Comparative Analysis of the Tax Burden on Innovative and Non-Innovative Sectors of Manufacturing in Russia

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***Abstract* — The purpose of this paper is a comparative analysis of the tax burden on innovative and non-innovative sectors of manufacturing industry in Russia. We analyze the differences between innovative subsection DL "Manufacture of electrical and optical equipment" and non-innovative section D "Manufacturing" at the Russian regional level using methods of statistical analysis. We found that the level of the tax burden on innovative subsection DL is not lower than on non-innovative section D. It was not discovered though a stimulating effect of taxation on innovative development. Cluster analysis confirmed statistically significant differences in the level of tax burden on subsection DL by regions. We identified several regions with low tax burden. Tax incentives can be used to stimulate industrial development in these territories.**

Keywords — tax burden; innovative development; statistical analysis; manufacture of electrical and optical equipment; manufacturing industry; Russian regions

I. INTRODUCTION

Many current scientific studies have questioned the effect of the tax burden level on economic and innovative development of certain countries and territories. In economic studies, scientists conduct extensive researches on impact of tax rates, tax reform, progressive taxation scales, preferential taxation on enterprise performance and economic growth [1, 2, 3, 4]. Based on revealed regularities, scientists develop proposals to improve the taxation systems in individual countries and territories. The effect of taxation on the innovative development is studied in [5, 6]. Currently the effect of tax incentives to encourage investment in research and development are being studied intensively. Scientists confirm the effect of tax benefits on R & D investment. However, it is noted, that the level of such influence is lower than expected. In the works of Russian scientists the problem of the tax burden influence on economic and innovative development, including on the basis of statistical data is also studied [7, 8, 9, 10]. Note, however, that all these studies are carried out at the level of individual businesses, economy sector or regional level. The study of the tax burden across sectors and regions at the same time has not been realized yet.

In this paper we solve this problem by conducting the analysis broken down by regions, sectors and types of taxes. The purpose of our study is to compare the tax burden of innovative subsection DL and manufacturing sector (section D) and to implement cluster analysis of tax burden on subsection DL at the level of Russian regions.

The object of research is subsection DL "Manufacture of electrical and optical equipment" (subsection DL according to the NACE Rev. 1.1. or C26+C27 according to the NACE Rev. 2, Eurostat classification of economic activities). This subsection is one of the innovation-active subsections of manufacturing industry in Russia. It is also characterized by high social indicators such as employment rate and payroll fund. As an object for comparison section D "Manufacturing" is selected. It should be noted that a significant portion of D section's shipping, accounted for resource-related subsections, characterized by low innovation activity (DJ, DF). The

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research period is 2013 year. The information base includes data of tax statistics [11] and economic statistics [12] at the level of Russia and its regions. We apply the following methods of analysis: variance and cluster analysis and use software product "Statistics" for calculations [13, 14, 15, 16].

II. Research Methodology

Research is conducted at the level of Russian regions. The sample of subsection DL formed from the 30 regions with the largest volumes of products shipped in 2013 and sorted in descending order. The sample of section D is built for comparison a similar way. The indicators system for the study is presented in Table 1.

On the basis of tax and economic statistics for 2013, tax burden in a cut of regions and types of taxes was calculated. Calculation of indicators №1-7 and №10 was carried out by dividing the amount of the corresponding tax paid on volume of shipped products. For indicators №8 and №9 taxes into respective budgets (excluding excise taxes and insurance premiums) were preliminarily assessed:

- Federal budget. The corresponding part of income tax (tax statistics data is available), VAT and all other federal taxes;
- Regional and Local budgets. Part of income tax, personal income tax, regional and local taxes.

The obtained values were divided by the volume of shipped products.

It should be noted that these tax statistics does not provide information about the amount of the paid social insurance tax payments by type of economic activity and regions of Russia.

III. Results of Statistical Analysis

A. *The level of tax burden on the subsection DL broken down by regions*

The level of tax burden on the subsection DL broken down by regions and types of taxes is represented on Fig. 1. Here and below, the numbering of indicators in the figures and in the text is given in accordance with their numbering in the Table 1.

Calculations show the significant differentiation of the tax burden by Russian regions. We identified several regions with lower tax burden on subsection DL. These regions are: the Kaluga region, Kaliningrad region, Pskov region, Ulyanovsk region. Tax incentives can be used to stimulate industrial development on these territories.

B. *Comparison of the mean values of the tax burden on subsection DL and on section D (analysis of variance)*

Using analysis of variance, we compared the mean values of the tax burden on subsection DL and on section D for two samples of regions. The results of comparison are represented on Fig. 2.

In this case, the parametric F-test and Kruskal-Wallis test show that the differences between DL and D are highly significant (at $p < 0.0005$) for the indicators №1, 3, 4, 8, 9; statistically significant for №5, 7 ($0,05 > p > 0,005$); weakly significant for №2 ($0,105 > p > 0,05$) and not significant for №6, 10 ($p > 0,105$).

TABLE I. The System Of Indicators For The Analysis Of Tax Burden Of Subsection DL

№	Indicators
1	Total tax revenues (excluding excise taxes and insurance premiums) (total taxes) / shipped goods
2	Income tax (profit tax) / shipped goods
3	Personal income tax (PIT) [a] / shipped goods
4	Value added tax (VAT) / shipped goods
5	Regional taxes / shipped goods
6	Local taxes / shipped goods
7	Taxes collected in accordance with the special regimes (Special regimes) / shipped goods
8	Taxes into federal budget (Federal budget) / shipped goods
9	Taxes into regional and local budgets (Regional and local budgets) / shipped goods
10	Total tax revenues (including excise taxes, but excluding insurance payments) / shipped products

[a] In regard to the personal income tax (PIT) we note the following. The PIT is paid from the salary of the employee and has no direct effect to company's expenses. However, we do not exclude it from the analysis, because businesses are forced to take PIT into account in determining salaries, particularly in sectors with low wages.

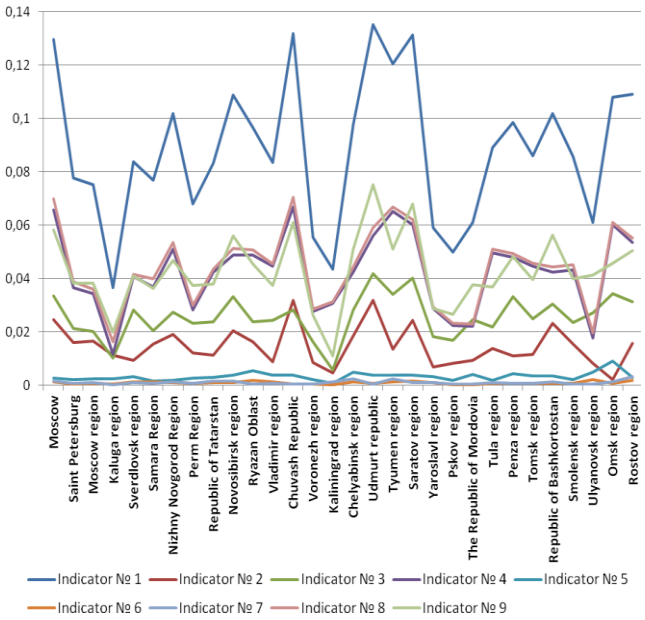

Fig. 1. The level of tax burden on the subsection DL broken down by regions and types of taxes

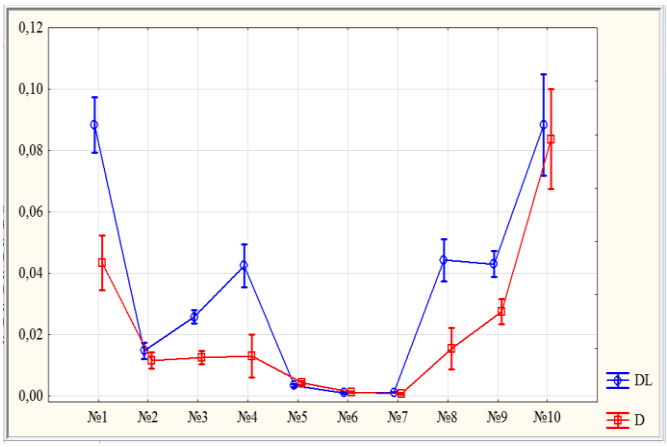

Fig. 2. Mean values of indicators for the subsection DL and section D with 95% confidence intervals

For indicators №1 (Total tax revenues (excluding excise taxes and insurance premiums)), №3 (PIT), №4 (VAT), №8 (Taxes into federal budget) and №9 (Taxes into regional and local budgets) were revealed highly significant statistical differences in the average tax burdens. Moreover, for all these types of taxes the tax burden of innovative subsection DL is much higher than in the manufacturing industry as a whole (Fig. 2). Average values are comparable in size only for indicator №10.

Thus, at the level of innovative subsection DL we have not observed any signs of tax incentives for innovation activity. Tax incentives in certain regions (Kaluga region, Kaliningrad region, etc.) does not solve the problem at the sector level, where the tax burden (excluding excise taxes) is higher than the one of manufacturing industry as a whole.

C. Cluster analysis of regions.

The regions were clustered by the indicators №8 and №9. Using the methods of tree clustering (with the unit rule of Ward's method) and k-means clustering we have combined the 30 regions in the 6 clusters. Graphically, clustering results are illustrated in the scatter plot (Fig. 3). In this Figure the number of regions in each cluster was indicated in parentheses. Table 2 shows distribution of Russian regions by clusters.

Parametric analysis of variance showed that clusters in their totality differ highly significant (significance level of p <0,0005) for indicators №8 and №9 (Table 3).

According to Table 4 (significance levels for multiple comparisons), there is no uniform (not significantly different) cluster group on set of indicators №8 and №9. For example, clusters C2 and C3 are insignificantly different by the indicator №9, but they differ highly significant by the indicator №8.

The smallness of the clusters sample assumes to control these results by rank Kruskal-Wallis test. The Kruskal-Wallis test smoothes out the differences for clusters in their totality to strongly significant (0,005> p> 0,0005). At the same time, the difference between C2 and C3 by indicator №8 is smoothed to a statistically significant level (0.05> p≈ 0.007> 0.005).

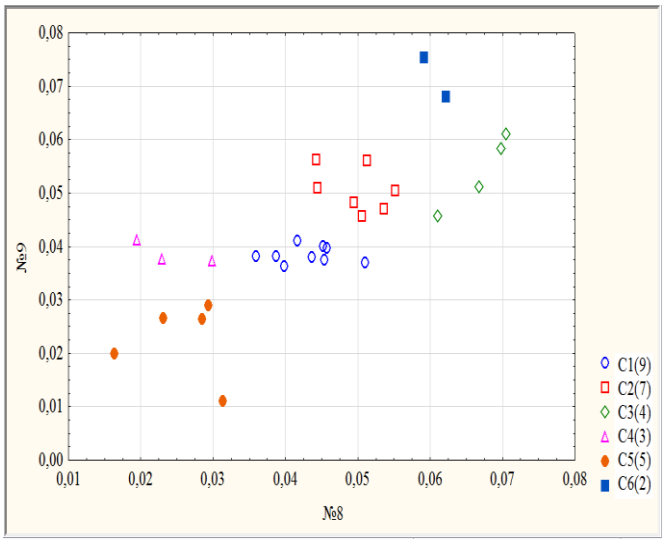

Fig. 3. Scattering of regions clusters by the indicators №8 and №9

TABLE II. DISTRIBUTION OF RUSSIAN REGIONS BY CLUSTERS

Region	Values of indicators		Cluster
	№8	*№9*	
Vladimir region	0,0454	0,0375	C1
St. Petersburg	0,0387	0,0382	C1
Moscow region	0,0359	0,0381	C1
Republic Of Tatarstan	0,0437	0,0379	C1
Samara Region	0,0399	0,0362	C1
Sverdlovsk region	0,0417	0,0411	C1
Smolensk region	0,0452	0,0399	C1
Tomsk region	0,0457	0,0396	C1
Tula region	0,0510	0,0369	C1
Nizhny Novgorod Region	0,0536	0,0470	C2
Novosibirsk region	0,0513	0,0561	C2
Penza region	0,0494	0,0481	C2
Republic Of Bashkortostan	0,0442	0,0563	C2
Rostov region	0,0552	0,0505	C2
Ryazan region	0,0506	0,0456	C2
Chelyabinsk region	0,0444	0,0510	C2
Moscow	0,0698	0,0583	C3
Omsk region	0,0610	0,0457	C3
Tyumen region	0,0668	0,0510	C3
Chuvash region	0,0705	0,0610	C3
Perm Region	0,0298	0,0373	C4
Mordovia region	0,0230	0,0376	C4
Ulyanovsk region	0,0195	0,0412	C4
Voronezh region	0,0285	0,0264	C5
Kaliningrad region	0,0314	0,0110	C5
Kaluga region	0,0163	0,0199	C5
Pskov region	0,0232	0,0265	C5
Yaroslavl region	0,0294	0,0289	C5
Saratov region	0,0622	0,0680	C6
Udmurt region	0,0592	0,0753	C6

TABLE III. VARIANCE ANALYSIS OF THE REGIONS CLUSTERING

Indicator	Between SS	df	Within SS	df	F	p
№8	26,270	5	2,730	24	46,198	0,0000
№9	26,598	5	2,402	24	53,153	0,0000

TABLE IV. RESULTS OF F-TEST FOR MULTIPLE COMPARISONS OF CLUSTERS

Indicator		C1	C2	C3	C4	C5	C6
№8	C1		0,008	0,000	0,000	0,000	0,000

	C2	0,008		0,000	0,000	0,000	0,008
	C3	0,000	0,000		0,000	0,000	0,133
	C4	0,000	0,000	0,000		0,634	0,000
	C5	0,000	0,000	0,000	0,634		0,000
	C6	0,000	0,008	0,133	0,000	0,000	
№9		C1	C2	C3	C4	C5	C6
	C1		0,000	0,000	0,921	0,000	0,000
	C2	0,000		0,259	0,001	0,000	0,000
	C3	0,000	0,259		0,000	0,000	0,000
	C4	0,921	0,001	0,000		0,000	0,000
	C5	0,000	0,000	0,000	0,000		0,000
	C6	0,000	0,000	0,000	0,000	0,000	

Clustering of regions is an important supplement to other methods of statistical analysis, in particular, analysis of variance. ANOVA allows exploring differences in rates for the whole a set of regions. Clustering provides the opportunity to explore the differences in rates at the level of certain regions or groups of regions (clusters) and identify the regions or groups of regions with atypical behavior. In this case, we find clusters C4 (including 3 regions) and C5 (5 regions), which are characterized by low tax burden.

IV. Conclusions

The conducted analysis allows us to make the following conclusions.

1. Significant differentiation of the tax burden subsection DL by regions and types of taxes is revealed. Some regions are characterized by a lower level of tax burden, which suggests the presence in these territories of tax benefits aimed at promoting industrial development.

2. Analysis of variance at the regional level of Russia showed that the level of tax burden (excluding excise taxes) of innovative subsection DL is higher than non-innovative section D. Considering the excise, tax burden of DL and D is statistically insignificant. Thus, it does not occur a stimulation of the development of innovative subsection DL due to taxes in Russia.

3. Cluster analysis confirmed statistically significant differences in the tax burden level of subsection DL by regions. A number of regions have a low tax burden. These peculiarities require further in-depth analysis of the behavior of these regions, both at the level of the tax legislation, as well as by assessing the impact of the low tax burden on DL-enterprises development.

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