



Instruments of Production Functions as Reserves of Increase in Regional Tax Revenues

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ABSTRACT

The article is devoted to the quantitative analysis of the possibilities to increase tax revenues of the regions of the North Caucasus Federal District of the Russian Federation on the basis of more efficient use of the available factors of production – labor and capital. Successfully verified approach of production functions enables to use their potential in order to study the reserves of increase in tax revenues of budgets of all levels and quantitatively substantiate their priorities as well as the prospects of regional economic policy.

Keywords: Tax Revenues, Gross Regional Product, Production Function, Factors of Production, Regional Economy

JEL Classifications: C21, H71, R10

1. INTRODUCTION

The economic heterogeneity of regional development generates a number of problems in ensuring the effective functioning of the tax system. Russian practice on fiscal federalism, based on inter-budget movement of significant financial resources under a hyper-concentration of tax powers of the federal center, is one of the limiting factors in the formation of budget revenues.

A large-scale interregional displacement of budgetary resources contributes to the reduction of interest of the sub-federal authorities in the development of “individual” tax base, and these trends are equally manifested in the federation subjects with different levels of budget sufficiency. It is obvious that the current situation requires a rethinking of conceptual priorities of the fiscal policy, related to the replacement of the paradigm of budget resources redistribution to the paradigm of their territorial formation (Ovchinnikov et al., 2010).

A detailed study on the processes of formation of tax revenues of RF subjects is necessary to be supplemented by the tools of economic and statistical modeling. The feasibility of the implication of econometric methods is defined by their heuristic

character, allowing the identification of the complex and not always obvious relationships between the aggregated meso-economic parameters and the effectiveness of the tax system (Zyuzina et al., 2014). This will not only improve the quality of the budget process, but will also establish a scientific basis for fiscal modernization of the regional economy, including taking into account the targets of increasing its fiscal capacity.

2. LITERATURE REVIEW

Turning to the existing instruments of tax revenues modeling, it is possible to identify a number of approaches that differ among themselves as by a conceptual idea underlying them, and by the specifics of applied computational tools and data sources (King, 1993).

Building traditional econometric models of tax revenue is based on the use of explanatory variables, directly or indirectly characterizing the tax base, as well as the dummy regressors, which allow to take into account discretionary changes, for example, in the rates of certain taxes (Turuntseva et al., 2005). Additional complexity in the evaluation process places the hard-identifiable group within the framework of formal models of institutional

estimates factors: The level of corruption and the shadow economy, the scale of tax evasion, which have a negative impact on the dynamics of tax revenues and increase the level of uncertainty in the simulation process.

The literature review enables to determine the following key parameters of tax revenues modeling techniques as the applied and empirical basis used in Russia: Programs of the socio-economic development of the territory, the forecast of macroeconomic indicators, changes in tax and budget legislation (Lavrov, 2007). However, these approaches hardly find their application in the practice of fiscal authorities as the instrumentality and methodological basis of analysis and planning of tax revenues.

Describing the current state of the tax system simulation at the macro level, it is necessary to allocate a number of methodological flaws, leading to a decrease in the accuracy and validity of forecasts and planning (Zyuzina et al., 2014):

- The use of mainly deterministic models that describe the processes of formation of tax revenues solely based on the positions of the tax legislation;
- Extensive involvement of the indexing methods of tax revenue with the help of the planned macroeconomic indicators deflator of the socio-economic development, which are, in fact, planning “from the achieved;”
- Overly optimistic planning, not taking into account the probability of bifurcation changes of the inertial time trend of macroeconomic indicators.

These shortcomings determine the feasibility of using the so-called “macro-economic” approach, that assumes a study of correlations in tax revenue with a small number of aggregated economic indicators (King, 1993). The best-known mathematical tool for formalization of macroeconomic parameters is the production function of the Cobb-Douglas that uses only the traditional factors of production (labor and capital) as covariates, related to the volume of gross domestic product (GDP) by the degree of dependence.

The most productive and brought up to the level of practical recommendations studies of the formation of tax revenues in the Russian scientific literature are presented in the works of Balatsky (2003), who uses industrial-institutional and fiscal-institutional functions in order to undertake quantitative analysis of Laffer points and reserves of tax revenues’ increase.

Recognizing the significant contribution of the above mentioned scholars in research and testing of tax revenue models, we shall note that the regional aspect of their formation with an emphasis on affordable mesoscale factors of production are fragmentary presented in modern literature and requires further research, including empirical verification.

3. METHODOLOGY

Quantitative study of the possibilities of increasing tax revenues of the subsidized regions of Russia assumes need for identification of macroeconomic factors in the framework of economic and statistical analysis procedures.

The simplest model of formation of the tax revenues of the region, which would take into account the index of aggregate tax base (gross regional product [GRP]), is described by the exponential function:

$$T=aY^b, \quad (1)$$

with T – Tax revenues of the region, thousand rubles,
 Y – Gross regional product, thousand rubles,
 a, b – Regression coefficients determined by calculation.

Use of this functional relationship is based on the assumption of a non-linear change in tax revenues by increasing the GRP as a result of the complex interaction of economic, administrative and institutional factors. Having obtained a compelling test results of the above function on empirical data from various countries and regions enables to make the expansion of the GRP on a more complex function of the production category.

In this study, it is assumed that tax revenues are described by exponential relationship, which is basically a production function. The covariates used are the traditional factors of production - capital and labor, while the explanatory variable is the total tax revenues collected in the territory of a particular region:

$$T=aK^bL^c, \quad (2)$$

with K – The volume of investments in the region, thousand rubles (the use of investments index instead of the traditionally used indicators of the book value of fixed assets is more preferable in terms of the adequacy of the statistical models; Gorbunov and Lvov, 2012);
 L – The number of employed in the economy of the region, thousand per.; a, b, c – Regression coefficients determined by calculation.

The “operationality” of application of this equation is determined by the fact that, according to the globally adopted classification all of the existing taxes can be divided into three groups: Capital, labor, and consumption (Mendoza et al., 1994). Taking into account the fact that the expenditure of funds for current consumption is carried out as by the capital owners, and individuals receiving remuneration for work, the taxes on consumption, ultimately, boil down to taxes on capital and labor, being distributed among them in a certain proportion.

Note that the factor of taxation in the presented model is not considered as a separate variable, as it occurs, for example, in the production and institutional function used in the works of Russian scientists (Balatsky, 2003). Simplification of the functional design is quite justified and operational, since the actual factor of the tax burden, as shown in the qualitative and quantitative analysis, also depends on the size of GDP (GRP) per capita (Zyuzina et al., 2014). In addition, the regional projection of the research on tax relations set the latter as an aggregate of stable legal and institutional parameters defined from the outside (especially at the federal regulatory level).

4. RESEARCH RESULTS

Modeling the dependence of tax revenue on the dynamics of the GRP, realized from empirical data of 2007-2013 (except for

the “emissions” – Moscow, Khanty-Mansi and Yamalo-Nenets Autonomous District, which generate extremely high per capita income), it allows to confirm the above mentioned hypothesis and ascertain the presence of a exponential functional relationship, having easily interpretable economic sense and gives the opportunity for further advanced analysis (Table 1).

The presented non-linear function of tax revenues provide a basis for ascertaining the progressive dependence of the latter on the dynamics of the aggregate tax base: GRP growth by 1% provides an increase in tax revenue by 1.11-1.14%, which, in general, indicates a relatively stable progressive relationships between the level of economic development of an individual region and its fiscal productivity.

For descriptive characteristics of the Figure 1 are considered trends, taking the form of short-term trends, one should take into consideration the following economic and institutional determinants:

- GRP growth usually leads to a change in its structural components (primarily due to the increase in the share of wages and profit in the structural elements of GRP), which, in turn, directly contributes to the fiscal exemptions potential for income taxes and personal income tax, as well as indirectly, triggers an increase in the cost of current consumption, and therefore extends the potential of indirect taxation;
- Sectoral projection of GRP indicators’ dynamics shows marked upward trend of economic growth in the regions, specializing in mining or having a diversified industrial complex; these sectors of the regional economy automatically generate higher tax revenues;
- Higher values of per capita GRP, indirectly characterizing the increased level of “regional well-being,” helps to reduce inconsistencies in tax relations through more comprehensive tax collection and loyalty of economic subjects in the area of enforcement of tax legislation.

Relative comparability of coefficients of the regression equations calculated for different years, allows us to speak about the stability of functional relationship in the studied time interval. Hence, the percentage of unexplained variance in tax revenues by 5-7% in different years of study describes regional differences in the level of tax collection, i.e., mostly the action of institutional-enforcement factors.

As the result of the regression estimation produced using the package “Statistica 6.0” multiplicative function (2) on the empirical data of Russian regions the regression equation is obtained (Table 2).

Econometric models presented in Table 2, account for about 89-92% of the variance in tax revenues of regions, the remaining 10-12% of the variance, is likely to reflect the contribution hardly measurable factors (that are statistically insignificant when combined with the analysis of macroeconomic indicators), which may include both economic (a different level of profitability of individual industries by region), and institutional enforcement determinants related to the “quality” of the tax

administration, the level of “shadow” economy, the tax debt dynamics, etc.

The calculations show a different contribution of individual factors of production in the formation of tax revenues. In particular, the growth of investment in fixed assets by 1% increases in tax revenues from 0.65% to 1.05%, while the increase in employment in the economy has an elasticity of tax revenue in the amount of 0.22-0.61%. Analysis of the significance of the coefficients (β -factors) suggests that the factor “capital” is almost twice the force of impact on the dynamics of tax revenues than the factor “labor.” This situation can be interpreted in terms

Table 1: Regression models for the formation of tax revenues in the regions of Russia in 2008-2013

Year	Type of equation	The coefficient of determination (R ²)	The elasticity of tax revenue by GRP, %
2008	T=0.047Y ^{1.114}	0.927	1.114
2009	T=0.044Y ^{1.114}	0.925	1.114
2010	T=0.036Y ^{1.127}	0.934	1.127
2011	T=0.035Y ^{1.119}	0.948	1.119
2012	T=0.039Y ^{1.111}	0.940	1.111
2013	T=0.027Y ^{1.139}	0.930	1.139

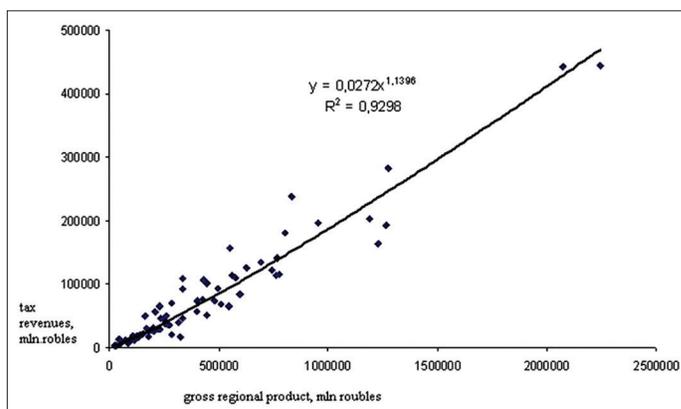
Source: Computed based on (Russian Finance, 2014). GRP: Gross regional product

Table 2: Basic dependence parameters of the tax revenues of the RF regions from the use of factors of production (i.e. capital and labor)

Year	Type of equation	The coefficient of determination	The coefficients of significance (β)
2008	T=0.57K ^{0.65} L ^{0.61}	0.91	$\beta(K)=0.55$ $\beta(L)=0.45$
2009	T=0.36K ^{0.78} L ^{0.45}	0.92	$\beta(K)=0.67$ $\beta(L)=0.33$
2010	T=0.70K ^{0.65} L ^{0.56}	0.92	$\beta(K)=0.58$ $\beta(L)=0.42$
2011	T=0.64K ^{0.66} L ^{0.57}	0.91	$\beta(K)=0.57$ $\beta(L)=0.43$
2012	T=0.55K ^{0.65} L ^{0.61}	0.89	$\beta(K)=0.65$ $\beta(L)=0.35$
2013	T=0.08K ^{1.05} L ^{0.22}	0.89	$\beta(K)=0.71$ $\beta(L)=0.29$

Source: Computed based on (Regions of Russia, 2015)

Figure 1: The relationship between the dynamics of production of gross regional product and the tax revenues of the RF regions in 2013



of macro-proportions of the economy and architectonic of the Russian tax system.

The modern economy is characterized by relatively low levels of aggregate unemployment rate, which declined from 8.3% in 2009 to 5.2% in 2014 (Sinelnikov-Murylev and Radygin, 2015). It defines a limited possibility to further increase the level of employment without investments in the creation of new jobs and, as a result, provides a lower impact on the formation of tax revenues. On the other hand, within the overall downward trend, some of the depressive subjects of the Russian Federation become highlighted, the unemployment rate in which has exceeded 10% in 2014. The most dramatic situation is the Chechen Republic and Ingushetia, where, according to regional statistics, the unemployment rate is respectively 29.8% and 29.5% of the economically active population. Therefore, these actors are able to provide an additional increase in the fiscal exemptions as a result of extensive engagement of the “labor” factor.

An indirect confirmation of a significant impact of the labor force on the fiscal performance of regions is the fact that measures of employment stimulation, implemented in a number of subjects of the Russian Federation during the crisis, ensured the stability of personal income tax. However, government support of the development of “self-employment” via the financial aid and subsidized loans to individuals who start activities in the field of SME also has a predominantly tactical fiscal effect, due to the lower burden of special tax regimes, as well as the presence of significant opportunities for “shadow” entrepreneurial activity.

In general, the simulation results allow to scientifically substantiate the priorities of economic policy on promotion of the tax “returns” of the regions. Tactical measures to increase employment, the

experience of which took place during the crisis of 2009-2010, can only partly increase fiscal efficiency of individual territories. This is evidenced by the values of the regression coefficients (β -coefficients), according to which the factor “labor” has almost twice as little effect on the dynamics of tax revenues and its elasticity was about 0.22% in 2013. However, this increase in the use of labor resources in the region is the most obvious reserve growth of its tax revenues, primarily due to the tax on personal income and, to a lesser extent, indirect taxes, the concomitant increase of which may be caused by the increased level of end-use.

On the basis of the multiplicative function, shown in Table 2 (for the situation in 2014), Tables 3 and 4 present the results of the analysis of the potential increase in the fiscal exemptions of the North Caucasus Federal District through the implementation of employment policy in two areas:

1. Providing jobs within the applications of economic entities (pessimistic scenario);
2. The total elimination of officially registered unemployment (optimistic scenario).

Comparative analysis of registered unemployment indicators and the availability of applications from business entities indicates the emergence of significant imbalances: Economically stable regions have the potential to provide jobs and thus increase tax revenue by a factor “labor,” while depressed subjects of the Russian Federation have extremely limited manufacturing capabilities to engage the unemployed in employment.

In particular, the model calculations carried out by the function of formation of regional tax revenues in 2013, demonstrate the likely increase in tax revenues in the regions of North Caucasus Federal District in providing workforce employers’ applications in the

Table 3: Analysis of growth reserves of tax revenues in implementing the pessimistic scenario of reducing unemployment in the regions of the North Caucasus Federal District

Region	Applications to the employment service organizations. thousand people	Probable increase in tax revenues	
		Absolute, thousand rubles	Per capita, rub. per person
The Republic of Dagestan	0.669	21.35	0.01
The Republic of Ingushetia	0.128	1.97	0.00
Kabardino-Balkar Republic	3.379	31.48	0.04
Karachay-Cherkess Republic	1.443	16.49	0.04
Republic of North Ossetia	2.491	32.42	0.05
Chechen Republic	3.067	59.52	0.04
Stavropol region	19.044	342.38	0.12

Source: Computed based on (Regions of Russia, 2015)

Table 4: Analysis of growth reserves of tax revenues in implementing the optimistic scenario of reducing unemployment in the regions of the North Caucasus Federal District

Region	Applications to the employment service organizations. thousand people	Probable increase in tax revenues	
		Absolute, thousand rubles	Per capita, rub. per person
The Republic of Dagestan	135	4101.90	1.37
The Republic of Ingushetia	63	758.77	1.63
Kabardino-Balkar Republic	41	365.10	0.42
Karachay-Cherkess Republic	30	322.52	0.68
Republic of North Ossetia	29	365.12	0.51
Chechen Republic	136	2331.74	1.70
Stavropol region	73	1290.94	0.46

Source: Computed based on (Regions of Russia, 2015)

amount from 1.97 thousand rubles in the republic of Ingushetia to 342.38 thousand rubles in the Stavropol region, i.e., additionally mobilized sums are insignificant in terms of the impact on total revenues.

The elimination of officially registered unemployment is able to give a more significant effect on the budget system: From 322.5 thousand rubles in Karachay-Cherkessia to 4.1 million in the republic of Dagestan. Another thing is that the provision of jobs for 135 thousand unemployed people in the latter subject is not possible without a substantial increase in investment activity.

5. RESULTS AND DISCUSSION

In general, the proposed methodological tools and its testing on statistical data of the subsidized subjects of the North Caucasus Federal District enable to ascertain sufficient operationally and the possibility of practical use in the course of verification of quantitative economic policy to increase tax “productivity” of the regions.

Speaking about the shortcomings of the model used, it is necessary to focus on its static nature, which does not allow to fully assess the long-term effect of a possible increase in tax revenues due to the implementation of investment projects (accounted for in the model through the “capital” factor), the payback period of which is more than 1 year.

Tactical measures to stimulate employment are the most obvious reserve for tax revenue growth in the region, primarily due to the tax on personal income and, to a lesser extent, due to indirect taxes.

The strategic solution to the issue of increasing tax revenue in depressed regions is in the plane of the investment, including at the expense of budget funds, the development of various sectors of the economy, generating a higher level of tax liabilities (manufacturing, transport and communications, construction, real estate). At first glance, the relative stability and the low value of the tax revenues on investments rate elasticity was 0.65-0.66% in the 2010-2012 indicates a weak fiscal impact. However, a significant increase in demand for investment resources is clearly seen in 2013 that was marked by the growth of elasticity coefficient, whose

value reached 1.05%. Given the fact that the payback period of capital investment exceeds 1 year, the upward dynamics of tax revenues will be more optimistic than the results of calculations by the model presented.

It is obvious that an increase in investment activity in depressed regions is a very complex task that is independent of economic policy, the effective implementation of which should involve consideration of factors and the potential productivity of fiscal territories.

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