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Sectoral determinants of sub-federal budget tax revenues: Russian case study

JEL Classification: H20; H61

Keywords: *sub-federal budgets; tax revenues; sectoral structure of economy; level of tax absorption; inter-regional inequality*

Abstract

Research background: The research is based on the assumption that the sectoral structure of economy has a significant impact on the level and dynamics of sub-federal budget tax revenues. It distinguishes the following sectoral determinants of tax revenues in regions: the levels of tax return and tax absorption, inflation and economic growth in various economic activities.

Purpose of the article: We aimed at assessment of contribution of economic activities and their determinants to the increase in tax revenues of sub-federal budgets of the Russian Federation in 2011–2015 compared to 2006–2010.

Methods: Development of a four-factor additive-multiplicative model of the tax revenue formation in regions, application of the proportional and logarithm methods of factor analysis to assessment of contribution of various activities and their determinants to increase in tax revenues of sub-federal budgets, evaluation of inter-regional inequality of tax revenues growth based on the weighted coefficient of variation, and decomposition of this inequality using the A. Shorrocks technique.

Findings & Value added: We identified activities that made the largest contribution to the increase in tax revenues of the Russian sub-federal budgets. We found that the inflation factor had a predominant positive effect on the growth of tax revenues, while the contribution of the economic growth factor was 4 times less; however, the situation in various activities differed significantly. Generally, changes of sectoral levels of tax return and tax absorption influenced negatively the regional tax revenues. In addition, they moved in opposite direction in the regions. Ultimately,

the uneven change in tax returns and price levels in the mining and manufacturing activities of Russian regions made the greatest contribution to inter-regional inequality of the growth of sub-federal budgets tax revenues.

Introduction

The sectoral structure of economy and its dynamics have a significant impact on the formation of tax revenue of a particular region or country. The sectors (economic activities) differ in their financial conditions, which affects the level of their tax return. Due to the differences in income and tax structure, the share of tax revenues remaining in the constituent entities of the Russian Federation after their distribution in the budget system varies greatly. In particular, in Russia, the mineral extraction tax (MET) and value added tax (VAT) are fully transferred to the federal budget. The personal income tax wholly remains at the regional level, while the profit tax is split between the federal and regional budgets (during the period under study, this proportion was 2% to 18%, respectively).

The sub-federal budgets tax revenue growth depends on the change of tax rate and its sectoral composition, as well as on the pace of the total tax base, which can be likened to gross value added (GVA). In turn, the growth of GVA in regions also depends on the sectoral structure of regional economies and includes two components: a rise in the price level and an increase in production.

The purpose of this study is to assess the contribution of sectoral factors of the regional economies to the growth rates of tax revenues of sub-federal budgets and their inequality in the constituent entities (hereinafter referred to as regions) of the Russian Federation in 2011–2015 compared to 2006–2010.

To achieve this purpose, we developed an authentic additive-multiplicative model that allowed us to distinguish the influence of the determinants of economic activity, including the level of tax return, the level of tax absorption (the share of collected taxes remained in the sub-federal budgets after their distribution in the budget system), increase in production and inflation, on the growth of tax revenues of the sub-federal budgets of the Russian regions. To assess the contribution of these determinants to inter-regional differences in the tax revenue growth rates we have applied the A. Shorrocks technique of inequality decomposition.

The rest of the paper is arranged as follows. In the “Literature review”, we examine relevant studies on determinants of sub-federal budget revenues in various countries in general and in Russia in particular. In the “Research methodology”, we disclose the data included in our research and

their processing method. The “Results and Discussion” section presents our assessments of the contribution of four factors to sub-federal budget tax revenues at two levels (national and regional average), as well as evaluations of their contribution to interregional inequality of sub-federal budget tax growth. In this section, we will also discuss in detail the impact of differences in the sectoral structure of regional economies on the dynamics of their tax revenues. The “Conclusions” section summarizes the obtained results, reveals their importance and limitations, and determines the prospects for future research.

Literature review

Modern scientists paid special attention to in-depth studies of the factors that influenced regional tax revenues of sub-federal budgets. They emphasized the fact that tax incomes depended on the institutional peculiarities of the tax system (tax structure, rate, benefits and preferences), as well as on taxpayers’ behavior (their level of fiscal responsibility and degree of tax evasion), the dynamics of macroeconomic indicators and the sectoral structure of economy. In addition, they analyzed the impact of intergovernmental relations and the system of tax sharing on the formation of regional tax revenues.

A number of researchers studied structural interconnections within the tax system. Some of them (Das-Gupta & Gang, 2000, p. 177) analyzed the impact of the tax structure, the level of tax rate, the amount of tax relief and the degree of tax evasion on tax revenues in the Indian economy. Other researchers (Braun & Otsuka, 1998, pp. 259–270) attempted to build an optimal tax portfolio, taking into account the interaction of macroeconomic conditions and the tax system parameters. In Serkah and Abizadeh (2005, pp. 2251–2263), based on the data of OECD countries for 1980–1999, the authors studied the response of the tax systems to economic growth. They discovered that various taxes responded to per-capita GDP growth in different ways: the property tax and the tax on securities income showed a positive reaction, while the negative impact was typical for payroll taxes and indirect taxes.

Many scholars have investigated the impact of various macroeconomic determinants on tax revenues in some countries and regions. They tested how tax revenue was influenced by such factors as inflation, unemployment, tax shocks (Heim, 2017, pp. 303–308); GDP, levels of employment, national debt and foreign direct investment, current and effective tax rates (Andrejovská & Puliková, 2018, pp. 133–141); population density, house-

hold spending, national income per capita, and export and import indicators (Sharma & Singh, 2015, pp. 18–29).

The works which studied the effect of the sectoral structure of economy along with macroeconomic conditions on the level of tax revenue should be noted separately. For example, Sharma and Singh (2015, pp. 18–29) included in their model such independent variables as the growth of certain sectors (agriculture, industry, services sector). Another researcher (Karagöz, 2013, pp. 50–63) built a regressive dependence of tax revenue in Turkey on the shares of agricultural and industrial sectors in the country's GDP, the level of foreign debt, the level of economy monetization and the degree of the country's urbanization. The study of Carrol (2009, pp. 27–48) evidenced that the diversity of the sectoral structure of economy can reduce the volatility of tax revenues, while the complexity of the tax system can reinforce it.

Apart from purely macroeconomic and structural determinants, some researchers included in their models the institutional and behavioral factors that presumably influenced the tax revenue of some territories. For example, Castro and Camarillo (2014, pp. 35–59), using longitudinal data, analyzed the impact of economic, structural, institutional and social factors on the dynamics of tax revenue of 34 OECD countries in 2001–2011. The authors concluded that GDP per capita, the share of industrial sector and the level of civil liberties had a positive effect on tax revenue. At the same time, the share of the agricultural sector and the volume of foreign direct investment had a negative impact on tax revenue. It was especially emphasized that the extent to which input variables affect the output variable depended on the general level of a country's economic development.

In the context of the study of sub-federal budgets tax revenues, it is worth noting the works that analyzed the distribution of tax revenue among the levels of the budget system (Bizioli & Sacchetto, 2011, p. 770) and implications of fiscal decentralization for sufficiency of regional budgets (Zhang, 2016, pp. 21–49).

Tax revenue of consolidated budgets of the Russian Federation constituencies was also studied from the standpoint of the characteristics of the tax sharing system (distribution of taxes among federal, regional and municipal levels). The research of Malkina (2016, pp. 16–37) showed that the tax sharing system in the Russian Federation contributed significantly to the leveling of the Russian regions in terms of budget sufficiency. In the paper by Yushkov (2015, pp. 404–418) it has been demonstrated that the centralized distribution of resources in the Russian budget system had a positive effect on economic growth in the Russian regions in 2005–2012. Other authors Martinez-Vazquez and Timofeev (2014, pp. 469–489), on the con-

trary, found the negative impact of inter-budgetary equalization through the tax sharing and grants distribution on economic growth in Russian regions in 1999–2008.

In another paper Mishustin (2016, pp. 8–27) dedicated to Russian tax system, there has been assessed a differential impact of various groups of factors (socio-economic and legislative ones, those of tax administration) on the receipt of the most profitable taxes (profit tax, personal income tax, value added tax, MET and excise duties).

The researchers applied various methods of tax revenue analysis. Most of them preferred to build multiple regressions (e.g. Mahdavi, 2008, pp. 607–617). Much more rarely, the scholars developed strict functional dependencies for tax revenue or tax return, to which the methods of deterministic factor analysis were applied (Clausing, 2007, pp. 115–133; Ohno *et al.*, 2015, pp. 333–360). Among them, it is important to mention our previous research (Malkina & Balakin, 2016, pp. 11–24), where, using the methods of factor analysis for the worked out DuPont-type model, we evaluated the influence of the determinants on the tax revenues in the regions of the Russian Federation.

Our current study develops the above mentioned approaches. Its novelty consists in inclusion of the sectoral determinants of macroeconomic, institutional and inter-budgetary origin to our new model.

Research methodology

In our research, we employed the official data of the Russian Federation State Statistics Service on gross value added (GVA), its deflators and volume indices for 80 Russian regions in 2006–2015. This data was used both for the entire economy and with a breakdown by main types of economic activity in accordance with the All-Russian Classification of Economic Activities. We also applied the data of the Federal Tax Service of the Russian Federation on the collected tax revenues in the Russian regions and their distribution among the levels of the budget system (federal and sub-federal budgets) with the economic activities under research disaggregated.

When processing the data, we made an assumption. Tax revenue from the mining sector in Moscow has been referred to the financial sector, because GVA of Mining and quarrying in the capital city equals zero. A considerable amount of tax revenue from this sector in Moscow was due to the headquarters of some large mining companies, whose assets are actually located in other regions.

We suggested the following additive-multiplicative model of formation of tax revenues of sub-federal budgets:

$$Tr_i = \sum_{k=1}^K \frac{T_{ik}}{Y_{ik}} \cdot \frac{Tr_{ik}}{T_{ik}} \cdot \frac{Y_{ik}}{Y_{ik}^*} \cdot Y_{ik}^* = \sum_{k=1}^K t_{ik} \cdot \tau_{ik} \cdot P_{ik} \cdot Y_{ik}^*, \quad (1)$$

where: Tr_i is own tax revenue of the i -th region. All other indicators in the model refer to the k -th economic activity in the i -th region: T_{ik} is collected tax revenue; Y_{ik} is GVA; $t_{ik} = T_{ik} / Y_{ik}$ is tax return; Tr_{ik} is tax revenue from the relevant activity that remain in the region after the distribution of taxes in the budget system; $\tau_{ik} = \frac{Tr_{ik}}{T_{ik}}$ is the level of tax absorption; Y_{ik}^* is

GVA in real terms; $P_{ik} = \frac{Y_{ik}}{Y_{ik}^*}$ is deflator index.

Based on this model, we assessed the impact of economic activities and their determinants on the change in the own tax revenues of the sub-federal budgets of Russian regions in 2011–2015 compared to 2006–2010.

To assess the contribution of economic activities to the growth of tax revenues in Russian regions, we applied the proportional method of factor analysis. The contributions of sectoral determinants within each k -th economic activity was evaluated using the logarithmic method of factor analysis:

1) the contribution of tax return (t_{ik}):

$$\Delta Tr_{ij} (\Delta t_{ijk}) = \Delta Tr_{ijk} \cdot \frac{\ln(t_{ijk} / t_{ij-1k})}{\ln(Tr_{ijk} / Tr_{ij-1k})}; \quad (2)$$

2) the contribution of the level of tax absorption (τ_{ik}):

$$\Delta Tr_{ij} (\Delta \tau_{ijk}) = \Delta Tr_{ijk} \cdot \frac{\ln(\tau_{ijk} / \tau_{ij-1k})}{\ln(Tr_{ijk} / Tr_{ij-1k})}; \quad (3)$$

3) the contribution of the level of inflation (P_{ik}):

$$\Delta Tr_{ij}(\Delta P_{ijk}) = \Delta Tr_{ijk} \cdot \frac{\ln(P_{ijk} / P_{ij-1k})}{\ln(Tr_{ijk} / Tr_{ij-1k})}; \quad (4)$$

4) the contribution of economic growth (Y_{ik}^*):

$$\Delta Tr_{ij}(\Delta Y_{ij}) = \Delta Tr_{ijk} \cdot \frac{\ln(Y_{ij} / Y_{ij-1})}{\ln(Tr_{ijk} / Tr_{ij-1k})}. \quad (5)$$

The relative impact of each sectoral determinant (hereinafter referred to as X) on the tax revenue growth was calculated as follows:

$$\varphi_{Xijk} = \Delta Tr_{ij}(\Delta X_{ijk}) / Tr_{ij-1}. \quad (6)$$

To evaluate the contribution of determinants nation-wide, we used two approaches: 1) aggregated approach based on the summarized data of the country; 2) disaggregated approach which was the sum of each activity determinant contribution in all regions.

The inter-regional inequality of the tax revenue growth was assessed by means of the coefficient of variation (CV), where the share of each i -th region in the consolidated tax revenues in the basic period ($d_{ij-1} = Tr_{ij-1} / \sum_{i=1}^m Tr_{ij-1} = Tr_{ij-1} / Tr_{j-1}$) was used as a weight. Similarly, we calculated the inter-regional coefficient of variation of contribution of each X-th determinant to the regional tax revenue growth:

$$CV(\varphi_{Xijk}) = \frac{\sigma(\varphi_{Xijk})}{\overline{\varphi_{Xijk}}} = \frac{\sqrt{\sum_{i=1}^m (\varphi_{Xijk} - \overline{\varphi_{Xijk}})^2 \cdot d_{ij-1}}}{\overline{\varphi_{Xijk}}}, \quad (7)$$

where $\sigma(\varphi_{Xijk}) = \sqrt{Var(\varphi_{Xijk})}$ is the standard deviation of the contribution of the X-th determinant; $\overline{\varphi_{Xijk}} = \varphi_{Xjk} = \sum_{i=1}^m \varphi_{Xijk} \cdot d_{ij-1}$ is the average contribution of the X-th determinant in the country.

However, the contribution of the determinants to inter-regional inequality of the tax revenue growth depended not only on their own variation, but also on their mutual influence on each other. This fact was taken into account in the technology of inequality decomposition developed by Shorrocks (1982, pp. 193–212). Using this technique, we evaluated the contribution of all the determinants in all activities to the inter-regional inequality of the tax revenue growth:

$$\text{Var}_i(\varphi_{ij}) = \sum_{X=1}^4 \sum_{k=1}^K \text{Cov}_i(\varphi_{Xijk}; \varphi_{ij}), \quad (8)$$

$$\text{Cov}_i(\varphi_{Xijk}; \varphi_{ij}) = \sum_{i=1}^m (\varphi_{Xijk} - \varphi_{Xjk}) \cdot (\varphi_{ij} - \varphi_j) \cdot d_{ij-1}, \quad (9)$$

where: $\varphi_{ij} = \sum_{f=1}^4 \sum_{k=1}^K \varphi_{Xijk}$ is the growth of tax revenue in the i -th region in the j -th period due to all the determinants in all activities, φ_j is the same on the country level.

The application of the suggested methodology allowed us to decompose the tax revenue growth in the country and in the regions by all the activities under consideration and their determinants, as well as to identify which of them influenced the most and, to a lesser extent, the change of tax revenue of sub-federal budgets. In addition, the use of this technique elicited the contribution of the above factors to the level of inter-regional differences in the growth rates of the sub-federal budgets tax revenue.

Results and discussion

We shall commence with the analysis of the dynamics of tax revenue in the Russian regions. First of all, the growth of own tax revenue of the consolidated sub-federal budgets of the Russian Federation in 2011–2015 compared to 2006–2010 was 66%. In the regions, this growth ranged from 30% (in Vologda region) to 249% (in Sakhalin region). The tax revenues from economic activities in sub-federal budgets also changed very unevenly.

Table 1 shows the main determinants of tax revenue growth in the economic activities and nation-wide. It attests that the sectoral structure of

regional economies has substantially influenced the level and dynamics of tax revenue of sub-federal budgets.

The economic activities of Russian regions differed both in *the level of tax return* and its change. Indeed, the level of tax return in Mining and quarrying exceeded the country average by 2.5–2.8 times. The increased tax return was also observed in the joint sector of Financial intermediation and Real estate. Meanwhile, Agriculture and Fishing activities demonstrated the lowest level of tax return, which was only 12–16% of the country average. A major share in the Russian economy belonged to three activities with very different levels of tax return. Namely, Trade was characterized by a low level of tax return, Manufacturing showed an average level of it, and Mining demonstrated a high tax return level. Since the sectoral structures of regional economies were considerably differentiated, the levels of tax return in them varied a lot: from 5% in Dagestan (where Trade, Construction and Agriculture predominated) to 50% in Tyumen region (where Mining played a crucial role in the sectoral structure of economy).

In the reference period, the average tax return in Russian regions showed a minor drop, which negatively affected the sufficiency of sub-federal budgets. A positive effect of the tax return growth in Manufacturing, which amounted to 2.4 percentage points (p.p.), was partly offset by a reduction of this activity's share in the total GVA from 18.4% to 17.4%. At the same time, a significant increase in the tax return of Mining (6.4 p.p.) was strengthened by an increase in its share in the country's GVA from 10.4% to 11%. A considerable drop in the tax return of the joint sector of Financial intermediation and Real estate was accompanied by an increase of its share in the country's GVA (from 11.4% to 12.4%), while a minor drop of the tax return of Agriculture and Fishing came along a permanently low share of these activities in GVA (4.85% and 4.86% in the corresponding periods).

The economic activities also differed in the *level of tax absorption*. Tax revenue from Mining and quarrying was basically transferred to the federal budget (because of the mineral extraction tax paid by this sector, which is mainly allocated at the federal level), and just 17–21% of it remained in the regions. At the same time, in the low-profit activities of the social sphere and Public administration the major part of tax revenue (over 90%) was left at the regional level. In these activities, the personal income tax, which was completely retained in the sub-federal budgets, prevailed in the overall structure of tax revenues (e.g., in 2015 in Public administration it was 90%, in Education — 76%, in Health and social services — 80%). An average level of tax absorption was found in Construction, Manufacturing and Elec-

tricity, gas and water supply, where almost half of all tax revenue was formed by VAT, which was fully transferred to the federal budget.

In the reference period, the average level of tax absorption in the regions dropped, which meant an increase in the share of tax revenue transferred to the federal budget. It should be emphasized that the level of tax absorption decreased the most in the activities with the highest growth of tax return (Manufacturing and Mining). Simultaneously, it increased the most in the activities with the greatest drop in tax return (Agriculture, Fishing, Real estate and Financial activities, Public administration, Transport and communications).

Besides the overall level of tax return in the activities and the peculiarities of tax distribution among the levels of Russian budget system, the change in tax revenues of the regions was affected by a change of their tax base, i.e. GVA of each activity. The growth of GVA in the activities varied greatly, which caused fluctuations in the sectoral structures of regional economies. This was due to the uneven change in the real and inflationary components of the tax base in various activities.

The inflation factor has greatly influenced tax revenues in Public administration, Education, Health and social work, Mining and quarrying, Construction and in the sector of natural monopolies (Electricity, gas and water supply). Its least influence was in Agriculture and Fishing.

The economic growth factor turned out to be predominant in Agriculture and Fishing, where GVA in constant prices increased by 40%. This was partly due to the fact that this sector took advantage of the policy of import substitution. For comparison, GVA in real terms in Manufacturing grew by 19%, while in the sector of natural monopolies and Education it even decreased by 2% in each.

Table 2 presents the results of factor analysis, which was carried out using formulas 2–6. It allowed us to precisely assess the contribution of various activities' determinants to the growth of tax revenues of sub-federal budgets. For comparison purposes, Table 2 demonstrates the results of two approaches: an aggregated one (a country-scale approach) and disaggregated one (an average regional approach).

We discovered that the inflation factor made the most significant contribution to the growth of tax revenues of sub-federal budgets. It accounted for 92.4% of the total increase in tax revenues of sub-federal budgets, according to the aggregated approach, and 90.6% of it, according to the disaggregated approach. The most significant influence of the inflation factor was found in the sector of natural monopolies (Electricity, gas and water supply), where it brought about 149.9% of the total increase in tax revenue, while other factors contributed to its decline. The inflation factor was also

prevailing in Construction (its contribution there was 122.3%), the joint sector of Financial intermediation and Real estate (106.7%) and a range of other activities. The only sector where the inflation factor turned out to be not predominant was Agriculture and Fishing. It provided 56.02% of the total increase in tax revenue in this sector, while the contribution of the economic growth factor was 78.63%.

The economic growth factor in general was in charge of 21.86% of tax revenue growth of sub-federal budgets, according to the aggregated approach, and of 22.72%, according to the disaggregated approach. Its contribution was above the average in Financial intermediation and Real estate, Manufacturing, Transport and communications. Taken together, economic growth in these three industries provided 16.58% (16.46%) of additional tax revenue of sub-federal budgets. At the same time, the decline in production in the sector of natural monopolies and Education slightly influenced the volume of tax revenue, causing a drop of 0.29% (0.24%).

Two other factors, the level of tax return and the level of tax absorption, promoted a decrease in tax revenue. Their negative contributions to the change of tax revenue were 10.44% (9.69%) and 3.82% (3.59%), respectively. The impact of these factors on the change of tax revenue in various activities was diverse. The sub-federal budgets' major losses were caused by a decrease in the tax return in Financial intermediation and Real estate sector: -13.93% (-12.24%). Meanwhile, over half of these losses were compensated by an increase in the level of tax absorption in these activities: +6.98% (+7.07%). The most significant growth of sub-federal budgets tax revenue was brought about by the increase of tax return in Mining and Manufacturing, which provided 7.41% (6.42%) of additional tax revenue. However, there has also been found a compensatory effect, which turned out to be surpassing. Namely, the decrease in the level of tax absorption in these activities led to an even larger cut in the sub-federal budgets tax revenue: -10.71% (-9.86%).

The differences in the assessments resulting from the aggregated and disaggregated approaches were explained by the inter-regional variation of determinants in regions. The inter-regional coefficient of variation of tax revenue growth was 0.370. The largest variation was observed for the level of tax absorption ($CV = -6.821$) and the level of tax return ($CV = -3.329$) in the regions. The least variation was found for the economic growth rates ($CV = 0.646$) and inflation ($CV = 0.225$). However, the contribution of these determinants to the inter-regional inequality of tax revenue growth was not only due to their own variation, but also because of their mutual influence.

Table 3 shows the results of the bi-dimensional (by activities and their determinants) decomposition of the inequality of regional tax revenues growth, obtained using the A. Shorrocks technique (formulas 8–9).

The assessments clearly testified to a major impact of Mining and Manufacturing on differences in the tax revenues growth in the regions. For the four determinants analyzed, 46.25% of inter-regional differences in the growth rates of sub-federal budgets tax revenue were caused by uneven changes in tax return, 98% of which came from the Mining and Manufacturing; 40.36% of these differences were due to an uneven price growth; 19.12% by uneven economic growth in the regions. At the same time, the level of tax absorption contributed to the leveling of inter-regional differences in the tax revenues growth by 5.73%. It was explained by its changes in the opposite direction to the changes in the level of tax return in the regions (the regions, where the tax return grew, increased their share of tax transfer to the federal budget, and vice versa).

Conclusions

This paper suggests an additive-multiplicative model of the formation of tax revenue of the sub-federal budgets. On its basis, using the mixed methods of factor analysis an assessment has been made of the contribution of various economic activities and their determinants, such as the level of tax return, the level of tax absorption, economic growth and inflation into the growth of tax revenue of sub-federal budgets in the Russian Federation in 2011–2015 compared to 2006–2010.

It was found that the largest contribution to the growth of tax revenue at the country level was made by Manufacturing, the joint sector of Financial intermediation and Real estate, Trade and Mining. Among the determining factors, it was the rise in prices that had a predominant effect on the tax revenues growth, primarily in Mining and Manufacturing. This conclusion is consistent with the results of the study of the United States economy (Heim, 2017, pp. 303–308), where the inflation factor of tax revenues turned out to be predominant, too. However, in another research which studied tax revenue in developed countries (Andrejovská & Puliková, 2018, pp. 133–141), the hypothesis about inflation being the major impact factor was not evidenced, so it was the employment level that proved to be prevailing.

In the Russian regions, the positive impact of economic growth on regional tax revenues was 4 times less than the positive impact of the infla-

tion factor, but the former was the main source of tax revenues to sub-federal budgets from agriculture.

The decrease in the levels of tax return and tax absorption on average negatively influenced the tax revenue of sub-federal budgets, albeit the situation in the economic activities varied. We also found an inverse relationship between changes in the level of tax return and the level of tax absorption in the regions, which caused a compensatory effect in the regional budget system.

The difference in the assessments of determinants' contribution to the tax revenue growth at the aggregated (country) and disaggregated (average regional) levels was explained by the variation of these determinants in the regions, as well as by their interconnection. Decomposition of the inequality of the growth rates of own tax revenues in the regions using the A. Shorrocks technique elicited that this inequality was mainly contributed by the uneven level of tax return and inflation in Mining and Manufacturing.

We comprehend that our study has certain limitations.

Firstly, the spatial mismatch between the legal addresses of some companies and the actual location of their production led to a certain discrepancy in tax revenues and gross value added in some sectors of the Russian regions. This primarily relates to the Mining industry, but also applies to Agriculture and Financial intermediation activities. We solved this problem by combining industries (for example, Agriculture and Fishing) or by assigning tax revenues from the Mining industry in Moscow to the Financial intermediation, which was a definite assumption. However, the division of tax revenues from the Mining industry in the capital city between the extractive regions, whose head offices are located in Moscow, would be difficult to implement, let alone justify, because in fact these revenues are collected and distributed in Moscow.

Secondly, consideration of the aggregated five-year periods smoothed out the annual fluctuations in tax returns, but it enabled to identify long-term changes in tax revenues of sub-federal budgets. The annual fluctuations in tax returns in the Russian regions are not only macroeconomic but also institutional by nature. Significant changes in tax returns in regions can be resulting from various political decisions to support certain enterprises in special economic zones by providing them with temporary tax reliefs and rebates. It fits into the mechanism of manual management in the budget system, which is a special topic within Russian studies that requires an in-depth independent analysis.

In general, the outcomes of our research may be applicable to a detailed analysis of tax revenues in certain regions of the Russian Federation and across the country. Further extension of the research is possible in a way of

profound analysis of tax revenue formation within economic activities (which means their deeper disaggregation). In addition, sectoral decomposition of tax revenue within tax types will also allow to obtain more precise results and conclusions in the future.

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Annex

Table 1. The dynamics of indicators of the regional tax sphere and factors influencing them disaggregated by main economic activities (%)

Economic activity*	Share in GVA, d_k		Level of tax return, t_k		Level of tax absorption, τ_k		Economic growth, $\frac{Y_{kt}}{Y_{kt-1}}$ *	Inflation, $\frac{P_{kt}}{P_{kt-1}}$
	2006-2010	2011-2015	2006-2010	2011-2015	2006-2010	2011-2015	$\frac{Y_{kt}}{Y_{kt-1}}$ *	$\frac{P_{kt}}{P_{kt-1}}$
AB	4.9	4.9	3.4	2.6	106.6	121.3	1.40	1.27
C	10.4	11.0	51.9	58.3	21.3	17.2	1.07	1.77
D	18.4	17.4	19.9	22.3	67.2	58.2	1.19	1.40
E	3.9	3.8	19.5	16.5	54.0	54.0	0.98	1.77
F	6.6	7.0	18.1	15.2	47.2	46.5	1.09	1.74
G	20.3	18.6	11.1	12.4	69.7	70.6	1.05	1.55
H	1.0	1.1	13.5	12.6	66.6	61.3	1.13	1.64
I	10.3	9.7	17.4	14.5	60.6	64.2	1.15	1.45
JK	11.4	12.4	34.6	24.6	62.7	71.1	1.19	1.63
L	4.8	5.4	11.4	10.9	93.4	96.0	1.01	1.99
M	3.0	3.2	12.8	13.8	95.4	96.7	0.98	1.93
N	3.7	4.1	8.7	8.8	93.8	95.9	1.02	1.92
O	1.6	1.5	21.7	19.7	72.4	68.2	1.15	1.47
TOTAL	100.0	100.0	20.8	20.7	54.6	51.5	1.12	1.59

Note: * Hereinafter the reference letters are provided in accordance with the All-Russian Classifier of Types of Economic Activity, Products and Services: AB – joint Agriculture, hunting and forestry and Fishing; C – Mining and quarrying; D – Manufacturing; E – Electricity, gas and water supply; F – Construction; G – Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; H – Hotels and restaurants; I – Transport and communications; JK – joint Financial intermediation and Real estate, renting and business activities; L – Public administration and defense, compulsory social security; M – Education; N – Health and social work; O – Other community, social and personal service activities.

Table 2. The contribution of activities and their factors to the growth of tax revenue in the sub-federal budgets in 2011–2015 compared to 2006–2010 (%)

Activity	Level of tax return		Level of tax absorption		Economic growth		Inflation		TOTAL	
	a	b	a	b	a	b	a	b	a	b
AB	-0.5	-0.8	0.3	0.7	0.6	0.4	0.5	0.5	0.8	0.8
C	1.6	2.8	-2.9	-4.2	0.8	1.5	7.6	7.0	7.1	7.1
D*	3.2	1.4	-4.0	-2.3	4.8	4.6	9.4	9.7	13.5	13.5
E	-0.8	-0.7	0.0	0.0	-0.1	0.0	2.5	2.4	1.7	1.7
F	-1.1	-1.1	-0.1	-0.1	0.6	0.4	3.4	3.6	2.8	2.8
G	2.1	2.2	0.2	0.1	0.9	1.4	8.3	7.8	11.6	11.6
H	-0.1	-0.1	-0.1	0.0	0.1	0.1	0.5	0.5	0.5	0.5
I	-2.1	-2.1	0.7	0.6	1.6	1.6	4.3	4.3	4.5	4.5
JK	-9.3	-8.1	3.4	2.5	4.7	4.7	13.3	13.0	12.1	12.1
L	-0.3	-0.2	0.2	0.2	0.1	0.0	4.4	4.4	4.4	4.4

Table 2. Continued

Activity	Level of tax return		Level of tax absorption		Economic growth		Inflation		TOTAL	
	a	b	a	b	a	b	a	b	a	b
M	0.4	0.4	0.1	0.1	-0.1	-0.1	3.1	3.1	3.4	3.4
N	0.0	0.1	0.1	0.1	0.1	0.1	2.5	2.5	2.7	2.7
O	-0.3	-0.3	-0.2	-0.2	0.4	0.4	1.0	1.0	1.0	1.0
Total	-7.2	-6.4	-2.3	-2.4	14.5	15.0	60.9	59.6	66.0	65.8

Note: a – the results of the aggregated approach; b – the results of the disaggregated approach.

* The data of the disaggregated approach for Manufacturing has been given not including Manufacturing of the Republic of Karelia.

Table 3. The contribution of economic activities and their determinants to the inter-regional differences in tax revenue growth (%)

Activity	Level of tax return	Level of tax absorption	Economic growth	Inflation	TOTAL
AB	-1.61	0.93	0.98	0.93	1.23
C	27.77	3.98	7.60	20.37	59.71
D*	17.59	-7.17	6.70	7.29	24.40
E	-0.65	0.45	0.18	1.87	1.85
F	0.11	0.85	-1.43	1.25	0.77
G	-5.90	-0.68	4.48	-1.58	-3.67
H	-0.48	0.00	0.13	0.29	-0.07
I	0.41	-0.25	1.15	2.67	3.97
JK	11.05	-3.96	-0.79	-1.12	5.18
L	-0.65	-0.32	-0.40	4.47	3.09
M	-0.03	-0.02	0.07	1.84	1.85
N	-0.28	0.00	-0.08	1.60	1.25
O	-1.07	0.46	0.54	0.49	0.43
Total	46.25	-5.73	19.12	40.36	100.00

Note: * The data on Manufacturing in the Republic of Karelia was excluded as an outlier.