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Relationship Between the Tax Burden Structure and Citizens' Welfare in OECD Countries

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ABSTRACT
This research aims to examine the correlation between the tax burden structure and citizens' welfare in OECD countries in 2020 and 2021. The hypothesis tested suggests an interconnection between the tax burden structure and citizen welfare, particularly a direct relationship between the income tax share and welfare, and an inverse relationship between the share of indirect taxes and welfare. The study employs correlation-regression, cluster, and structural analysis methods, along with data from OECD.Stat and the World Bank. The calculations were performed by using the "Data Analysis" package in MS Excel for the years 2000, 2018–2019, and 2021. The resulting dataset, comprising 1,540 indicators of welfare and tax burden structure across 38 OECD countries, confirmed a significant connection between the two. The income tax share exhibited the most pronounced unidirectional relationship with welfare, while the share of indirect taxes showed a negative correlation. Conversely, the share of the corporate income tax, property taxes, and social security contributions displayed non-significant correlations with welfare levels. To further categorize OECD countries, the k-means method and the DATAtab web tool were employed based on the parameters of the relationship between welfare and the tax burden structure. In high-income OECD countries, the income tax share averages 37.6%, with indirect taxes comprising 24.1% while in lower-income countries the share of the income tax is 6–20% (average 14.8%), with indirect taxes comprising 35–53% (average 39.7%) of the tax burden. To foster the growth of citizens' welfare in Russia, it is advisable to increase the share of the income tax by enhancing the progressivity of its scale for the super-rich while maintaining the share of indirect taxes at the pre-crisis average level (≈25%).

KEYWORDS
citizen welfare, tax burden structure, income tax, indirect taxes, property taxes

JEL H21, H24, I31

УДК 336.22

Взаимосвязь между структурой налогового бремени и благосостоянием граждан в странах ОЭСР

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АННОТАЦИЯ
Цель исследования – определение взаимосвязи структуры налогового бремени и благосостояния граждан в странах ОЭСР в 2020 и 2021 гг. Гипотеза исследования состоит в том, что структура налогового бремени и благосостояние граждан взаимосвязаны. При этом доля подходного налога в структуре налогового бремени имеет прямую связь с благосостоянием, а доля косвенных налогов – обратную. В рамках проверки гипотезы применены корреляционно-регрессионный, кластерный, структурный анализ. Расчеты проведены с использованием пакета «Анализ данных» в MS Excel для 2000 г. 2018–2019 гг., и 2021 г. на основе данных OECD.Stat и World Bank Data. Сформированный Data Set индикаторов благосо-

стояния и структуры налогового бремени в 38 странах ОЭСР содержит 1540 показателей. Подтверждено наличие взаимосвязи между структурой налогового бремени и показателями благосостояния граждан. Наиболее тесная однонаправленная связь с уровнем благосостояния сложилась у доли подоходного налога в структуре налогового бремени. Доля косвенных налогов имеет отрицательную взаимосвязь с благосостоянием. По доле налога на прибыль корпораций, имущественных налогов и взносов на социальное обеспечение взаимосвязь с уровнем благосостояния не является существенной. Кластерный анализ стран ОЭСР методом k-средних с использованием web-разработки австрийских ученых DATAtab позволил выделить группы государств по параметрам взаимосвязи благосостояния со структурой налогового бремени. Для стран ОЭСР с высоким благосостоянием доля подоходного налога в налоговом бремени составляет 30–40% (в среднем 37,6%) при доле косвенных налогов – 16–30% (в среднем 24,1%), а для стран со сравнительно низким благосостоянием доля подоходного налога – 6–20% (в среднем 14,8%) при доле косвенных – 35–53% (в среднем 39,7%). Для обеспечения роста благосостояния граждан в России целесообразно повышение доли подоходного налога в налоговом бремени за счет усиления прогрессивности его шкалы для сверхбогатых при сохранении доли косвенных налогов на среднем докризисном уровне (≈25%).

КЛЮЧЕВЫЕ СЛОВА
благосостояние граждан, структура налогового бремени, подоходный налог, косвенные налоги, налоги на имущество

1. Introduction

The imperative to improve citizens' welfare is universally recognized at the current stage of human history. The importance of this task is underscored by the United Nations General Assembly through the Sustainable Development Goals for 2030.

According to the World Bank[1], despite the significant global progress achieved in poverty reduction by 2019, this trend took a downturn in 2020. The annual increase in the number of people living below the extreme poverty line was 70 million, and the global poverty rate reached 9.3%, increasing by 0.9 percentage points compared to 2019. This situation jeopardizes the achievement of UN Sustainable Development Goals #1 "No Poverty" and #10 "Reduced Inequality".

Taxes, along with social transfers, are critical instruments of state finance used to regulate the welfare of citizens. Tax burden is closely linked to welfare: depending on which function is prioritized – fiscal or stimulating, taxes can either diminish or augment welfare accordingly. Therefore, it is crucial to determine the guiding impact of the taxes in question.

The question of how citizens' welfare is connected to the structure of the tax burden, beyond just its size, is surrounded by active debate. On the one hand, provided that the level of welfare is high, the share of the income tax in the tax burden will increase as the proportion of indirect taxes decreases, given that as incomes rise, the marginal propensity to consume decreases. On the other hand, if the share of the income tax in the tax burden is large, a larger portion of current incomes will be extracted in the form of tax payments, reducing citizens' disposable incomes and diminishing their welfare. This means that there is a correlation between the structure of the tax burden and citizens' welfare, which can manifest itself in different ways.

In light of the above, the questions this study seeks to address are as follows. Is there a consistent correlation between the level of citizens' welfare and indicators of the tax burden structure? What are the main trends regarding this correlation in OECD countries? Which taxes primarily explain the dynamics of citizens' welfare in the structure of the tax burden? What are the possibilities of extrapolating

[1] https://www.vsemirnyjbank.org/ru/news/factsheet/2022/05/02/fact-sheet-an-adjustment-to-global-poverty-lines

the established relationship between the structure of the tax burden and the level of welfare to the Russian reality from the OECD countries?

The aim of the research is to determine the relationship between the structure of the tax burden and the welfare of citizens in OECD countries in 2020 and 2021.

The study hypothesizes that the structure of the tax burden is linked to the welfare of citizens. Specifically, the share of the income tax in the tax burden structure is directly correlated with welfare, while the share of indirect taxes is inversely correlated with welfare.

The article is structured as follows. The section "Literature review" describes prior research in the field of the economics of welfare and the relationship between the structure of the tax burden and citizens' welfare. The section "Methodology and Materials" outlines the methodological framework and data used for this study. The section «Results» presents the study's findings. The "Discussion" section contains the analysis of results and assesses their potential applicability to the Russian context. Some conclusions are drawn in the final section of the article.

2. Literature review

The welfare of citizens is a complex and multifaceted concept, and contemporary socio-economic and humanitarian knowledge has yet to establish a unified approach to its definition.

Hicks [1] demonstrated that an optimal distribution of resources among members of society is necessary to maximize their satisfaction from consuming goods and achieve welfare. Hicks' research is grounded in Pareto's theory [2], according to which an economic system reaches an optimum when the position of any participant in economic relations cannot be improved without simultaneously reducing the welfare of at least one participant in the economic system [3].

Pigou [4] investigated the impediments to achieving societal welfare, which he also attributed to the inequality among citizens. To address them, he proposed corresponding measures of government regulation, including progressive taxation, subsidies, and employment support [3].

In the mid-20th century, welfare economics laid the grounds for the concept of welfare state (later also the social state). This concept, as articulated by Galbraith [5] and Myrdal [6], remains a cornerstone for socio-economic policy-making in many developed countries.

In the 21st century, researchers have shifted their focus to identifying strategies to alleviate poverty and address citizen inequality, recognizing them as major obstacles to achieving overall welfare.

Stiglitz [7] explained poverty through "cumulative effects", which reduce economic mobility and limit opportunities for future generations.

Piketty [8] argued that poverty cannot be eliminated; it can only be reduced. Poverty, seen as an inherent characteristic not only of developing but also developed countries, is also explored by Milanovic [9] and Banerjee & Duflo [10].

Equally interesting is the approach that views welfare as a notion contrary to poverty or destitution. Towsend [11] and Sen [12] regard welfare as the ability to fully realize one's human potential, specifically as having sufficient resources to meet the established social standards of consumption [11] or a minimally acceptable lifestyle [12].

In addition to cumulative factors and inherited poverty, significant constraints on the growth of welfare include low- and middle-income traps as well as low intergenerational mobility.

Guriev & Treisman [13] pointed out that a major impediment to ensuring citizen welfare by the state is the inability of the national economy to maintain the transition from low-value-added to high-value-added sectors.

Piketty [8] and Corak [14] contend that limited intergenerational mobility, arising from inequalities in access to educational opportunities and from household income inequality, constrains the ability of subsequent generations to enhance their socio-economic status.

De la Croex & Doepke [15] argue that the decrease in welfare is a result

of inadequate spending on education and healthcare for the most disadvantaged groups. Fidrmuc & Gundacker [16] demonstrate that if such expenditures are reduced, this will lead to lower labor productivity and overall production volume.

Thus, economic welfare of citizens is defined as having sufficient resources to meet their needs, ensure an acceptable standard of living, and realize their human potential. Today, common measures for assessing welfare include traditional indicators, such as per capita GDP adjusted for purchasing power parity (PPP).

Karadjova & Trajkov [17] built regression models using per capita GDP indicators to demonstrate the correlation between welfare and economic growth.

Dorofeev [18] evaluated regional financial models for social security in Russia, employing the average per capita income as a key indicator. The objective was to devise solutions for improving citizen welfare.

In contemporary research, however, an increasingly common practice is to use the relatively new indicators of welfare that were developed in the late 20th century, such as the Human Development Index and its derivatives.

Kalimeris et al. [19] showed that welfare is determined not only by the quantitative aspect of GDP but also by its quality and by the dependence on resources to ensure growth.

Jin & Jakovljevic [20] used the Human Development Index to assess the correlation between fiscal decentralization and national development, concluding that moderate fiscal decentralization best contributes to growth.

The analysis of publications in scientometric databases shows that so far, the correlation between citizens' welfare and the structure of the tax burden has not been the primary focus of research. However, this does not imply that the scholarly community has overlooked the impact of taxes on citizens' welfare.

Puzule [21] argued that by receiving tax revenues, the government can enhance the level of citizens' welfare. In order to achieve this, taxpayers should make the most of the available tax incentives to reduce the tax burden [22].

Vylkova [23] examines the multifaceted impact of taxes on the economic welfare of citizens, considering both objective and subjective perspectives. She illustrated a positive correlation between welfare and tax revenues, as well as a negative correlation between welfare and tax administration. While highlighting the seemingly direct connection between taxes and welfare ("ceteris paribus, the larger the amount of tax collected, the higher the level of welfare of citizens"), she also notes that in citizens' perception, this relationship may appear inverse due to the obligatory nature of tax payments to the state.

When it comes to using fiscal tools to improve welfare, evidence suggests that developed countries adopt various strategies. These include implementing a tax-exempt minimum income, establishing a system of tax benefits and deductions, lowering the indirect tax rates on essential goods for the least affluent 50% of households. The middle 40% benefit from preferential indirect taxation, while the most affluent 10% are subject to taxes on wealth, non-labor (rent) income, and progressive taxation [3].

Lulaj & Dragusha [24] argue that the income tax system can contribute to the improvement of citizens' welfare.

Rothschild & Scheuer [25] demonstrate the positive role of the income tax in tackling income disparities and enhancing citizens' welfare through redistributive effects.

Bourguignon & Spadaro [26] emphasize that the system of tax exemptions plays a crucial role in reducing inequality and improving welfare through income taxation.

Conesa & Krueger [27] focus on the case of the United States to show that if the progressive income tax system is aligned with an optimal criterion, it would increase the welfare of 62% of citizens compared to the current level.

Benedek et al. [28] demonstrate that the income tax is one of the primary revenue-generating taxes in developed economies, which explains its significant impact on welfare.

Shephard & Blundell [29] contend that in developing countries and countries in the emerging market group, the role of the income tax is limited.

Koroleva [30] uses empirical data for the Russian economy to demonstrate a direct positive impact of the revenues from VAT collection on consumer spending.

Haibara [31] argues that indirect taxation can contribute to the improvement of welfare only if it is designed in a consumption-neutral manner.

Pugachev [32] demonstrates that indirect taxes in Russia do not have a significant impact on inequality reduction. To address inequality, it is advisable to differentiate VAT rates based on the consumption patterns of the most and least affluent citizens.

Muinelo-Gallo & Roca-Sagalés [33] in their analysis of the data for OECD countries from 1972 to 2006 show that indirect taxes are less effective in tackling inequality. Indirect taxes are more commonly used in low-income countries to mitigate the negative impact on welfare.

Guillaud et al. [30] examined the data on 22 OECD countries between 1999 and 2013 and found an insignificant influence of indirect taxes on inequality in comparison with direct taxes.

Pugachev [35] explored how the structure of the tax burden affects citizen inequality in OECD countries and found that the overall weight of the tax burden has a more substantial impact on citizen inequality than its specific structure. The change in the structure of the tax burden in OECD countries in 2020 compared to 2000 contributed to inequality alleviation due to the expanding share of the income tax (on average from 26.1% to 26.9%) and the decreasing share of indirect taxes (on average from 32.6% to 30.6%).

Thus, the broad spectrum of research examining the interplay between taxes, welfare, poverty, and citizen inequality, coupled with the absence of definitive evidence for a direct correlation between the tax burden structure and welfare, determines the significance of the chosen research direction.

3. Methodology and materials

The hypothesis was tested through correlation-regression analysis of the relationship between the welfare of citizens and the structure of the tax burden, which was broken down into individual taxes.

OECD countries were chosen as the research object because there is a unified statistical database on tax revenues, known as OECD.Stat. This database follows a consistent methodology and encompasses data dating back to 1965.

The trends in welfare dynamics in OECD countries with similar tax burden structures were determined through cluster analysis using the k-means method. For clustering, the web tool DATAtab[2] developed by Austrian researchers was used.

The k-means method, developed in the 1950s and 1960s, is a popular clustering method, as emphasized by Ikotun et al. [36]. The essence of this method is to minimize the sum of squared deviations of points from the cluster centers [37], which is demonstrated by Formula (1):

$$V = \sum_{i=1}^{k} \sum_{x \in S_i} (x - \mu_i)^2 \qquad (1)$$

where k is the number of clusters; S_i represents the obtained clusters; x, the coordinates of the points; and μ_i the coordinates of the cluster center.

The correlation between indicators of citizen welfare and the structure of the tax burden was examined with the help of correlation-regression analysis. The study relies on 5 indicators of welfare, drawing on the official statistical data from the World Bank: these include 4 indicators from the sections "World Development Indicators" (GDP per capita (y_1) and GNI per capita, PPP (y_2)) and "Wealth Accounts" (total wealth per capita (y_3) and human capital per capita (y_4)). To eliminate the inflation factor, the real GDP per capita growth rate (y_5) was also calculated by using the World Bank Data GDP deflator.

The selected indicators cover different aspects of citizens' welfare, including traditional economic measures like GDP and

[2] https://datatab.net/

GNI, as well as wealth and human capital. These indicators are compiled by the World Bank using a consistent methodology for all countries.

Total wealth is calculated as the sum of produced natural capital, human capital, and net foreign assets. Human capital is calculated as the present value of the future earnings of the working population over their lifetime. The indicators of citizens' welfare under investigation do not include measures of inequality, such as the Gini coefficient, because their relationship with the structure of the tax burden in OECD countries is discussed in a separate study [35]. This way we can concentrate on evaluating the relationship between the tax burden structure and the welfare of citizens, as expressed through its key indicators.

Tax burden at the macroeconomic level is understood as the ratio of total tax revenues to GDP, which has become a standard measure in contemporary empirical research. The structure of the tax burden is examined by individual types of taxes.

Ensuring equal proportions of individual taxes in GDP (representing the tax burden structure) and the equal proportions of individual taxes in the total tax revenues of the consolidated budget (as indicated in Equations (2) and (3)) allows for a more systematic calculation of the indicators reflecting the tax burden structure based on the distribution of tax revenues in the consolidated budget. Therefore, official OECD.Stat data on the structure of tax revenues in OECD countries have been used as indicators of the tax burden structure.

Since the tax burden is determined by the ratio of tax revenue to GDP,

$$\frac{X}{Y} = \frac{\sum_{i=1}^{n} x_i}{Y} \qquad (2)$$

where X is the sum of total tax revenues, Y is GDP, and x_i is the i-th tax paid, then the structure of the tax burden is determined by the shares (i) of individual taxes in the GDP, which are identical to the shares (i) of individual taxes in total tax revenues.

$$\frac{x_i / Y}{X / Y} = \frac{x_i \cdot Y}{Y \cdot X} = \frac{x_i}{X}. \qquad (3)$$

Examining how taxes are distributed within the tax burden structure enables us to conduct correlation-regression analysis. This approach mitigates the challenge of multicollinearity between indicators, such as the share of tax revenues in GDP and GDP per capita.

The calculations were carried out with the help of the "Data Analysis" package in MS Excel for the years 2000 and 2021, the latter being the latest year for which statistical data are available at the time of the study. The year 2019 was included to eliminate the influence of the coronavirus crisis. Additionally, data for the year 2018 were used for the indicators of total wealth and human capital, since it is the last available period in the World Bank Data for these metrics.

Table 1 below contains the details regarding the welfare indicators of citizens, the tax burden structure, and the sources of statistical data used in the study.

The data set created for this research includes 1,540 statistical indicators related to the welfare of citizens and the structure of the tax burden in 38 OECD countries. Based on this data set, a total of 78 dependencies were tested through correlation-regression analysis.

4. Results

Out of 78 tested dependencies, a statistically significant correlation was found in 38. The real GDP per capita growth rate showed no correlation with any indicators of the tax burden structure (y_5). When we shift from the actual shares of taxes in total tax revenues to examining their changes (to ensure comparable measurements of the factor and outcome), we see that there is no significant correlation with y_5. Furthermore, there was no statistically significant correlation with all the welfare indicators for the factor x_5 – the share of corporate income tax in total tax revenues. The multicollinearity check revealed a strong correlation between the share of the income tax and the share of direct

taxes in total tax revenues. Summary data on the correlation coefficients and the strength of the relationships on the Chaddock scale are presented in Table 2.

The share of the income tax exhibits a noticeable unidirectional correlation with welfare indicators in OECD countries, with this correlation strengthening from 2000 to 2018–2021: $0.5 < r < 0.7$. In 2018, a strong correlation was established for human capital and total wealth indicators on the Chaddock scale: $r > 0.7$.

In the structure of tax revenues, a statistically significant moderate ($0.3 < r < 0.5$) positive correlation is observed only in 2000 for GDP, GNI, and human capital per capita. Even though wealth is a source of revenue from property taxes, there is no statistically significant correlation with total wealth per capita.

A positive correlation is also established for the share of direct taxes in the structure of tax revenues. This correlation is evident for GDP and GNI in all time intervals ($0.5 < r < 0.7$) and is particularly strong ($r > 0.7$) for total wealth and human capital.

A unidirectional or positive correlation indicates that the increase in the welfare of citizens in OECD countries is accompanied by an increase in the share of the income tax, property taxes, and the total amount of direct taxes in tax revenues. The correlation between the share of indirect taxes and social security contributions with welfare indicators is negative. This means that an increase in their share is associated with a decrease in the welfare of citizens.

In 2000, there was a distinct negative correlation between the proportion of indirect taxes and welfare indicators ($0,5 < r < 0,7$). By 2018, 2019, and 2021, the correlation strengthened and became strong ($r > 0.7$) for GNI and human capital.

The correlation between social security contributions and tax revenues showed statistical significance in relation to the indicators of welfare only for human capital in 2000, both for human capital and total wealth in 2018, and for GDP in 2019 and 2021. In all these cases, the correlation was moderate ($0.3 < r < 0.5$). There is no statistically significant relationship with GNI in any of the years, and the same holds true for GDP and total wealth in 2000 concerning social security contributions.

The summarized data on the determination coefficients obtained during the analysis are presented in Table 3.

Table 1

Indicators of citizens' welfare and the structure of the tax burden

Indicators	Identifier	Source of data and period
GDP per capita (in current USD)	y_1	World Bank Data[1], 2000, 2019, 2021
GNI per capita, PPP (in current international USD)	y_2	
Total wealth per capita (in prices of 2018, USD)	y_3	World Bank Data[2], 2000, 2018
Human capital per capita (in prices of 2018, USD)	y_4	
Real GDP growth rate per capita	y_5	World Bank Data[3], 2000, 2019, 2021
Share of the income tax in total tax revenues	x_1	OECD.Stat[4], 2000, 2018, 2019, 2021
Share of property taxes in total tax revenues	x_2	
Share of indirect taxes in total tax revenues	x_3	
Share of direct taxes in total tax revenues	x_4	
Share of corporate income tax in total tax revenues	x_5	
Ratio of social security contributions to tax revenues	x_6	

Compiled by the author by using:
[1] https://databank.worldbank.org/indicator/NY.GDP.PCAP.CD/1ff4a498/Popular-Indicators#
[2] https://databank.worldbank.org/source/wealth-accounts/Type/TABLE/preview/on
[3] https://databank.worldbank.org/indicator/NY.GDP.PCAP.CD/1ff4a498/Popular-Indicators#
[4] https://stats.oecd.org/viewhtml.aspx?datasetcode=Rev&lang=en

The share of the income tax showed a stronger correlation with GDP and GNI in 2019 and 2021, the determination coefficient R^2 reaching 0.423. Therefore, the variation in GNI per capita in OECD countries in 2019 is explained by the change in the share of the income tax in tax revenues by 42.3%. As for the relationship with total wealth and human capital, the coefficient of determination R^2 rose to 0.55 and 0.591 in 2018. This implies that the change in the share of the income tax by 55% and 59.1% explains the variation in the levels of welfare, especially in terms of total wealth and human capital per capita, respectively.

Figure 1 graphically illustrates the relationship between human capital per capita and the share of the income tax in the tax revenues of OECD countries in 2018. It should be noted that this relationship is the most significant among those obtained.

Table 2

Matrix of correlation coefficients (r) between the indicators of citizen welfare and the tax burden structure in OECD countries in 2000–2021

Factor	Share in total tax revenues	y_1 GDP per capita	y_2 GNI per capita in PPS	y_3 Total wealth per capita	y_4 Human capital per capita
		2000			
x_1	Income tax	0.515	0.473	0.618	0.641
x_2	Property taxes	0.454	0.419	n/s	0.392
x_3	Indirect taxes	–0.641	–0.686	–0.568	–0.557
x_4	Direct taxes	0.66	0.613	0.687	0.711
x_6	Social security contributions	n/s	n/s	n/s	–0.377
		2018			
x_1	Income tax			0.742	0.769
x_2	Property taxes			n/s	n/s
x_3	Indirect taxes	n/a		–0.696	–0.701
x_4	Direct taxes			0.702	0.731
x_6	Social security contributions			–0.391	–0.436
		2019			
x_1	Income tax	0.63	0.65		
x_2	Property taxes	n/s	n/s		
x_3	Indirect taxes	–0.669	–0.739	n/a	
x_4	Direct taxes	0.646	0.542		
x_6	Social security contributions	–0.457	n/s		
		2021			
x_1	Income tax	0.623	0.636		
x_2	Property taxes	n/s	n/s		
x_3	Indirect taxes	–0.647	–0.73	n/a	
x_4	Direct taxes	0.625	0.55		
x_6	Social security contributions	–0.459	n/s		

Note: Abbreviations: n/a – no data; n/s – statistically not significant correlation.
The color shading in the cells indicates the tightness of the correlation on the Chaddock scale:

Moderate (0.3–0.5) | Noticeable (0.5–0.7) | High (0.7–0.9)

Compiled by the author by using the World Bank Data (https://databank.worldbank.org/source/wealth-accounts/Type/TABLE/preview/on, https://databank.worldbank.org/indicator/NY.GDP.PCAP.CD/1ff4a498/Popular-Indicators#) and OECD.Stat (https://stats.oecd.org/viewhtml.aspx?datasetcode=Rev&lang=en, https://rosstat.gov.ru/folder/13723).

The graphs are presented for both linear (dashed line) and nonlinear (solid line) regression. Among nonlinear functions, the quadratic function best describes the relationship, which is graphically represented by a parabola with branches facing downward. The coefficient of determination for it was 0.647, meaning that the change in the share of the income tax in total tax revenues by 64.7% is associated with a change in the level of human capital per capita, which is 5.6% higher than for the linear regression. The parabolic shape of the relationship suggests that it aligns with A. Laffer's concept [38]. Beyond a certain point, further increases in the tax burden from the income tax result in a reduction in the level of welfare.

The OECD countries under consideration were grouped into clusters using the k-means method. As a result, three clusters of countries were obtained. The first cluster includes the 5 most developed

Table 3

Matrix of determination coefficients (R^2) between the indicators of citizens' welfare and the structure of the tax burden in OECD countries in 2000–2021

Factor	Share in total tax revenues	y_1	y_2	y_3	y_4
		GDP per capita	GNI per capita in PPS	Total wealth per capita	Human capital per capita
		2000			
x_1	Income tax	0.265	0.224	0.382	0.41
x_2	Property taxes	0.206	0.089	n/s	0.154
x_3	Indirect taxes	0.411	0.471	0.323	0.31
x_4	Direct taxes	0.436	0.418	0.471	0.506
x_6	Social security contributions	n/s	n/s	n/s	0.142
		2018			
x_1	Income tax			0.55	0.591
x_2	Property taxes			n/s	n/s
x_3	Indirect taxes		n/a	0.485	0.492
x_4	Direct taxes			0.493	0.534
x_6	Social security contributions			0.153	0.19
		2019			
x_1	Income tax	0.397	0.423		
x_2	Property taxes	n/s	n/s		
x_3	Indirect taxes	0.448	0.546	n/a	
x_4	Direct taxes	0.376	0.294		
x_6	Social security contributions	0.209	n/s		
		2021			
x_1	Income tax	0.389	0.405		
x_2	Property taxes	n/s	n/s		
x_3	Indirect taxes	0.419	0.533	n/a	
x_4	Direct taxes	0.093	0.003		
x_6	Social security contributions	0.211	n/s		

Note: Abbreviations: n/a – no data; n/s – statistically not significant correlation.
Compiled by the author by using the World Bank Data (https://databank.worldbank.org/source/wealth-accounts/Type/TABLE/preview/on, https://databank.worldbank.org/indicator/NY.GDP.PCAP.CD/1ff4a498/Popular-Indicators#) and OECD.Stat (https://stats.oecd.org/viewhtml.aspx?datasetcode=Rev&lang=en, https://rosstat.gov.ru/folder/13723).

countries – the United States, Canada, Australia, Switzerland, and Iceland. The income tax accounts for a large share of their tax revenues (30–40%) and they also have the highest level of human capital, ranging from 500–800 thousand USD per capita in 2018 prices. In Figure 1, countries of the first cluster are marked with turquoise triangles.

The second cluster comprises developed European countries as well as Japan and Israel, – in total, 13 states. The share of the income tax in these countries is 20–30% with the level of human capital ranging from 200,000 to 500,000 dollars per capita in 2018 prices. Countries in the second cluster are marked on the graph with light blue squares.

The third cluster is mainly composed of new OECD countries, less economically developed states such as Chile, Colombia, Turkey, Greece, Spain, Portugal, and countries of the former socialist bloc. While the share of the income tax in these countries is low (6–20%), the human capital per capita does not exceed $200,000 in constant 2018 prices. These countries are marked with blue dots.

The detected multicollinearity of the share of direct taxes and the share of the income tax in tax revenues makes it impractical to analyze the relationship between welfare indicators and the share of direct taxes in more detail.

The correlation with welfare indicators also increased for the share of indirect taxes by 2018, 2019, and 2021 (Table 3). In 2000, the coefficient of determination (R^2) for the relationship with GDP and GNI reached 0.471, and in 2019, it was 0.546: 54.6% of the variance in GNI per capita is associated with changes in the share of indirect taxes in tax revenues. The connection with human capital and total wealth was less tight, with $R^2 = 0.323$ in 2000 for total wealth and $R^2 = 0.492$ for human capital in 2018. This means that 49.2% of the variation in the tax burden from indirect taxes is related to changes in human capital.

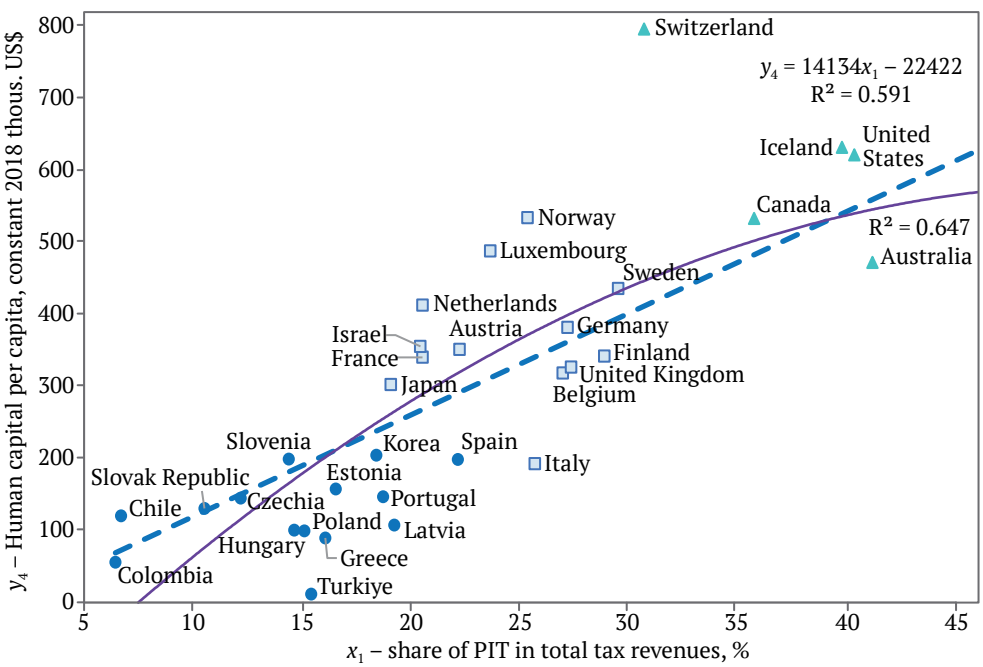

Figure 1. **Correlation between human capital per capita and the share of the income tax in the tax revenues of OECD countries in 2018**

Compiled by the author by using the World Bank Data (https://databank.worldbank.org/source/wealth-accounts/Type/TABLE/preview/on) and OECD.Stat (https://stats.oecd.org/viewhtml.aspx?datasetcode=Rev&lang=en, https://rosstat.gov.ru/folder/13723)

The relationship between GNI per capita at PPP and the share of indirect taxes in the tax revenues of OECD countries in 2021 is shown in Figure 2.

The graph is presented only for linear regression. When testing for nonlinearity, we found no significant increase in the coefficient of determination compared to linear regression. R^2 for linear regression was 0.533, which means that a 53.3% change in the share of indirect taxes in total tax revenues leads to a change in GNI per capita at PPP in OECD countries.

As a result of clustering, three clusters of states were identified. The first cluster includes 6 of the most developed countries – the United States, Switzerland, Luxembourg, Norway, Denmark, and Ireland. These countries have the highest GNI per capita at PPP, ranging from $67,000 to $85,000 annually. This level is achieved with a relatively low share of indirect taxes in tax revenues (16-30%). In Figure 2, countries in the first cluster are marked with turquoise triangles. The second cluster comprises developed European countries as well as Canada, Korea, Japan and Israel, – in total, 17 states. The share of indirect taxes for countries in this group is 21–34%, with GNI per capita in PPP ranging from $41,000 to $63,000 annually. Countries in the second cluster are marked on the graph with light blue squares. The third cluster is primarily composed of new OECD member countries, less economically developed nations, including Chile, Colombia, Turkey, Greece, Portugal, and countries from the former socialist bloc, totaling 13 states. These countries are characterized by a high share of indirect taxes (35–53%) and GNI per capita at PPP of less than $45,000 per year. In Figure 2 these states are marked with blue dots.

The results of the correlation analysis suggest a connection between the structure of the tax burden and indicators of citizens' welfare. Over time, in OECD countries from 2000 onwards, this connection has strengthened, and the COVID-19 crisis did not impact this relationship. The tightest unidirectional connection with welfare is shown by the share of the income tax in tax revenues. For example, in 2018 in OECD countries, a change in the share of the income tax by 55% and 59.1%

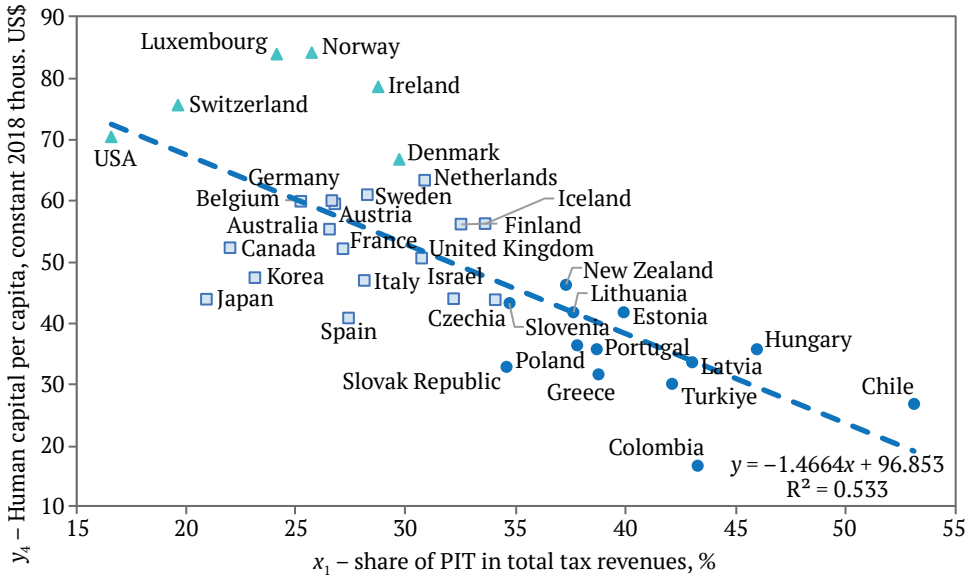

***Figure 2*. Correlation between GNI per capita, PPP, and the share of indirect taxes in the tax revenues of OECD countries in 2021**

Compiled by the author by using the World Bank Data (https://databank.worldbank.org/indicator/NY.GDP.PCAP.CD/1ff4a498/Popular-Indicators#) and OECD.Stat (https://stats.oecd.org/viewhtml.aspx?datasetcode=Rev&lang=en, https://rosstat.gov.ru/folder/13723)

explains the corresponding change in welfare indicators – total wealth and human capital per capita. The share of indirect taxes has a significant negative correlation with the level of welfare. Thus, in 2021, the change in the share of indirect taxes in total tax revenues by 53.3% is associated with a change in GNI per capita at PPP.

As for the share of property taxes and social security contributions, no significant correlation was found. The share of direct taxes in tax revenues exhibits multicollinearity with the share of the income tax. Therefore, we can draw the following conclusion. A greater emphasis on the income tax, coupled with a reduced reliance on indirect taxes in tax revenues, corresponds to a higher level of welfare among citizens. Conversely, countries with higher levels of welfare tend to rely more on the income tax and less on indirect taxes for their tax revenues. The same holds true for the opposite conclusion: a lower share of the income tax and a higher share of indirect taxes in tax revenues correspond to a lower level of citizen welfare. Countries with lower levels of welfare tend to rely more on indirect taxes and less on the income tax in their tax revenues.

By clustering OECD countries, we identified groups of states and specific parameters that support the results of the correlation-regression analysis mentioned earlier. For countries with a high level of citizen welfare, the share of the income tax in tax revenues is 30–40% (on average 37.6%) while indirect taxes account for 16–30% (on average 24.1%). In contrast, the share of the income tax in OECD countries with a comparatively lower level of welfare is 6-20% (on average 14.8%), while indirect taxes in these countries make up 35–53% (on average 39.7%).

5. Discussion

The study confirms the hypothesis that the tax burden structure and welfare are interconnected: specifically, the share of the income tax in the tax burden correlates directly with welfare indicators, while the share of indirect taxes has an inverse relationship.

By studying OECD countries, we identified groups of nations with different combinations of the income tax and indirect taxes in their tax burden, aligning them with variations in welfare levels. In this context, it is interesting to compare these results with the tax burden structure in other countries, particularly Russia. Russia, as a BRICS member state with a transitional economy, holds considerable potential in contributing to the UN Sustainable Development Goals through its tax policy, as highlighted by Halim & Rahman [39].

In recent years in Russia, the average share of the income tax was 19.3% (ranging from 17.2% to 23.4%), while indirect taxes accounted for 25% (ranging from 17.7% to 30.6%) (see Figure 3).

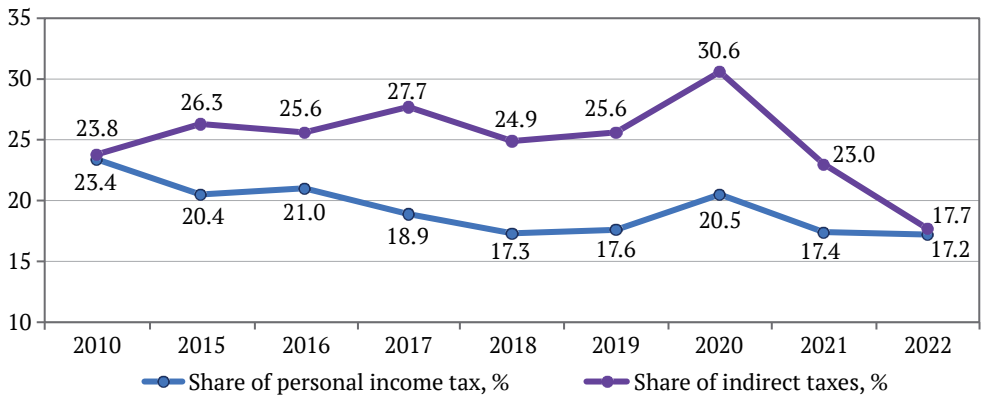

***Figure 3*. Dynamics of the share of the income tax and indirect taxes in Russia's tax revenues from 2010 to 2022, %**

Compiled by the author by using the Federal Tax Service data (https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/)

Judging by the share of indirect taxes (25%), Russia belongs to the first cluster of countries – 16–30% (on average 24.1%), even though its citizens' welfare is significantly lower. On the other hand, if we look at the share of the income tax (19.3%), Russia tends towards the third cluster – 6–20% (on average 14.8%), countries with a relatively low level of welfare. In 2021 and 2022, the share of indirect taxes significantly decreased compared to 2020, dropping from 30.6% to 17.7% (this figure tends to be quite volatile in general). This reduction, coupled with a decrease in the share of the income tax from 20.5% to 17.2%, correlates with the decline in the welfare of Russians during the crisis period.

To foster the growth in welfare in Russia, it is necessary to raise the share of the income tax in the tax burden by increasing the progressivity of its scale for the super-rich citizens. The current mild progressivity fails to address this task, as shown by Mayburov [40], while maintaining the share of indirect taxes at the pre-crisis average level (≈25%).

This study builds upon the idea put forward by Vylkova [23] about the multifaceted impact of taxes on the welfare of citizens. She underscores a distinction that is crucial for this research, moving beyond the simplistic view of a one-way connection ("the larger the amount of tax collected, the higher the level of welfare of citizens") [23].

This study's findings, suggesting that tax revenues can be used to improve welfare, are consistent with those of Puzule [21], Lulaj & Dragusha [24], Rothschild & Scheuer [25]. Additionally, they highlight the vital role of the income tax, as shown by Benedek et al. [28]. Regarding indirect taxation, our empirical study did not confirm the potential positive impact on welfare suggested by Haibara [31]. In the clustering process, the study relied on the works of Aydin [3], Benedek et al. [28], and Shephard & Blundell [29].

The study does not claim to provide a comprehensive analysis of all the factors influencing well-being. Instead, it demonstrates that there is a relationship (though not unidirectional) between welfare and the structure of the tax burden and identifies the determinants shaping this relationship. There is much room for discussion concerning the selection of indicators that reflect factors influencing welfare, the identification of taxes constituting the tax burden structure, and the method of clustering countries.

6. Conclusions

The above-described results lead us to the following conclusions.

1. Welfare is a nuanced concept; when examined from the economic perspective, it implies the availability of sufficient resources enabling citizens to meet their needs, maintain an acceptable standard of living, and unlock their human potential.

2. The structure of the tax burden and indicators of citizens' welfare are interconnected. Compared to 2000, this relationship strengthened in OECD countries by 2018–2021. Thus, the coefficient of determination (R^2) between the share of the income tax and human capital per capita increased from 0.41 in 2000 to 0.591 in 2018, while the share of the income tax rose slightly from 24.1% to 24.4% on average across OECD countries. Similarly, the relationship between the share of indirect taxes and welfare indicators strengthened by 2018–2021: in 2000, R^2 for the correlation with GDP and GNI reached 0.471, and in 2019, it was 0.546. Regarding human capital and total wealth, the connection was less tight (R^2 = 0.492 for human capital in 2018), while the share of indirect taxes reduced from 33.4% to 31.9% on average across OECD countries. These results confirm that the improvement of citizens' welfare in OECD countries from 2000 to 2020 is associated with an increase in the share of the income tax and a decrease in the share of indirect taxes. The tightest positive correlation is observed between welfare and the share of the income tax (the correlation coefficient r reaches 0.769, and the coefficient of determination R^2 in linear regression is 0.591). A negative correlation is observed with the share of indirect taxes (r reaches –0.739, and R^2, 0.533).

The relationship between welfare and the share of property taxes in the tax bur-

den weakened. In 2000, it was moderately unidirectional concerning GDP, GNI, and human capital per capita (R^2 up to 0.201). However, in 2018–2021, no statistically significant correlation was observed, despite the fact that the share of property taxes increased from 5.5% to 5.8% on average across OECD countries. The relationship between welfare and social security contributions strengthened since 2000, reaching a moderate level (R^2 up to 0.211). The correlation between welfare and the share of the corporate income tax has not been established.

The shares of direct taxes and the income tax exhibit multicollinearity.

3. The k-means clustering of OECD countries helped identify three clusters based on the correlation between welfare indicators and the tax burden structure. Countries were divided into those with high, medium, and low levels of welfare and human capital development. The differentiation is also linked to varying proportions of the income tax and indirect taxes in the tax burden structure.

In general, for OECD countries with a high level of citizen welfare, the share of the income tax is 30–40% (on average 37.6%), while the share of indirect taxes is 16–30% (on average 24.1%). For OECD countries with a comparatively lower level of citizen welfare, the share of the income tax is 6–20% (on average 14.8%), and the share of indirect taxes, 35–53% (on average 39.7%).

4. The study of the relationship between the structure of the tax burden and welfare in Russia has shown that to ensure an increase in welfare, it is necessary to increase the share of the income tax by enhancing the progressivity of its scale for the super-rich citizens. This should be done while maintaining the share of indirect taxes at the pre-crisis average level (≈25%).

Promising avenues for further research include the identification of the optimal structure of the tax burden to enhance citizens' welfare, especially achieving the balance between direct, indirect, and property taxes in emerging markets, developing countries, and countries implementing tax reforms. Additionally, it would be productive to investigate the correlation for specific countries over a long period, which can be accomplished with the help of the proposed methodology.

References

1. Hicks J. The Foundations of Welfare Economics. *Economic Journal*. 1939;49(196):696–712. https://doi.org/10.2307/2225023

2. Pareto V. *Cours d'économie politique*. Vol. 2. Lausanne: F. Rouge; 1897. 426 p. Available at: https://ia903402.us.archive.org/30/items/fp-0148-2/FP0148_2.pdf (accessed: 27.06.2023).

3. Aydin N. Pareto efficiency in individualistic vs. altruistic society. *Humanomics*. 2014;30(4):304–324. https://doi.org/10.1108/H-01-2013-0004

4. Pigou A. *The Economics of Welfare*. (4th ed.) London: Macmillan; 1920. 551 p. Available at: http://pombo.free.fr/pigou1920.pdf (accessed: 04.07.2023).

5. Galbraith J.K. Galbraith: a Partisan Appraisal. In: Laperche B., Uzunidis D. (eds) *John Kenneth Galbraith and the Future of Economics*. Palgrave Macmillan, London; 2005. https://doi.org/10.1057/9780230523708_2

6. Myrdal G. Beyond the welfare state. *Science and Society*. 1962;26(1):91–95. Available at: https://www.jstor.org/stable/i40018457 (accessed: 27.06.2023).

7. Stiglitz, J. *The price of inequality: how today's divided society endangers our future*. New York; 2012. 560 p. Available at: http://resistir.info/livros/stiglitz_the_price_of_inequality.pdf (accessed: 27.06.2023).

8. Piketti T. *Capital in XXI century*. Cambridge Massachusetts: The Belknap Press of Harvard University Press; 2014. 696 p. https://doi.org/10.1017/S0047279415000616

9. Milanovic B. *Global Inequality: New Approach for the Age of Globalization*. Cambridge Massachusetts: The Belknap Press of Harvard University Press; 2016. 300 p. Available at: http://resistir.info/livros/global_inequality.pdf (accessed: 02.07.2023).

10. Banerjee A., Duflo E. *Good Economics for Hard Times: Better Answers to Our Biggest Problems*. New York: PublicAffairs; 2019. 432 p. Available at: https://www.goodeconomicsforhardtimes.com/ (accessed: 27.06.2023).

11. Towsend P. *Poverty in the United Kingdom: A Survey of Household Resources and Standards of Living*. New York: University of California Press; 1979. 126 p. https://doi.org/10.1017/S0022050700108393

12. Sen A. *The standard of Living*. Cambridge: Cambridge University of Press; 1987. 125 p. https://doi.org/10.1017/S0266267100001334

13. Guriev S., Treisman D. Informational Autocrats. *Journal of Economic Perspectives*. 2019;33(4):100–127. https://doi.org/10.1257/jep.33.4.100

14. Corak M. Income Inequality, Equality of Opportunity, and Intergenerational Mobility. *Journal of Economic Perspectives*. 2013;27(3):79–102. https://doi.org/10.2307/41955546

15. De la Croix D., Doepke M. Inequality and Growth: Why Differential Fertility Matters. *American Economic Review*. 2003;93(4):1091–1113. https://doi.org/10.1257/000282803769206214

16. Fidrmuc J., Gundacke, L. Income inequality and oligarchs in Russian regions: A note. *European Journal of Political Economy*. 2017;50:196–207. https://doi.org/10.1016/j.ejpoleco.2017.09.005

17. Karadjova V., Trajkov A. Basic economic indicators and economic well-being. *Horizons – International Scientific Journal*. 2022;31(2):165–181. https://doi.org/10.20544/horizons.a.31.2.22.p13

18. Dorofeev M. Comprehensive analysis of the effectiveness of social security regional financial models in Russia based on the DEA method. *Voprosy Ekonomiki*. 2023;6:117–137. https://doi.org/10.32609/0042-8736-2023-6-117-137

19. Kalimeris P., Bithas K., Richardson C., Nijkamp, P. Hidden linkages between resources and economy: A "Beyond-GDP" approach using alternative welfare indicators. *Ecological Economics*. 2020;169:106508. https://doi.org/10.1016/j.ecolecon.2019.106508

20. Jin H., Jakovljevic M. Fiscal decentralization and the Human Development Index: a cross-border empirical study. *Sustainability*. 2023;15(11):8784. https://doi.org/10.3390/su15118784

21. Puzule A. Research on the Personal Income Tax Application to Wages in the Baltic States. *Society. Integration. Education. Proceedings of the International Scientific Conference*. 2019;6:654–664. https://doi.org/10.17770/sie2019vol6.3858

22. Romane-Jersova A., Kotane I. The impact of the labor tax burden on the living standard of the inhabitants of Latvia. *Journal of Regional Economic and Social Development*. 2020;1(12):97–106. https://doi.org/10.17770/jresd2020vol1.12.5388

23. Vylkova E. Palette Effect of Taxes on Economic, Social and Emotional Welfare of the Citizens. *Procedia – Social and Behavioral Sciences*. 2014;166:209–215. https://doi.org/10.1016/j.sbspro.2014.12.512

24. Lulaj E., Dragusha B. Incomes, Gaps and Well-Being: an Exploration of Direct Tax Income Statements Before and During Covid-19 Through the Comparability Interval. *International Journal of Professional Business Review*. 2022;7(6):1–31. https://doi.org/10.26668/businessreview/2022.v7i6.623

25. Rothschild C., Scheuer F. Redistributive Taxation in the Roy Model. *Quarterly Journal of Economics*. 2013;128(2):623–668. https://doi.org/10.1093/qje/qjs076

26. Bourguignon F., Spadaro A. Tax Benefit Revealed Social Preferences. *Journal of Economic Inequality*. 2012;10(1):75–108. https://doi.org/10.1007/s10888-010-9153-0

27. Conesa J., Krueger D. On the optimal progressivity of the income tax code. *Journal of Monetary Economics*. 2006;53(7):1425–1450. https://doi.org/10.1016/j.jmoneco.2005.03.016

28. Benedek D., Benítez J., C., Vellutin C. Progress of the Personal Income Tax in Emerging Markets and Developing Countries. *IMF Working Papers*. 2022;(20):1–36. https://doi.org/10.5089/9798400201134.001

29. Shephard A., Blundell R. Employment, Hours of Work and the Optimal Taxation of Low-Income Families. *Review of Economic Studies*. 2012;79(2):1–46. https://doi.org/10.2307/23261341

30. Koroleva L. Impact of Value Added Tax on Macro-Economic Parameters of the Russian Economy. *Journal of Tax Reform*. 2020;6(1):22–35. https://doi.org/10.15826/jtr.2020.6.1.073

31. Haibara T. Indirect Tax Reform in Developing Countries: A Consumption-Neutral Approach. *Journal of Globalization and Development*. 2017;8(1):1–11. https://doi.org/10.1515/jgd-2016-0036

32. Pugachev A. The Impact of Indirect Taxation on Inequality in Russia. *Journal of Tax Reform*. 2023;9(1):19–33. https://doi.org/10.15826/jtr.2023.9.1.126

33. Muinelo-Gallo L.; Roca-Sagalés O. Joint determinants of fiscal policy, income inequality and economic growth. *Economic Modelling*. 2013;30:814–824. https://doi.org/10.1016/j.econmod.2012.11.009

34. Guillaud E., Olckers M., Zemmour M. Four levers of redistribution: The impact of tax and transfer systems on inequality reduction. *Review of Income and Wealth.* 2020;66(2):444–466. https://doi.org/10.1111/roiw.12408

35. Pugachev A.A. Impact of the Level and Structure of the Tax Burden on Citizens Inequality. *Financial Journal*. 2023;15(3):59–77. https://doi.org/10.31107/2075-1990-2023-3-59-77

36. Ikotun A.M., Ezugwu A.E., Abualigah L., Abuhaija B., Heming J. K-means clustering algorithms: a comprehensive review, variants analysis, and advances in the area of big data. *Information Sciences.* 2023;622(11):178–210. https://doi.org/10.1016/j.ins.2022.11.139

37. Loog M., Krijthe J.H., Bicego M. Also for k-means: more data does not imply better performance. *Machine Learning*. 2023;112:3033–3050. https://doi.org/10.1007/s10994-023-06361-6

38. Laffer A.B. The Laffer Curve: Past, Present, and Future. *The Heritage Foundation Publications*. 2004;(1765):1–16. Available at: https://www.heritage.org/taxes/report/the-laffer-curve-past-present-and-future (accessed: 02.07.2023).

39. Halim M.A., Rahman M.M. The effect of taxation on sustainable development goals: evidence from emerging countries. *Heliyon*. 2022;8(9):e10512. https://doi.org/10.1016/j.heliyon.2022.e10512

40. Mayburov, I.A. Marking the Centenary of Income Tax in Russia: Theoretical Analysis of Key Stages of the Reform. *Journal of Tax Reform*. 2015;1(2-3):161–176. https://doi.org/10.15826/jtr.2015.1.2.010

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