	0.11	0.02	-0.06	0.17	±	-0.02	0.03	0.27	7.31%	0.00	1.10	14.00	4.60	0.31
Slovakia	-0.06	0.03	0.08	0.02	0.17	0.04	-0.23	0.11	±	0.00	0.07	-0.20	3.98%	0.00	0.58	14.00	4.60	0.46
Finland	0.06	-0.02	0.01	0.01	0.03	0.01	0.03	0.09	+	-0.03	-0.01	0.75	56.74%	0.00	18.37	14.00	4.60	0.00
Sweden	0.01	0.00	0.01	0.00	0.02	0.01	-0.01	0.03	±	0.00	0.01	0.29	8.62%	0.00	1.32	14.00	4.60	0.27
United Kingdom	0.10	-0.02	0.04	0.02	0.09	0.04	0.01	0.19	+	-0.06	0.01	0.55	30.13%	0.00	6.04	14.00	4.60	0.03

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; ρ - correlation coefficient; r2 - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

In the remaining 5 countries, the share of indirect taxes cannot be considered as the statistically dominant factor of variations in the analyzed group of expenditure ($r^2 \in [28.87\%, 41.95\%]$). A negative correlation was confirmed for the share of indirect taxes in 8 out of 28 countries: Netherlands, Germany, Hungary, Malta, Austria, Poland, Denmark, Luxembourg. In the Netherlands and Germany, it turned out to be very strong ($r^2 = 84.35\%$, $p = 0.0000$) and strong ($r^2 = 74.04\%$, $p = 0.0000$), respectively. In the case of Hungary – rather moderate ($r^2 = 55.99\%$, $p = 0.0009$). In the remaining 5 countries, it is rather weak ($r^2 \in [28.87\%, 34.01\%]$).

A positive correlation between the share of direct taxes and the share of CF06-10 expenditure (Table 10) was observed in 5 countries, Hungary, France, Malta, Denmark, Germany. Only in the case of Hungary can it be said that the influence of the tax share is weakly predominant in the context of explaining the variations in the

share of expenditure CF06-10 ($r^2 = 56.99\%$, $p = 0.0007$). In the remaining 4 countries, this relation is weak ($r^2 \in [26.86\%, 32.43\%]$). A negative correlation was found in 7 countries, Latvia, Croatia, Finland, United Kingdom, Estonia, Czechia, Greece. In the case of the first two, one can speak of a slight but dominant influence of the share of direct taxes on variations in the share of expenditure (r^2 slightly higher than 50%). In other countries, it can be stated that it was negative, towards weak and very weak ($r^2 \in [25.51\%, 45.14\%]$).

Table 9. Correlation between the share of indirect taxes in total tax revenues and the share of CF06-10 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	p	r2	s	F	df	F crit.	p			
EU28	0.83	0.40	0.61	0.21	1.30	0.45	-0.47	2.13	±	-0.05	0.85	0.34	11.82%	0.01	1.88	14.00	4.60	0.19
Belgium	1.58	0.16	0.85	0.26	1.82	0.56	-0.24	3.40	±	-0.40	0.72	0.45	19.82%	0.02	3.46	14.00	4.60	0.08
Bulgaria	0.37	0.41	0.53	0.28	1.14	0.61	-0.77	1.51	±	-0.20	1.02	0.18	3.35%	0.04	0.49	14.00	4.60	0.50
Czechia	0.38	0.51	0.15	0.05	0.33	0.11	0.05	0.71	+	0.40	0.62	0.55	30.64%	0.01	6.18	14.00	4.60	0.03
Denmark	-0.38	0.89	0.15	0.06	0.33	0.12	-0.71	-0.05	-	0.77	1.00	-0.55	30.01%	0.01	6.00	14.00	4.60	0.03
Germany	-1.24	1.07	0.20	0.06	0.42	0.12	-1.66	-0.82	-	0.95	1.19	-0.86	74.04%	0.01	39.93	14.00	4.60	0.00
Estonia	-0.21	0.76	0.37	0.16	0.80	0.34	-1.00	0.59	±	0.42	1.10	-0.15	2.17%	0.02	0.31	14.00	4.60	0.59
Ireland	0.06	0.67	0.51	0.20	1.09	0.43	-1.03	1.15	±	0.24	1.10	0.03	0.11%	0.06	0.02	14.00	4.60	0.90
Greece	0.91	0.20	0.32	0.13	0.69	0.29	0.22	1.61	+	-0.09	0.49	0.60	36.43%	0.03	8.02	14.00	4.60	0.01
Spain	0.18	0.60	0.24	0.08	0.52	0.17	-0.34	0.70	±	0.43	0.77	0.20	3.86%	0.02	0.56	14.00	4.60	0.47
France	-0.18	0.77	0.24	0.08	0.51	0.18	-0.69	0.34	±	0.59	0.95	-0.19	3.76%	0.01	0.55	14.00	4.60	0.47
Croatia	0.32	0.46	0.10	0.05	0.22	0.11	0.10	0.54	+	0.35	0.57	0.65	41.95%	0.01	10.12	14.00	4.60	0.01
Italy	-0.45	0.81	0.42	0.15	0.90	0.31	-1.35	0.45	±	0.50	1.12	-0.28	7.63%	0.02	1.16	14.00	4.60	0.30
Cyprus	-0.31	0.73	0.35	0.16	0.75	0.34	-1.06	0.43	±	0.39	1.07	-0.23	5.45%	0.03	0.81	14.00	4.60	0.38
Latvia	0.35	0.46	0.15	0.07	0.32	0.14	0.04	0.67	+	0.31	0.60	0.54	28.87%	0.01	5.68	14.00	4.60	0.03
Lithuania	-0.46	0.85	0.48	0.19	1.04	0.42	-1.49	0.58	±	0.43	1.27	-0.24	5.97%	0.03	0.89	14.00	4.60	0.36
Luxembourg	-0.23	0.77	0.10	0.03	0.21	0.07	-0.44	-0.02	-	0.70	0.84	-0.54	28.87%	0.01	5.68	14.00	4.60	0.03
Hungary	-0.46	0.80	0.11	0.05	0.23	0.11	-0.69	-0.23	-	0.70	0.91	-0.75	55.99%	0.01	17.81	14.00	4.60	0.00
Malta	-0.35	0.77	0.13	0.06	0.28	0.12	-0.64	-0.07	-	0.65	0.89	-0.58	34.01%	0.01	7.22	14.00	4.60	0.02
Netherlands	-1.70	1.23	0.20	0.06	0.42	0.13	-2.12	-1.28	-	1.09	1.36	-0.92	84.35%	0.01	75.44	14.00	4.60	0.00
Austria	-1.63	1.24	0.61	0.21	1.31	0.45	-2.94	-0.31	-	0.79	1.69	-0.58	33.54%	0.02	7.07	14.00	4.60	0.02
Poland	-0.78	0.98	0.31	0.13	0.66	0.28	-1.45	-0.12	-	0.71	1.26	-0.56	31.24%	0.02	6.36	14.00	4.60	0.02
Portugal	0.30	0.53	0.22	0.10	0.47	0.21	-0.17	0.77	±	0.32	0.74	0.34	11.69%	0.02	1.85	14.00	4.60	0.19
Romania	-0.33	0.73	0.23	0.10	0.50	0.22	-0.83	0.18	±	0.51	0.95	-0.35	12.07%	0.02	1.92	14.00	4.60	0.19
Slovenia	-0.91	1.04	0.52	0.20	1.12	0.43	-2.03	0.21	±	0.61	1.47	-0.42	17.92%	0.03	3.06	14.00	4.60	0.10
Slovakia	0.32	0.53	0.27	0.10	0.58	0.22	-0.26	0.90	±	0.32	0.75	0.30	9.05%	0.02	1.39	14.00	4.60	0.26
Finland	0.92	0.41	0.18	0.06	0.40	0.13	0.53	1.32	+	0.28	0.54	0.80	64.04%	0.01	24.93	14.00	4.60	0.00
Sweden	-0.04	0.73	0.18	0.09	0.38	0.19	-0.42	0.34	±	0.53	0.92	-0.06	0.37%	0.01	0.05	14.00	4.60	0.82
United Kingdom	0.30	0.58	0.10	0.04	0.21	0.08	0.09	0.51	+	0.51	0.66	0.64	40.89%	0.01	9.68	14.00	4.60	0.01

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; p - correlation coefficient; r^2 - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

A positive or negative dependence with the share of indirect taxes was confirmed in half of the analyzed countries. In the case of the share of direct taxes such dependence was confirmed in almost half of the analyzed countries (12 out of 28 countries). The strongest positive correlation was observed in the case of the share of indirect taxes and the share of CF01-03 expenditure in the Netherlands, which belongs to the 1st quartile of countries classified according to the average level of the share of indirect taxes in the studied research period. The strongest positive correlation in the case of indirect taxes and CF04 expenditure was observed for

Sweden and Hungary, which belong to the 4th quartile of countries broken down by the criterion of the average share of indirect taxes in total tax revenues.

Table 10. Correlation between the share of direct taxes in total tax revenues and the share of CF06-10 expenditure in total expenditure

Region/State	b1	b0	s(b1)	s(b0)	± 95%	95% conf. for b1	95% conf. that b1 is	95% conf. for b0	ρ	r2	s	F	df	F crit.	p			
EU28	-0.02	0.69	0.42	0.14	0.91	0.31	-0.93	0.88	±	0.39	1.00	-0.01	0.02%	0.01	0.00	14.00	4.60	0.96
Belgium	0.29	0.53	0.56	0.21	1.20	0.46	-0.91	1.49	±	0.07	0.99	0.14	1.89%	0.02	0.27	14.00	4.60	0.61
Bulgaria	-0.42	0.69	0.53	0.10	1.14	0.22	-1.56	0.72	±	0.47	0.91	-0.21	4.29%	0.04	0.63	14.00	4.60	0.44
Czechia	-0.48	0.75	0.20	0.05	0.44	0.10	-0.92	-0.04	-	0.65	0.86	-0.53	28.23%	0.01	5.51	14.00	4.60	0.03
Denmark	0.39	0.50	0.16	0.10	0.34	0.22	0.05	0.73	+	0.29	0.72	0.55	30.31%	0.01	6.09	14.00	4.60	0.03
Germany	0.37	0.60	0.16	0.05	0.35	0.11	0.02	0.73	+	0.48	0.71	0.52	26.86%	0.01	5.14	14.00	4.60	0.04
Estonia	-0.72	0.83	0.26	0.06	0.55	0.12	-1.27	-0.17	-	0.71	0.96	-0.60	35.84%	0.02	7.82	14.00	4.60	0.01
Ireland	1.64	-0.04	0.91	0.41	1.96	0.87	-0.31	3.60	±	-0.91	0.83	0.43	18.79%	0.05	3.24	14.00	4.60	0.09
Greece	-1.35	0.94	0.62	0.17	1.32	0.36	-2.67	-0.03	-	0.58	1.30	-0.51	25.51%	0.04	4.80	14.00	4.60	0.05
Spain	-0.63	0.86	0.38	0.12	0.82	0.26	-1.45	0.19	±	0.60	1.12	-0.40	16.35%	0.02	2.74	14.00	4.60	0.12
France	0.38	0.60	0.15	0.04	0.31	0.09	0.07	0.69	+	0.51	0.69	0.57	32.43%	0.01	6.72	14.00	4.60	0.02
Croatia	-0.51	0.71	0.14	0.02	0.29	0.05	-0.80	-0.22	-	0.66	0.76	-0.71	50.08%	0.01	14.04	14.00	4.60	0.00
Italy	0.09	0.62	0.65	0.22	1.39	0.48	-1.29	1.48	±	0.14	1.10	0.04	0.15%	0.02	0.02	14.00	4.60	0.89
Cyprus	0.07	0.56	0.40	0.12	0.85	0.25	-0.78	0.92	±	0.31	0.82	0.05	0.22%	0.03	0.03	14.00	4.60	0.86
Latvia	-0.47	0.74	0.11	0.03	0.24	0.06	-0.71	-0.23	-	0.67	0.80	-0.74	55.38%	0.01	17.38	14.00	4.60	0.00
Lithuania	-0.12	0.69	0.12	0.03	0.26	0.06	-0.38	0.14	±	0.63	0.76	-0.25	6.33%	0.03	0.95	14.00	4.60	0.35
Luxembourg	0.20	0.62	0.09	0.04	0.20	0.08	0.00	0.40	±	0.54	0.70	0.49	24.47%	0.01	4.54	14.00	4.60	0.05
Hungary	0.44	0.50	0.10	0.02	0.22	0.05	0.22	0.66	+	0.46	0.55	0.75	56.99%	0.01	18.55	14.00	4.60	0.00
Malta	0.25	0.52	0.10	0.04	0.21	0.09	0.04	0.46	+	0.43	0.61	0.56	31.67%	0.01	6.49	14.00	4.60	0.02
Netherlands	0.31	0.59	0.35	0.11	0.75	0.23	-0.44	1.06	±	0.36	0.82	0.23	5.36%	0.02	0.79	14.00	4.60	0.39
Austria	-0.03	0.70	0.65	0.21	1.40	0.44	-1.43	1.37	±	0.25	1.14	-0.01	0.02%	0.02	0.00	14.00	4.60	0.96
Poland	-0.53	0.77	0.38	0.08	0.82	0.18	-1.35	0.29	±	0.59	0.95	-0.35	11.94%	0.02	1.90	14.00	4.60	0.19
Portugal	-0.35	0.76	0.22	0.06	0.47	0.14	-0.81	0.12	±	0.62	0.90	-0.39	15.23%	0.02	2.51	14.00	4.60	0.14
Romania	-0.13	0.62	0.32	0.07	0.68	0.15	-0.81	0.55	±	0.47	0.77	-0.11	1.23%	0.02	0.17	14.00	4.60	0.68
Slovenia	0.90	0.50	0.45	0.09	0.96	0.20	-0.07	1.86	±	0.29	0.70	0.47	22.21%	0.03	4.00	14.00	4.60	0.07
Slovakia	-0.65	0.79	0.41	0.08	0.87	0.18	-1.53	0.22	±	0.61	0.97	-0.39	15.60%	0.02	2.59	14.00	4.60	0.13
Finland	-0.51	0.91	0.15	0.06	0.32	0.13	-0.83	-0.19	-	0.78	1.04	-0.67	45.14%	0.01	11.52	14.00	4.60	0.00
Sweden	0.01	0.70	0.16	0.07	0.35	0.15	-0.33	0.36	±	0.55	0.85	0.02	0.06%	0.01	0.01	14.00	4.60	0.93
United Kingdom	-0.30	0.83	0.09	0.04	0.20	0.09	-0.50	-0.11	-	0.74	0.92	-0.66	44.12%	0.01	11.05	14.00	4.60	0.01

b1 - regression slope; b0 - regression intercept; s(b1) - standard error of slope; s(b0) - standard error of intercept; ρ - correlation coefficient; r2 - determination coefficient; s - standard error of prediction; df - degrees of freedom;
QnT - quartile n in terms of main national accounts tax aggregates as a percentage of GDP; NC - not classified

Source: Own study based on Eurostat data:

https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_exp&lang=en.

A very strong or strong positive correlation between the share of indirect taxes and the share of CF05 expenditure was observed in Ireland, Greece, Netherlands. Ireland and Greece belong to the 3rd quartile of states due to the average share of indirect taxes, and the Netherlands to the 1st quartile. The moderately strong positive correlation for indirect taxes was confirmed in the comparison with the share of CF06-10 expenditure in Finland, which belongs to the 1st quartile of countries due to the average share of indirect taxes in total tax revenues. In the case of direct taxes, a strong correlation was not found with any of the considered types of expenditure or groups of expenditure.

6. Conclusions

The results of the research carried out with the use of statistical methods and tools

entitle us to draw the following conclusion: in the years 2004-2019 in the EU Member States the relations between the structure of tax revenues and the structure of public expenditure were very diversified. In the studied period, the structure of tax revenues broken down into direct and indirect revenues differed in the analyzed countries. However, a higher share of revenues from direct taxes in total tax revenues was noted in more affluent than less prosperous countries. On the other hand, in the case of indirect taxes, in principle, the opposite was true – a greater share of their income in tax revenues was in less wealthy than more affluent countries.

Therefore, from the point of view of tax fairness, the tax systems of the more affluent countries should be assessed higher. In these countries, the tax redistributive function is also more properly implemented. At the same time, it should be noted that a very strong or strong dependence between the share of a specific tax group in total tax revenues and the share of specific expenditure in total public expenditure was observed only in relation to indirect taxes. In the case of direct taxes, no such dependence was observed. The obtained research result indicates that in the current meeting of the demand for money, related to the necessity to finance specific public expenditure, the public authority is more active with indirect taxes than with direct ones. Indirect taxes, regardless of their share in total tax revenues, are used in the active fiscal policy of individual countries.

This means that in the current fiscal policy, the priority is not tax fairness, but fiscal goals, as these are more efficiently implemented by indirect taxes than direct ones. As a consequence, a conclusion arises that it is necessary to constantly verify the applied tax solutions from the point of view of tax fairness. This postulate is particularly important in situations of increasing current needs for financing public expenditure. This is also exceptionally topical, as the crisis related to the COVID-19 pandemic forces the current, significant increase in specific public expenditure in the EU Member States.

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