Taxation-Based Indicators as a Measure of Income Inequality in Russian Regions

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ABSTRACT

Russia is one of the most unequal of the world's major economies, with its wealth and income inequalities having drastically increased in recent years. This study aims to describe the influence of the flat personal income tax on income inequality in Russia and its regional characteristics by analyzing per capita tax revenues. The hypothesis is that the system of income taxation that existed in Russia until 2021 did not help reduce income inequality but on the contrary, exacerbated it, which is particularly evident on the regional level. Methodologically, the article relies on statistical analysis of concentration indices, time series analysis, index method, and comparative analysis. The calculations were made with the help of the Analysis ToolPack in MS Excel by using the data on 85 Russian regions. To test the hypothesis, 7 indicators were calculated: the range of variation, standard deviation, coefficient of variation, decile ratio of funds, decile ratio of differentiation, quintile ratio of funds, and the Gini index for 85 Russian regions for the period from 2006 to 2020. In the given period, these indicators remained steadily at a high level with a slight decrease in 2008–2010. Judging by the dynamics of the Gini index calculated by Rosstat, income inequality tended to decline although there were no significant changes in the regional differences in income while regional inequality also remained high. Monetary income and gross regional product are distributed more evenly across Russian regions in comparison with the personal income tax revenues and tax revenues in general of the regional governments' consolidated budgets. The findings confirm the hypothesis and show that the personal income tax, which is an essential element of the tax system, exacerbated the situation of inequality in Russian regions. These findings can be of use to policy-makers and contribute to further research on taxation instruments and their potential to reduce or mitigate inequality.

KEYWORDS

personal income tax, inequality, income inequality, differentiation, stratification, Gini index, equalization

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Оценка монетарного неравенства и его территориальных особенностей в России с использованием налоговых показателей

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АННОТАЦИЯ

В России остро выражено монетарное неравенство на фоне высокого уровня бедности и снижения благосостояния. Цель исследования – определение влияния подоходного налогообложения в период действия плоской шкалы на монетарное неравенство и его территориальные особенности в России на основе показателей среднедушевых налоговых поступлений. Гипотеза исследования состоит в том, что действующая в России до 2021 г. система подоходного налогообложе-

ния не способствовала сглаживанию неравенства, а напротив, усугубляла его, и в региональном разрезе неравенство выражено более ярко. В рамках проверки гипотезы применены метод статистической оценки концентрации, анализ рядов динамики, индексный метод и сравнительный анализ. Расчеты проведены с использованием пакета «Анализ данных» в MS Excel для 85 субъектов РФ. Тестирование гипотезы проведено посредством расчета 7 показателей: размах вариации, стандартное отклонение, коэффициент вариации, децильный коэффициент фондов, децильный коэффициент дифференциации, квинтильный коэффициент фондов, аналог коэффициента Джини для 85 субъектов РФ в динамике с 2006 по 2020 гг. В рассматриваемом периоде они находились на стабильно высоком уровне с некоторым снижением в 2008–2010 гг. Монетарное неравенство граждан по динамике коэффициента Джини Росстата имело слабую тенденцию к сокращению, а вот значимого изменения региональной дифференциации в благосостоянии граждан не происходило, она остается на стабильно высоком уровне. Денежные доходы населения и валовый региональный продукт в России распределены более равномерно относительно налоговых поступлений по регионам в бюджеты всех уровней бюджетной системы и поступлений налога на доходы физических лиц в консолидированные бюджеты субъектов Федерации. Результаты анализа подтверждают, что действующая в России до 2021 г. налоговая система усиливала монетарное неравенство в России, и подоходное налогообложение, как элемент налоговой системы, явилось усугубляющим фактором. Поиск инструментов сглаживания неравенства за счет налогообложения открывает широкие перспективы для дальнейших исследований.

КЛЮЧЕВЫЕ СЛОВА
подоходный налог, неравенство, монетарное неравенство, дифференциация, расслоение, индекс Джини, сглаживание

1. Introduction

Since the beginning of Russia's transition to a market economy, income inequality has been growing and despite the government's efforts to curb it in recent years, it has remained excessive. By the World Bank's estimates, Russia's Gini index – an indicator of social and economic inequality – was 0.375 as of 2018. To put this in context, the Gini index in Germany is 0.319; Norway, Belgium, and Sweden, 0.27-0.28; Belarus, 0.252, and Ukraine, 0.261[1]. In Russia this figure has been high (0.37-0.42) since the collapse of the USSR, which resulted in the concentration of economic power in the hands of the few while broader segments of the population fell into abject poverty. The Russian government's efforts so far have failed to produce any significant effect on social inequality. The introduction of a flat scale for the personal income tax (PIT) in 2001 led to a rise in income inequality.

The flat PIT scale with the rate of 13%, which existed for 20 years, was the main reason why the government failed to tackle the problem of income inequality through income taxation. It is now obvious that in order to address this problem more efficiently, new instruments are needed. There is still untapped potential for taxation as a tool for reducing income inequality.

The impact of income taxation on inequality has been in the focus of Russian and international researchers' attention for a long time. Their interest is determined, first and foremost, by the enormous social significance of this question. Nevertheless, at present, we are unaware of any studies reporting on the relationship between the personal income tax collections per capita in Russian regions and the level of inequality. This is the research gap that this study seeks to address: Can income taxation contribute to the mitigation of income inequality in Russia? How evenly are the PIT revenues distributed among Russian regions? What indicators are most suitable for estimating the dis-

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[1]   https://data.worldbank.org/indicator/
SI.POV.GINI?end=2019&start=2019&view=bar&
year=2019

tribution level of the PIT revenues across Russian regions? How can income taxation tools be used to mitigate income inequality in the Russian context?

This study aims to describe the influence of the flat personal income tax on inequality in Russia and its regional characteristics by using the indicators of per capita tax revenues.

The hypothesis of this study is that the system of income taxation that existed in Russia until 2021 did not help reduce income inequality but on the contrary, exacerbated it, which is particularly evident on the regional level.

The following section provides a review of the research literature on this topic. The section 'Methodology and Materials' describes the indicators of inequality calculated for 85 Russian regions and substantiates the choice of the Gini index on PIT revenues to study regional disparities. The section 'Results' describes the major findings of this study. The section 'Discussion' contains our interpretation of the results and their comparison with the previous research evidence as well as the outline of the possible ways of overcoming inequality through the use of tax instruments. In the final section the conclusions are presented.

2. Literature review

The relationship between taxation and inequality as well as taxation and economic growth are widely discussed in contemporary research literature.

Stiglitz [1] believes that inequality is an inevitable result of a market economy and that once inequality emerges, it is self-reinforcing and, in order to tackle this problem, state regulation is necessary especially in the sphere of taxation.

Atkinson [2] argues that the problem is not simply that the rich are getting richer but that there are no effective ways of dealing with poverty. In order to reduce inequality, it is necessary to go beyond placing new taxes on the wealthy and providing state support for the poor and devise new tools for tackling the problem. Such tools might be the new policies in five areas: technology, employment, so-

cial security, the sharing of capital, and taxation.

Alvaredo et al. [3] contend that progressive income taxation is a tried and tested way of fighting income inequality. Not only does progressive taxation reduce inequality after the taxes are paid but also before tax because affluent taxpayers are thus discouraged from striving to increase their earnings and assets.

Piketty et al. [4] studied the relationship between social inequality and the progressivity of the income tax in the USA over a 100-year period and showed that an increase in inequality correlates with the declining progressivity of taxes in the last decades: in the period of declining progressivity of the income tax from 1980 to 2014, the share of after-tax income of the wealthiest 10% of Americans grew from 30 to 40% and pre-tax income, from 35 to 47%.

However, these results are disputed by Auten и Splinter [5], who point out that Piketty et al. [4] gave a distorted view of income inequality levels and trends and that their results become less reliable for larger sample sizes. Instead, Auten and Splinter [5] contend that in the last decades taxation has largely tended to contribute to income inequality reduction in the USA. In 1979, the average tax rates for the top one percent of US citizens fluctuated around 38% with no clear trend. In contrast, the tax rates for the bottom 90 % of the distribution have decreased from 25 to 20% since 1979 in spite of increased payroll taxes.

Kessing et al. [6] show that income taxation has a significant influence on regional inequality. When centralized redistribution schemes are applied, interregional migration exerts downward pressure on optimal marginal tax rates. To reduce regional disparities while establishing regional differentiated schemes of personal income taxation in the USA, it is necessary to take into account regional labour productivity differences and interregional migration.

Parfenova et al. [7] studied the problems of regional differentiation in terms of tax revenues and found that in Russia, taxes do not cause regional disparities but,

on the contrary, serve as instruments to compensate for such disparities. The main factors of regional disparities are the economic and geographical position, investment climate, and labour resources.

Gbohoui et al. [8] showed that in developed countries of the OECD, on the regional level inequality is reduced by 75% through cash transfers from the central government and by 25% through income taxation (for example, in the USA, UK, Switzerland and Spain). The only exception is Germany, where taxation helped reduce inequality by 40%.

Saidin et al. [9] examined the data on 27 countries and showed that income tax has a positive impact on GDP growth.

Gbato [10] tested the impact of taxation on the long-run growth of a sample of 32 countries in sub-Saharan Africa and showed a zero effect of taxation on the long-run growth.

Abdon et al. [11] studied the data on 13 developing Asian countries and found that the taxation on high and middle income slows down economic growth.

The study of Turkey's economy by Katircioglu [12] has shown a positive relationship between tax revenues and economic growth.

In their study of 55 countries in 1981–2005, Duncan et al. [13] found that progressivity in income taxation reduces inequality in observed income.

Martorano [14] focused on the case of 14 countries in Latin America in 1990-2010 to show that the increasing contribution of direct taxes with respect to indirect taxes lead to a reduction in inequality.

For the Russian context, the studies of the countries with the flat personal income tax systems (ex-Soviet countries and countries of the Eastern Bloc) are of particular relevance. Shmelev [15] argues that these countries' tax policies were to a great extent influenced by the International Monetary Fund, which resulted in the principles of equity and efficiency being seen as competing with the priority of efficiency to the detriment of equity.

Tanchev [16] demonstrates that there is a long-run rather than short-run equilibrium between the PIT and economic growth. The progressive tax system is more compatible with economic growth than the proportional income tax in Bulgaria in the long run. In the short run, the progressive and proportional income tax have not shown statistically significant relationships with economic growth. Therefore, progressive income taxation leads to greater economic growth than proportional. Regarding the impact of income taxation on inequality, Tanchev [17] shows through the use of economic-mathematical models that in Bulgaria the introduction of the proportional income tax will lead to an increase in inequality.

Other studies of Eastern Europe have shown that proportional income taxation increases inequality. In Slovakia, inequality decreased after the introduction of the progressive scale, in the Czech Republic an increase in public transfers contributed to income inequality [18] while in Romania the proportional tax also tended to contribute to inequality [19; 20].

Pinskaya [21] argues that the current Russian system of income taxation is unable to fairly equalize the level of income.

In 2015, Mayburov [22] analyzed the progressive income tax that existed in Russia in the 1990s and showed that if a mild degree of progression is introduced, it will not have a significant impact on income inequality.

Thus, even though the influence of taxation on income inequality and the relationship between inequality and economic growth are the questions that have been widely discussed in the research literature, some of their aspects are unsettled and still leave room for debate. For instance, regarding the influence of the degree of progressivity of the income tax system on inequality, the researchers from the same countries dealing with the same periods can come to different conclusions (see, for example, the studies for the USA [4; 5]). Some of the questions still remain unresolved. These include, for example, the possibilities of mitigating inequality with the help of income taxation, manifestations of income inequality on the regional level, and the relationship between per capita tax revenues and inequality in different regions.

3. Methodology and materials

To test the hypothesis, the indicators of inequality in regional PIT revenues were calculated. The study relies on the method of statistical analysis of concentration indices, time series analysis, index method, and comparative analysis. The calculations were made with the help of the Analysis ToolPack in MS Excel by using the data on 85 Russian regions for 2006–2020. The PIT revenues were chosen as an indicator of inequality because, first, the PIT reflects the level of income since it is the income that is the tax base on which this tax is levied; second, the dynamic of per capita PIT revenues illustrates the influence of taxation on inequality in retrospect.

Table 1 summarizes the indicators of inequality used in this study. These indicators describe the dynamics of the distribution of per capita PIT revenues to the consolidated budgets of Russian regions.

Concentration indicators can be compared in order to reveal the dynamics in the level of regional disparities and the concentration of tax revenues. The use of a broader range of inequality indicators can provide a fuller and more reliable picture of inequality in Russian regions by the level of per capita tax revenues to their consolidated budgets.

As an indicator of concentration, we used the Gini index, which demonstrates how the actual distribution of per capita PIT revenues in Russian regions deviates from the totally balanced distribution, thus shedding light on the extent of disparities in tax revenue. The Gini index is widely used to measure different manifestations of inequality [23].

One of the most popular methods of its calculation is to use covariance-based formulas (see Table 1). This way we can detect the changes in the group of neighbouring regions although this indicator does not point to the specific groups of regions in whose favour there is an imbalance. Therefore, it is necessary to supplement this indicator with simpler coefficients: decile and quintile ratios, which do not take into account changes in the group of neighbouring regions to which the Gini index is particularly sensitive.

Thus, the selected indicators complement each other and make up for each other's weaknesses, which results in a fuller and more accurate picture.

The calculations were based on the data for Russian regions in 2006–2020. The choice of this period was determined by the availability of the data of the Federal Tax Service (FNS) of the Russian Federation for the revenues collected from specific tax sources on the regional level. The study relies on the official data of the FNS on regional governments' revenues from taxes and levies (report 1-HM "Report on the Accrued and Collected Taxes, Levies, Insurance Contributions and Other Obligatory Payments to the Budget System of the Russian Federation"[2]), the data from Rosstat on gross regional product (GRP)[3], and on the population statistics of Russian regions[4].

4. Results

Table 2 below summarizes the calculated indicators of regional disparities in PIT revenues, tax revenues in general, and GRP in 2002–2020.

The range of variation r of the revenues from the PIT received by regional governments is quite substantial. For instance, in 2019, it reached 2,950 thousand roubles per person per year: the maximum was 2,955 thousand roubles per person in the Yamalo-Nenets Autonomous District and the minimum was 5 thousand roubles per person in the Republic of Ingushetia. The coefficient of variation V of regions' PIT revenues displayed diverse trends in the given period, remaining within the range of 200–250%. This shows considerable regional disparities in PIT revenues since $V > 33\%$ signifies the heterogeneity of the population.

The decile ratio of funds k_2 was 58.7 in 2009 and 109 in 2018. It shows that the tax revenues per capita in 10% of the most prosperous regions were 59-100 times higher than in 10% of the least prosperous regions. For instance, in 2020 it was

<div align="right">Table 1</div>

Indicators of regional disparities in PIT revenues

Indicator	Identifier	Description	Calculation formula
Range of variation	r	The difference between the highest and lowest values of per capita PIT revenues to the consolidated budget of a Russian region	$r = x_{\max} - x_{\min}$, where x is the per capita revenue from the PIT received by the consolidated budget of a Russian region
Standard deviation	σ	A measure of dispersion of a random variable, which demonstrates on average how far each score lies from the mean value.	$\sigma = \sqrt{\dfrac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^2}$, where n is the number of Russian regions
Coefficient of variation	V	A statistical measure of the relative dispersion of data points in a data series around the mean. It shows the extent of variability in relation to the mean of the population.	$V = \dfrac{\sigma}{\overline{x}} \cdot 100\%$
Decile ratio of funds	k_1	The ratio of per capita PIT revenue of 10% of the regions with the highest revenues to 10% of the regions with the lowest revenues	$k_1 = \dfrac{\overline{x_{10}}}{\overline{x_1}}$, where $\overline{x_{10}}$ is per capita PIT revenue of the 10% of the regions with the highest revenues, $\overline{x_1}$ per capita PIT revenue of the 10% of the regions with the lowest revenues.
Decile ratio of differentiation	k_2	The ratio of the lowest value of per capita PIT revenues among the 10% richest regions to the highest value of this indicator among the 10% poorest regions	$k_2 = \dfrac{x_9}{x_1}$, where x_9 is the per capita revenue from the PIT in the poorest region among the 10% of the regions with the highest revenues, x_1 is the per capita revenue from the PIT in the richest region among the 10% of regions with the lowest revenues
Quintile ratio of funds	k_3	The ratio of per capita PIT revenues of 20% of the regions with the highest revenues to 20% of the regions with the lowest revenues. This indicator is similar to the decile ratio of funds and enables us to measure the changes in a larger number of regions by encompassing the data on 40% of the regions	$k_3 = \dfrac{\overline{x_5}}{\overline{x_1}}$, where $\overline{x_5}$ is per capita PIT revenues of the 20% of the regions with the highest revenues, $\overline{x_1}$ per capita PIT revenues of the 20% of the regions with the lowest revenues
Gini index	k_4	Concentration index which measures how much the actual distribution of tax revenues differs from the absolutely balanced distribution of revenues. It ranges between 0 (no concentration) and 1 (maximum concentration). It helps detect the changes in the group of average regions.	$k_4 = \dfrac{2\,covar(x, \rho_x)}{n \cdot \overline{x}}$, where is $2\,covar(x, \rho_x)$ the covariance between PIT revenues and regions' ranks ρ_x is the ranking position of the region in terms of tax revenues, from the lowest to the highest $\rho_x = 1 \cdot \rho_x = n$

Note: compiled by the author based on [23–27].

Table 2

Indicators of regional disparities in PIT revenues, tax revenues in general, and GRP in 2006–2020

Descriptor	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PIT revenues of regional consolidated budgets															
r, ths rbs per person per year	643.0	627.5	864.3	541.2	689.7	966.7	1,111.9	1,162.2	1,314.2	1,447.5	1,513.9	2,123.3	2,709.6	2,950.3	2,228.1
σ, ths rbs per person per year	95.2	90.4	116.7	81.0	100.9	140.9	166.3	170.1	193.5	208.9	198.9	267.5	363.2	384.3	284.1
V, %	247	224	223	200	205	217	225	225	222	219	207	228	242	238	211
k_1	106.4	79.6	81.2	58.7	66.1	80.7	70.9	64.9	73.2	84.8	74.9	89.7	109.0	108.8	79.6
k_2	14.4	12.3	9.8	8.9	8.5	12.2	12.1	11.0	11.4	12.3	12.0	13.6	17.3	17.3	12.8
k_3	44.1	31.3	31.1	23.8	26.8	32.3	30.0	27.8	30.7	34.5	30.9	36.2	43.8	44.1	32.6
k_4	0.565	0.542	0.542	0.535	0.540	0.557	0.554	0.545	0.559	0.571	0.546	0.543	0.568	0.569	0.549
Total tax revenues of regional budgets on all levels of the state budget system															
r, ths rbs per person per year	825.3	823.4	1 005,8	554.4	900.6	1,178.1	1,339.4	1,223.4	1,310.9	1,443.4	1,509.8	2,119.0	2,733.4	2,945.6	2,239.7
σ, ths rbs per person per year	129.3	125.4	156.6	98.2	136.7	185.5	215.4	210.4	230.6	249.7	242.5	313.2	456.4	463.1	324.1
V, %	223	205	208	181	191	200	205	203	198	197	187	200	222	213	184
k_1	63.4	50.0	51.0	36.6	43.7	54.7	52.8	45.7	49.2	52.4	43.7	46.5	62.9	66.1	45.9
k_2	5.5	4.7	6.3	4.7	5.9	6.0	5.3	6.0	6.1	6.4	6.1	6.4	7.3	7.6	7.3
k_3	24.0	18.4	19.9	14.5	16.4	19.6	19.0	17.7	18.4	20.1	17.2	18.8	24.3	24.1	20.1
k_4	0.553	0.531	0.541	0.519	0.521	0.541	0.539	0.538	0.544	0.555	0.530	0.531	0.569	0.564	0.533
Gross regional product															
k_1	17.3	16.4	14.6	15.1	15.1	15.3	13.8	12.9	15.6	15.7	15.0	15.6	15.9	15.4	No data
k_2	4.1	3.7	3.8	3.6	3.7	3.9	3.8	3.7	3.7	4.0	4.4	4.5	4.5	4.4	
k_3	8.9	8.5	7.8	8.1	8.0	7.7	7.1	6.8	7.5	7.8	7.8	8.1	8.3	8.0	
k_4	0.471	0.467	0.442	0.462	0.457	0.455	0.439	0.434	0.443	0.449	0.453	0.457	0.471	0.464	

The table is compiled by the author by using Rosstat data (https://www.fedstat.ru/indicator/42928, https://www.fedstat.ru/indicator/31557, http://www.rosstat.gov.ru) and FNS data (https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/)

79.6. In the eight less prosperous regions (the republics of Adygea, North Ossetia – Alania, Kalmykia, Karachay-Cherkessia, Chechnya, Dagestan, Kabardino-Balkaria,and Ingushetia), the revenue raised from the PIT was on average 8.4 thousand roubles per person per year. In the 8 most prosperous regions (republics of Sakha (Yakutia) and Tatarstan, the Yamalo-Nenets, Khanty-Mansiysk, and Chukotka autonomous districts, Sakhalin, Magadan and Krasnoyarsk regions), this figure was 672,4 thousand roubles.

The decile ratio of differentiation k_2 has a significantly lower value in relation to the decile ratio of funds: from 8.5 in 2010 to 17.3 in 2018 and 2019. This can be explained by the fact that, unlike k_1, the calculation of k_2 excludes the poorest and richest regions. For example, in 2020 it was 12.8 calculated as a ratio of per capita PIT revenues received by Irkutsk region (158.8 thousand roubles) to that of Stavropol region (12.1 thousand roubles).

Since quintile ratio of funds k_3 covers 40% of the regions while decile ration k_1 covers only 20%, the former also has smaller values: from 23.6 in 2009 to 44.1 in 2006 and 2019. The per capita PIT revenue in the 20% of the most prosperous regions exceeded that of the poorest regions by 24–44 times. For instance, in 2020 it was 32.6. In 17 least prosperous regions, the PIT revenue was on average 11.9 thousand roubles per capita per year while in the 17 most prosperous regions, this figure was 32.6 times higher – 388.9 thousand.

The concentration indices calculated in this study reflect the considerable regional disparities in Russia in per capita PIT revenues. The drawbacks of these indices is that they take into account only the extreme points of the population, which is why for the analysis of changes in the group of regions with the average PIT revenue a more sensitive indicator was calculated – the Gini index k_4. In 2006–2020, it remained at a high level: from 0.535 in 2009 to 0.571 in 2015. This coefficient value is very high – it reflects the excessive level of differentiation between Russian regions in per capita PIT revenues.

Thus, all the calculated indicators have confirmed our hypothesis about the high regional disparities in Russia in per capita PIT revenues, which also signifies pronounced monetary inequality on the regional level. Most of the calculated indicators hit their lowest levels in 2009, when regional disparities were at their lowest, although this situation did not persist for long. This can be explained by economic recessions and their consequences in the absence of efficient mechanisms for stimulating the development of lagging regions and mechanisms for reducing the dependence of tax revenues in more prosperous regions on extractive industry, the rise of urbanization and accumulation of capital in large agglomerations.

In this respect it is quite interesting to compare the indicators reflecting the disparities of Russian regions in terms of PIT revenues and the general tax revenues of the budgets on all levels of the state budget system (see Table 2).

The indicators of regional disparities in Russia in tax revenues in general turned out to be lower than those of the regional disparities in PIT revenues. Nevertheless, these indicators also have high values and demonstrate a high degree of disparities between the regions regarding the level of realized tax potential. The coefficient of variation V ranged from 181% in 2009 to 222% in 2018. The decile ratio of funds k_1 ranges from 36.6 in 2009 to 66.1 in 2019; the decile ratio of differentiation k_2, from 4.7 in 2007 and 2009 to 7.6 in 2019; and the quintile ratio of funds k_3, from 14.5 in 2009 to 24.3 in 2018. The Gini index k_4 ranged from 0.519 in 2009 to 0.569 in 2018.

The fact that the indicators reflecting the disparities in tax revenues in general were lower than those corresponding to the revenues from the PIT signifies that the PIT, which plays a pivotal role in the budgets of regional governments, exacerbated the inter-regional disparities in budget revenues. From the perspective of the decile and quintile ratios, these disparities appear even more pronounced than from the perspective of the Gini index, which did not show such a significant difference between the regions in PIT reve-

nues and tax revenues in general. Keeping in mind the specifics of these coefficients, it may be said that they demonstrate a higher degree of inequality in per capita PIT revenues in the groups of the poorest and wealthiest regions than in the group of average regions.

Let us now compare the indicators of regional disparities with the corresponding GRP-related indicators shown in Table 2.

The regional differences in GRP in 2006–2020 are significantly lower than those in PIT and tax revenues in general. The decile ratio of funds k_1 did not exceed 17.3. The decile ratio of differentiation k_2 ranged between 3.6 and 4.5; the quintile coefficient of funds k_3, between 6.8 and 8.9; and the Gini index k_4, 0.434 and 0.471. The values of these indicators are quite high and point to the high degree of inequality of Russian regions. The indicators reflecting the regional differences in GRP were lower than those reflecting the differences in PIT revenues and tax revenues in general, which means that the current tax system and the PIT in particular increases income inequality, including the regional level.

The differences in the indicators of inequality of Russian regions are illustrated by the dynamics of the decile ratio of funds (see Fig. 1).

Let us now compare the income Gini index for Russia as a measure of income inequality with the Gini indices calculated as part of our analysis (Fig. 2).

The dynamics of all the given indicators reflects the high level of regional disparities and income inequality in Russia. In the given period, these indicators held steady at a high level with a slight decrease in 2008–2010. The Gini index calculated by Rosstat was between 0.403 and 0.422. The Gini index of GRP per capita ranged from 0.439 in 2012 to 0.471 in 2006 and 2018; the Gini index of per capita tax revenues received by the budgets on all levels of the state budget system, from 0.519 in 2009 to 0.569 in 2018; and the Gini index of per capita PIT revenues received by the consolidated budgets of Russian regions, from 0.535 in 2009 to 0.571 in 2015. The trend analysis of the data in the given period shows the absence of any significant growth trends or decrease in regional disparities in such indicators as the Gini index of per capita GRP, PIT collections and revenues, which remained at a steadily high level. Interestingly, in 2006–2020, inequality reflected in the Gini index calculated by Rosstat showed a weak downward tendency.

In general, in Russia, income and GRP are distributed more evenly among the regions compared with the tax revenues
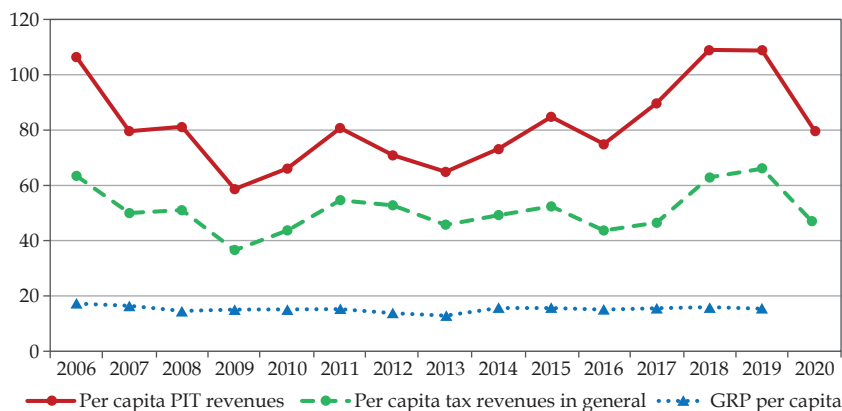
***Figure 1.* Dynamics of the decile ratio of funds for the per capita tax revenues and GRP of Russian regions in 2006–2020**

Source: Compiled by the author by using Rosstat data (https://www.fedstat.ru/indicator/42928, https://www.fedstat.ru/indicator/31557) and FTS data (https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/)

in general and PIT revenues in particular. Therefore, from 2006 to 2020, taxation in Russia did not help reduce income inequality but on the contrary, exacerbated it and income taxation was one of such negative factors. Similarly, income inequality was not lowered on the regional level.

5. Discussion

The analysis has confirmed the hypothesis that the system of income taxation that existed in Russia until 2021 did not help reduce income inequality but on the contrary, exacerbated it, which is particularly evident on the regional level. We have also explored the possibilities of using statistical indicators of inequality and Gini indices to study the regional disparities in tax revenues.

In the choice of the regional-level statistical indicators of inequality this research drew on the studies by Salmina [23] and Pugachev [27], taking into account the strengths and weaknesses of the chosen indicators as described in Burkholder [24] and Klasen [25]. The Gini index was calculated by applying one of the most popular approaches – by using the covariance formula of Pyatt et al. [26].

The flat income tax with the rate of 13% resulted in a situation where income taxation had become a factor that increased regional disparities in terms of tax revenues. This may also signify an increase in income inequality of citizens stemming from the implementation of the flat-rate tax system. Importantly, even the rather broad system of PIT deductions did not result in the reduction in taxpayers' inequality.

The question of the impact of PIT deductions on inequality should be studied separately. The absence of any significant impact of tax deductions on inequality reduction can be explained the following way. Since the social deductions and tax credits for parents are insignificant, property-related and investment deductions create a hidden regression in income taxation, which means that the effective rate of tax decreases as the taxpayers' ability to pay increases [28]. This situation results from the low income level combined with the high real estate prices and the poorest people's inability to invest in the stock market. As a result, the current system of personal tax deductions and credits does not bring any reduction in inequality.

Another important finding is that GRP and income are distributed more evenly compared with regional governments' PIT revenues and tax revenues in general. Thus, the PIT in Russia does not help mitigate inequality on the regional
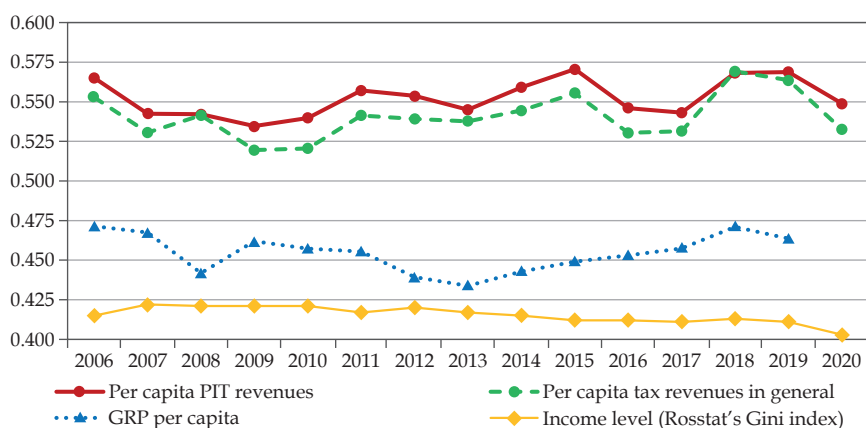
Figure 2. **Dynamics of the Gini indices on per capita PIT revenues to the consolidated budgets of Russian regions, tax revenues in general, GRP per capita, and the Gini index in 2006–2020**

Source: Compiled by the author by using Rosstat data (https://www.fedstat.ru/indicator/42928, https://www.fedstat.ru/indicator/31557, https://www.fedstat.ru/indicator/31165) and FTS data (https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/)

level or address the disproportions in regional governments' revenues. In order to reduce regional inequality, it might make sense to switch from the pay-as-your-earn system (employers deduct the tax directly from the taxpayer's wages) to the pay-where-you-live system. This will be conducive to the redistribution of tax revenues from the regions with the largest labour force (Moscow, St.Petersburg, regions with million-plus cities, extractive regions of the North) in favour of the regions where the taxpayers actually reside.

The government's social transfers have a more significant influence on income inequality than the flat personal income tax. This was shown through the correlation-regression analysis of the relationship between inequality and welfare described with the help of a modified Kuznets curve and the impact of income taxation on this relationship [29].

The introduction of the progressive rate in 2021, with the rates of 13% or 15% for those earning over 5 million rubles per year, was a major but insufficient step towards reducing income inequality. We believe that the PIT structure should be made more progressive and that a personal tax-free allowance should be introduced. It should, however, be noted that the introduction of a tax-free allowance will not help reduce income inequality in regions but, on the contrary, might increase it because in the regions with the lowest PIT revenues, many taxpayers have low incomes of which the tax-free allowance will make a significant part, which will result in considerable losses in the tax revenues of regional budgets. For more prosperous regions, the losses caused by the introduction of the tax-free allowance will not be critical [27].

These findings regarding the absence of the flat income tax's positive effect on the reduction in income inequality confirm the above-cited research – Pinskaya [21], Mayburov [22] for Russia, Tanchev [17] for Bulgaria, Ilie [19] and Mihaescu et al. [20] for Romania, and Moździerz [18] for other Eastern European countries where the flat personal income tax is currently applied or used to be applied.

There is evidence provided by Piketty et al. [4] for the USA that the flat tax exacerbates income inequality: they have shown that an increase in inequality has correlated with the declining progressivity of the tax system in recent decades. These findings also agree with those of Duncan et al. [13] on the inequality in 55 countries in 1981–2005.

Our findings provide a more in-depth understanding of the conclusion made by Parfenova et al. [7] that while taxes in Russia are not the cause of regional disparities, they serve to compensate for them. This study takes her conclusion even further by showing that income taxation not only fails to mitigate inequality but in fact exacerbates it on the regional level.

What distinguishes this study from the previous research on the topic is that it evaluates the indicators of inequality of Russian regions by looking at the dynamics of their PIT revenues. These figures are compared with tax revenues in general and with the figures characterizing the distribution of GRP. It is shown that GRP and income are distributed more evenly in comparison with the tax revenues and PIT revenues of regional governments. This new approach to the analysis of the relationship between income taxation and inequality has also confirmed that the income taxation system that had existed in Russia until 2021 not only failed to reduce income inequality but actually exacerbated it.

The search for instruments that could increase the redistributive impact of tax systems and thus mitigate inequality holds a high potential for future research.

6. Conclusions

Inequality is a major problem in many countries of the world. In Russia income inequality is a persistent challenge. The tax system, in particular income taxation, along with the redistribution mechanism in the state financial system is expected to reduce inequality.

The majority of countries use progressive income taxation to bring down inequality. In Russia, however, as well as in some other post-Soviet countries, until 2021 there had been a flat tax on per-

sonal income, which means that the tax base that high earners represent remained largely untapped.

This study relies on the data on 85 Russian regions covering the period from 2006 to 2020 and on the set of 7 inequality indicators to test the hypothesis that the flat income tax which had been in use in Russia until 2021 not only failed to mitigate income inequality but actually exacerbated the problem, which is particularly evident on the regional level. The analysis of the dynamics of the statistical indicators shows a high degree of income inequality in Russia, especially on the regional level. In 2006–2020, the level of inequality was relatively stable with a slight decrease in 2008–2010. Income inequality measured through the Gini index calculated by Rosstat demonstrated an insignificant downward trend. No considerable change in regional wealth inequality was detected and it steadily remained at a high level.

The practical significance of this study resides in the importance of exploring the potential of income taxation as a tool for decreasing income inequality, including its particular manifestations in the regional context.

The introduction of the progressive PIT in 2021 may contribute to the reduction in inequality although it is but a first step in the process. In order to tackle the problem of income inequality more efficiently, it is necessary to develop new tools both within the tax system and the system of distribution of the government's transfers.

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