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FINANCIAL PROBLEMS

Fiscal Multipliers of the Extended Budget of the Russian Federation and Methods of Estimating Them[1]

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Abstract—Different methods of estimating the fiscal multipliers of the budgetary expenditures are reviewed in the article, including traditional methods, regression models and distributed lags models, the Perotti–Corsetti two-step method, and large econometric models. The author's calculations of the multipliers of the economic macrofactors for the Russian Federation and regions are represented. A conclusion is drawn regarding the low efficiency of the budgetary expenditures in Russia.

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Since the times of John Maynard Keynes [1], economists have been facing the problem of estimation of effects of the government expenditures using the fiscal multipliers. This problem is especially urgent under conditions countries and regions during budget crises. Exactly under what conditions the selection of the directions of the budgetary expenditures that provide the largest and fastest socioeconomic effect becomes urgent.

In macroeconomic theory, there are two traditional methods of estimating the economic effects of the government expenditures. First, using the multiplier (1), i.e., as the GDP growth per a unit of growth of the government expenditures

$$M = \Delta GDP/\Delta G, \quad (1)$$

where ΔGDP is the value of the GDP growth and ΔG is the value of the growth of the government expenditures.

Second, using the elasticity (2), i.e., as the percentage change of the GDP by 1% of the change of the government expenditures

$$E = \frac{\Delta GDP}{GDP} \Big/ \frac{\Delta G}{G}. \quad (2)$$

In Fig. 1, estimations of the multiplier and elasticity are given calculated according to the formulas (1) and (2), respectively, based on the data of the Russian Federal State Statistics Service (www.gks.ru) and Federal Treasury (www.roskazna.ru). The calculations according to the simple theoretical formulas give fairly volatile estimations. The multiplier mainly assumes the values of 2–5 rubles, and elasticity of 0.5–1.5%. On average, in the precrisis period of 2001–2007, the multiplier was 3.21 rubles per 1 ruble of the government expenditures, while the elasticity was 0.91%.

The constraints of estimating the multipliers according to formulas (1) and (2) are, first, neglecting the influence of other factors besides budgetary expenditures on the GDP and, second, assuming that the return from the government expenditures (external lag) is completely localized to the same period. These disadvantages are overcome in the dynamic and structural models studied below.

It is possible to obtain an estimate of the multiplier and elasticity that is stable over time using regression models. In 2000–2007, the estimate of the parameters of Eqs. (1) and (2) can be obtained using the following paired regressions:

– for the multiplier, $\Delta GDP = 1.31\Delta G$; (3)

– for the elasticity, $\Delta GDP/GDP = 0.49\Delta G/G$; (4)

– for the elasticity, $\ln(GDP) = 1.15\ln(G)$. (5)

As is clear from the obtained results, estimates of the efficiency of the government expenditures decreased slightly.

It should be noted that formula (3) is a transformation of the additive dependence between the GDP and government expenditures, and formulas (4) and (5) describe the multiplicative dependence.

To take into account that fact that the return from the government expenditures is not localized within a single period of time, the following model of distributed lags can be used (6):

$$\Delta GDP_t = \alpha + \sum_{k=1}^{q} \beta_k \Delta G_{t-k} + \varepsilon_t, \quad (6)$$

where q is the value of the largest lag of the explanatory variable included into the model, ΔG_{t-k} is the growth of the government expenditures G at the moment of time $t-k$, ε is a random deviation that characterizes the action on the explanatory variable of the factors not considered in the model, and β_k represents the short-term multipliers upon the lagged variables of the government expenditures.

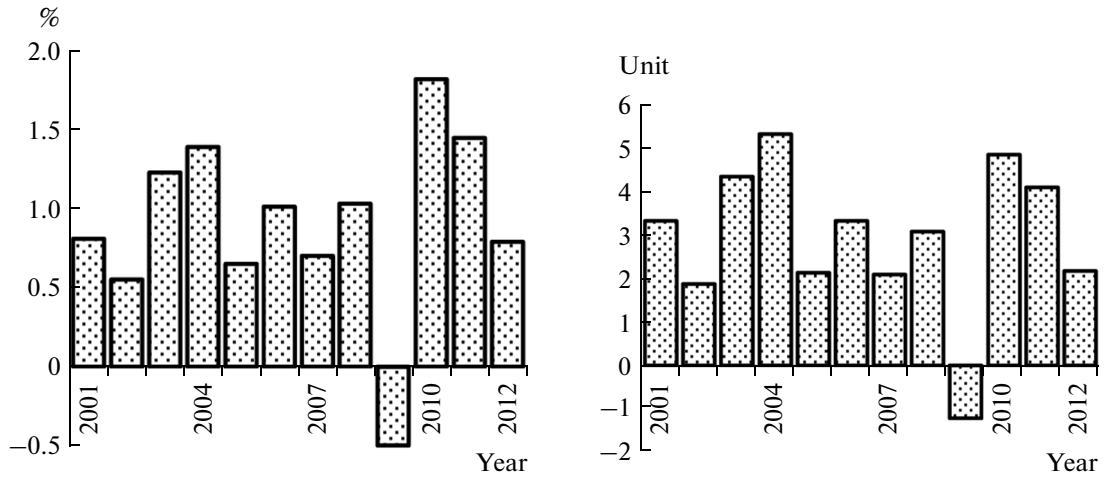

Fig. 1. Dynamics of GDP Growth by 1% (left scale) and per unit (right) of the consolidated government expenditures in the Russian Federation in 2001–2012.

For the consolidated budget of the Russian Federation, the authors estimated the multipliers of the government expenditures according to Almon polynomial lag model. Estimation was carried on in Prognoz Platform 7.2 tool [2] using the pre-crisis data for 2001–2007. The greatest depth of the lag was selected equal to $q = 4$ (years) and the polynomial degree $p = 2$. The values of the short- and long-term multipliers (sum β_k) are given in Table 1.

As is clear from Table 1, the one-time effect of the government investments makes a little less than 0.2 (a short-term multiplier). The greatest effect (0.34) is achieved in two years after increasing of the government expenditures. The total effect of the investments of 1 ruble of the budget funds for 5 years makes 1.3 rubles (a long-term multiplier).

The above-mentioned methods of estimating the multipliers assume the invariability of other exogenous variables including the actual values for the Russian economy (prices for oil, private investments, tariff regulation, etc.), which is why more perfect methods are used in practice.

Here, one important terminological note is necessary; i.e., during further statements, the term *fiscal multiplier* will be understood as the ratio of the changes of the fundamental variables (real GDP, investments, expenditures of the population, budget revenues, etc.) to the change of the fiscal policy parameters (total expenditures, as well as their structure). In particular, as is assumed in the foreign literature, the action of the change of the total government expenditures share in the GDP will be estimated by the change in the growth rates of the real GDP.

Below, let us represent estimates of the fiscal multipliers based on the model of error correction. As is known, the ECM model enables one to divide the short- and long-term (cointegration) relationships between the variables. In the period from the first quarter of 2000 to the third quarter of 2013, the authors had been estimating the following model of error correction (7):

$$\begin{aligned}\Delta GDP_t = &-0.17(GDP_{t-1} - 0.02FI_{t-1} - 0.24G_{t-1} \\ &- 0.89E_{t-1}) + 0.40\Delta GDP_t + 0{,}06\Delta G_t \\ &+ 0.22\Delta E_t + 0.02\Delta P_t,\end{aligned} \quad (7)$$

where GDP_t is the growth rate of the GDP in market prices, percent of the relevant period; FI_t is the growth rate of foreign investments in the Russian economy, percent of the relevant period; G_t is expenditures of the consolidated budget, percent of the GDP (with the adjusted seasonality); E_t is the growth rate of the commodity and service export volumes, percent of the relevant period; and P_t is the growth rate of world oil prices (Urals), percent of the relevant period.

As is clear from Eq. (7), the long-term multiplier equals 0.24; and the short-term multiplier equals 0.06; i.e., after excluding the influence of the external eco-

Table 1. Fiscal multiplier based on the distributed lag model

	Coefficient	Standard error	*t*-statistics
β_0	0.19926	0.07134	2.79323
β_1	0.30888	0.08508	3.63031
β_2	0.34041	0.10566	3.22173
β_3	0.29383	0.09522	3.08581
β_4	0.16915	0.08441	2.00382
Sum of lags	**1.3115**	–	–

The given values (coefficients) of the fiscal multipliers means by how many rubles the GDP value will change upon changing of the consolidated government expenditures by 1 ruble (upon other equal conditions). The standard error and *t*-statistics are necessary to check the hypotheses on the statistic value of the coefficients in the extended lags model.

nomic factors, the estimation of the efficiency of the government expenditures reduced more significantly and, within a short-term period, is at the zero point.

The logical development of the distributed lags model and errors correction model is the vector autoregression model. Thus, in work [3], VAR model was proposed (8), in which the interaction of the budgetary variables and GDP is taken into account as follows:

$$X_t = A(L)X_{t-1} + U_t, \quad (8)$$

where $X_t \equiv [T,G,Y]'$ is the vector of variables (government revenues, government expenditures and GDP), $A(L)$ is the polynomial with the lag operator, and $U_t \equiv [u_t^T, u_t^G, u_t^Y]$ is the vector of residuals.

Furthermore, the residuals U can be represented in the form of linear combinations of the residuals of other exogenous variables, and relevant mutually uncorrelated structural shocks (υ_t) as follows:

$$\begin{aligned} u_t^T &= a_1 u_t^Y + a_2 \upsilon_t^G + \upsilon_t^T, \\ u_t^G &= b_1 u_t^Y + b_2 \upsilon_t^T + \upsilon_t^G, \\ u_t^Y &= c_1 u_t^T + c_2 u_t^G + \upsilon_t^Y. \end{aligned} \quad (9)$$

The so-called structural VAR model (SVAR) is obtained. It follows from the first and second equations of system (9) that the residuals of the equations of the government revenues and expenditures depend on the residuals of the GDP equation within the same period, as well as the structural shocks of these values.

The factors of the national accounts system are used as a rule as the initial data for SVAR models, which enables one to ensure the economic homogeneity of the modeled variables. In work [4], the factor of the taxes for production minus net transfers and subsidies interpolated from the years to the quarters proportionally to the revenues of the extended budget was used as a variable of the government revenues (T) in [4]. The sum of the expenditures for finite consumption and gross accumulation of the government control sector interpolated proportionally to the expenditures of the extended budget was used as a factor of the government expenditures (G). The oil prices were also added to the model as the exogenous variable. All factors were brought to the real expression using the GDP deflator, leveled seasonally (except for the oil price factor) using the procedure Census X12, and given in the natural logarithms.

The results of estimations of Eqs. (8)–(9) for 2000–2007 are given below.

Estimations of Short-Term Effects of the Budgetary Policy

Coefficient	Estimation of the coefficient
$c1$	0.032
$c2$	0.083
$b2$	–0.028

The coefficient $b2$ reflects how much the real government expenditure will change upon changing of the real budgetary expenditure by 1%. The coefficient $c1$ and $c2$ are how much the real GDP will change upon changes in the real government revenues and expenditures by 1%.

It is clear that the coefficient $c2$ represents a short-term multiplier that turns out to be close to 0. The medium-term multiplier is calculated based on the impulse-response function. The multiplier of the government expenditure is calculated as the cumulative growth of the GDP factor within three years after an increase in the government expenditures for the growth in government expenditures. For Russia, this factor was 0.6; i.e., according to the results of three, if the government expenditures grow by 1% of the GDP, the real GDP will increase by 0.6% years.

In [5], based on SVAR model, the fiscal multipliers are estimated according to the budget items by the federal and consolidated budgets. The multiplier of the federal government expenditures as a whole amounted to 0.47, whiles consolidated expenditures amounted to 0.45. The multiplier for government consumption was 0.215, and the multiplier for defense expenditure was 0.0.

Another practical method for estimating fiscal multipliers is the Perotti–Corsetti two-step procedure [6]. The method in itself is close to the estimation of the vector autoregression, but permits carrying out the analysis for shorter time series which is very relevant while working with the Russian economic statistics.

In this method, the cumulative multiplier is estimated (10), which is understood as an output reaction in response to the noncyclic component of the government expenditures (fiscal shock) at the moment of time N as follows:

$$M = \frac{\sum_{j=0}^{N} \Delta Y(t+j)}{\sum_{j=0}^{N} \Delta\left(\frac{G(t+j)}{GDP(t+j)}\right)}, \quad (10)$$

which measures the total change of the physical volume of the GDP at the moment of time $t + N$ as a result of the total increase of the share (noninterest) government expenditures in the GDP by 1 pp beginning at time moment t, where N corresponds to the maximum lag of action of the fiscal shock on the output.

The estimate is made in two stages. At the first stage, the model of the dependence of the government expenditures on the fundamental factors is constructed as follows:

$$g_t = \varphi(\Omega_t) + \varepsilon_t, \quad (11)$$

where g_t is the share of the government expenditures in the GDP, Ω_t is the set of information available at the moment t, and ε_t is the fiscal shock.

Because, while calculating the fiscal multiplier, the main role is played by the only unexpected (nonsystematic) component of the fiscal policy and, at the second stage, the equation is constructed by explaining the output reaction to the fiscal shocks as follows:

$$\Delta y_t = \varphi(\Omega_t \varepsilon_{t-1}, \varepsilon_{t-2}, \ldots), \quad (12)$$

Table 2. Fiscal multipliers of the extended budget of the Russian Federation obtained using the two-step estimation

Category of expenditures	Multiplier		
	Russia*	Perm Krai	Republic of Tatarstan
Total noninterest expenditures	0.13	0.26	0.33
Total government problems	–0.76	0.22	–0.13
National defense, national safety, and law enforcement	0.29	0.25	0.27
National economy, housing and public utilities sector, environment protection	0.55	0.58	0.43
Culture and social sphere	0.20	0.14	0.16

* Source [6].

The given values of the fiscal multiplier means by how many per cent the value of the real GDP (GRP) will change if some or other category of expenditures of the budget (of Russia or region) changes by 1% of the GDP (GRP).

where Δy_t is the growth of the outputs at the moment t; Ω_t is the set of information available at the moment t; and ε_{t-1}, ε_{t-2}, ... are the fiscal shocks of the previous periods. Here, as well as in expression (9), the coefficients at ε_{t-1}, ε_{t-2}, ... represent the fiscal multipliers.

The authors used the Perotti–Corsetti procedure to estimate the fiscal multipliers by the expenditure items of the regional budgets of Perm Krai and Tatarstan. The results of a comparison of the multipliers by the regions and the whole Russian Federation are given in Table 2.

The data of Table 2 proves that changing of the real GDP (GRP) goes in the same direction as the changing of some or other category of the budget expenditures (at that the most efficient from the point of view of stimulation of the economy by the direction of the budgetary funds spending is the "National economy, housing and public utilities sector, environment protection"—exactly for this category of the budget expenditures the values of the fiscal multiplier in Russia and regions are the largest). The exception is the expenditures of Russia and Republic of Tatarstan for the general government problems which is connected with the fact that the government sector pulls over the resources to itself which can be engaged in other sectors of the economy. This effect is also described in the work of the Center for macroeconomic researches of Sberbank of Russia [7].

As is mentioned above the simple methods to calculate the multipliers do not consider the effect of other economic factors on the GDP, the inverse effect of the economic factors on the budget, all possible interaction between the exogenous variables. That is why to estimate the fiscal multipliers large econometric models can be used describing the interrelations between all key sectors of the economy [8, pp. 417–418].

To estimate the fiscal multipliers for Russia the authors took as the basis the econometric model of the Russian Federation developed at ZAO Prognoz in the interests of the Russian Ministry of Economic Development for the purpose of the medium-term forecasting [2]. It includes about 300 regression and balance equations as follows:

$$Y_t = F(Y_t, \ldots, Y_{t-\tau}, X_t, \ldots, X_{t-\tau}), \qquad (13)$$

where Y_t is the vector of the modeled variables at the moment of time t, X_t is an exogenous variable of the model, and τ is the lag of the factors. The dynamics of the factors used in the model is quarterly and the total period of estimation of the coefficients extends from the first quarter of 2000 to the third quarter of 2013.

The multiplier is estimated as follows (Fig. 2): in one of the scenarios the value of the government expenditures of the consolidated budget increases by 1% of the GDP; then, using model (13), the deviation of new calculated values of the GDP from the values according to the basic scenario is estimated.

Furthermore, the authors slightly extended the concept of socioeconomic efficiency by defining the economic, budgetary, and social efficiency of government expenditures. With regard to economic efficiency, the influence on the GDP, investments, and industrial production depend on the budget revenues, while the social efficiency depends on the population's employment and income.

As is clear from the estimation results (Fig. 2), the influence of government expenditures on the macroeconomic factors is irregular over time. The influence on the nominal factors accumulates over time, while the influence on real factors is short term. For the index of the physical volume of the GDP, it is almost completely localized within the first year and, for real disposable income of the population, it weakens gradually beginning with the second year.

The estimations of the short- (for the first year) and medium- (the average for three years) term multipliers are also given in Table 3.

The value of the multiplier for the first year made 0.63% and, in the medium-term prospect, it was 0.25%. Thus, the budgetary stimulation of the econ-

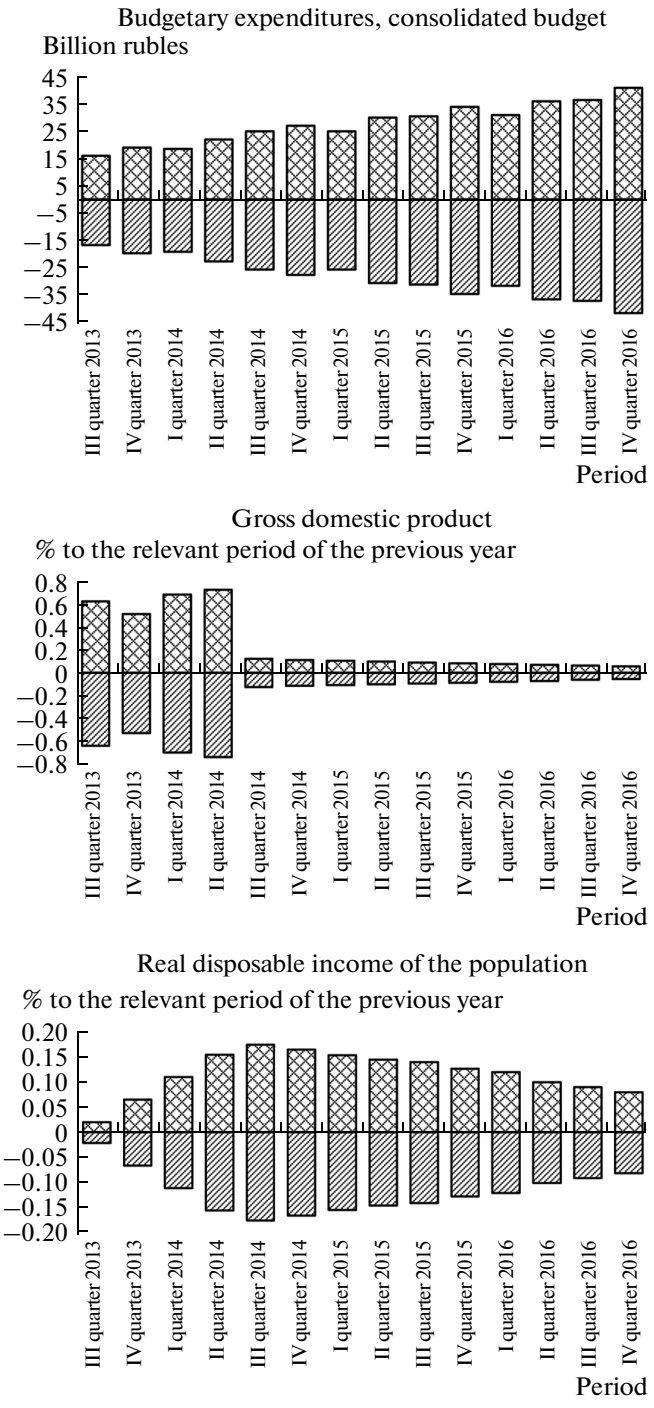

Fig. 2. Analysis of sensitivity of macroeconomic factors in the Russian Federation to change in government expenditures by 1% of the GDP: ▨ shock (+); ▨ shock (–).

omy provides a sufficiently restrained effect in time and should be also supported by the government policy tools. However, the results of estimations using the traditional econometric model turn out to have the highest results.

The government expenditures efficiency can be also estimated using another class of models, and namely using the model of the interindustry balance (IIB) or the input–output model. As is known, these models enable one to take into account the interactions between the types of the economic activity. At present, they are widely used methods of calculating different kinds of multiplier effects.

Unfortunately, the last official publications of the interindustry balance in Russia are only available for 2003. The authors learned the success of this approach through their own experience when estimating the socioeconomic effects of the Program of forced industrial development of the Republic of Kazakhstan [9].

In the basic IIB models, crowding-out effects, loss of competitiveness, and other effects connected with government activity are not represented. These disadvantages can be partially overcome in the CGE and DSGE models, in which the IIB models are incorporated to describe the interrelation between the branches of the real sector.

The DSGE models represent synthesis of the new Keynesian economics theory and models of the real business cycle (RBC) [10]. The model derived from the new Keynesians such elements as imperfect competition and nominal strictness; from RBC models—the accent on the technological changes and the system of the rational expectations theory [11, pp. 27–29]. For reference, the estimation of the multipliers for the United States can be given obtained using the DSGE models; their values vary within 1.036–1.16 [12].

In summary, it should be noted that, as a whole, estimates of the fiscal multipliers in the Russian Federation give sufficiently coordinated results that the efficiency of the budgetary expenditures are at a low level.

Let us name some factors of low estimation of the fiscal multipliers besides the widely used thesis on inefficiency of the governmental authorities in the Russian Federation and/or the underdevelopment of institutions.

Import effect. It is evident that the effect of the growth of the government expenditures is divided into the growth of domestic production (with further multiplying effects) and the growth of imports. In the authors' opinion, the efficiency of the budgetary policy can be increased due to its combination with the import substitution measures.

Exchange rate effect. In the case of the low competitiveness of the domestic economy and a fixed exchange rate, fiscal policy will be inefficient. Correspondingly, the efficiency of the fiscal policy can be increased due to the parallel devaluation of the national currency.

Inflation effect. As was mentioned above, the peculiarity of the approach widely used at present consists of the fact that the influence of the nominal expenditures of the budget on the real GDP is estimated. With low inflation in developed countries, this estimate can be considered acceptable; however, under the condi-

Table 3. Multipliers of macrofactors of the Russian economy when the consolidated budget is changed by 1% of the GDP

Macrofactors	Multipliers, %	
	for the first year	average for 3 years
Real gross domestic product, percent of relevant period of the previous year	0.63	0.25
Budget revenues, consolidated budget, billion rubles	0.33	0.42
Money income of the population, billion rubles	0.10	0.27
Real disposable income, percent of relevant period of the previous year	0.09	0.12

The represented multipliers means by how many per cent some or other macrofactor will change if the government expenditures of the consolidated budget changes by 1% of the GDP in the short- and medium-term prospect.

tions of the domestic economy, inflation can reduce the effect of budgetary stimulation.

Crowding-out effect. Besides the fact inflation erodes the effect of a nominal increase in government expenditures, it influences the value of the interest rate. The efficiency of fiscal policy can be increased due to its combination with the monetary policy aimed at reduction of the interest rate.

Structure of the government expenditures. As has been shown above (Table 2), some items of budgetary expenditures do not provide any economic effect at all. Thus, an increase in the efficiency of government expenditures can be achieved while remaining within the same budgetary constraints by changing the structure of expenditures in favor of innovation sectors and branches with high added value and expenditures for developing human-capital assets, as well as by stimulating export-oriented branches and import substitution.

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