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Estimation of Government Spending Multipliers for Russian Economy

The article examines the impact of growth in public spending in Russia on the dynamics of macroeconomic and sectoral indicators using econometric techniques and dynamic input-output models.

Up to now, an ongoing debate about the effectiveness of public spending as a way to stimulate economic growth. The Keynesian point of view is that the economic multiplier is greater than unity. However, it is known assertion disputed by the new classical school. Representatives of the new classical school argue that in many cases the economic multiplier is less than one. In their opinion economic growth more effectively stimulated by tax cuts [1].

In reality different types of public spending (defense spending, construction spending, spending on education, etc.) have different multiplicative effect on the economy as a whole and on its individual sectors. Therefore it is necessary to talk about the system of multipliers. In addition, the growth of public investment has distributed in time multiplier effect, which is linked with the existence distributed construction lags in the economy. Therefore it is necessary to investigate the *system of dynamic economic multipliers.*

In the classical Leontief static I-O model multipliers role played by inverse matrix $(I-A)^{-1}$ (Leontief matrix). Leontief dynamic I-O model modifies the value of the multipliers at the expense of the capital intensity coefficients - the matrix B.

$$X(t) = A(\text{t})X(t) + B(t)\frac{dX(t)}{dt} + C(t)$$

where $X(t) = [x_j(t)]$ - gross output column vector;

$\dfrac{dX(t)}{dt}$ — column vector of gross output increase;

$C(t)$ — column vector of final demand (including government spending);

$A(t) = \|a_{ij}(t)\|$ intermediate consumption coefficients matrix;

$B(t) = \|b_{ij}(t)\|$ - capital intensity matrix of gross output increase.

It should be noted that W. Leontief described the so-called "dynamic inverse matrix", which is built using matrices A(t) and B(t) [2]. In fact, this matrix is a system of dynamic multipliers showing what it's necessary to make expenses a few years before consumers will be supplied additional final products.

System of government spending multipliers in Russia obtained using econometric analysis

1. For the study were allocated 6 main indicators of public spending:

- Nationwide Issues;

- National economy;

- Housing and utilities;

- Environmental protection;

- National defense + national security and law enforcement;

- Social spending, which includes spending on education, social policy, culture, cinema, media, health care, physical culture and sports.

2. Calculations have been performed using data with the annual step (1995-2013) and quarterly step (2004-2014).

Main conclusions on the results of econometric calculations.

• As a result of the econometric analysis was not found statistically significant dependence of growth of Russia's GDP from government spending for annual data and quarterly data. Therefore, on the basis of econometric analysis could not determine the multiplier of government spending for GDP of the Russian economy.

• Impact of growth of different types public spending on the growth of gross output and VA growth in various economic activities is contradictory. In some cases the results of calculations for quarterly and annual data contradict each other.

Calculations multipliers using the Dynamic Input-Output Model

In our view, the calculation of public expenditure multipliers using Dynamic Input-Output Model allows more precise determine the multiplier effect. In addition, the use of dynamic input-output models which take into account the investment lag, allows to define multiplier effects, distributed in time.

The Dynamic Input-Output Model with distributed construction lags has been used for the calculation. This model was developed at the Institute of Economics and Industrial Engineering of Siberian Branch of Russian Academy of Sciences and at the Novosibirsk State University [3].

The model simulated the dynamics of fixed assets and capital intensity coefficients are used (the ratio of fixed assets to gross output for each type of economic activity), not the coefficients of capital intensity of gross output increase. Capital intensity coefficients are determined separately for machinery and equipment and buildings.

As a starting point of the calculations have been used 2013 year information base of the Dynamic Input-Output Model for 32 industries. Each economic activity was divided into the production of goods and services of the first subdivision (production of means of production and intermediate services) and manufacturing products and services of the second subdivision (production of consumer goods and services that make up the final consumption of households). So the total number of industries of the DIOM was 64.

Another peculiarity of the Dynamic Input-Output Model was the division of machine building industry and construction industry on two subsectors. Machine building is divided into two kinds of economic activities: fixed assets-building subsector, which produces machinery and equipment and non fixed assets-building subsector producing parts and defense products. Construction is divided into two kinds of economic activities: fixed assets-building subsector, which produces buildings and structures and non-fixed assets-building subsector producing current repair of buildings.

Main purpose of the calculations using the DIOM was to analyze the impact of growth in public spending on the total value of gross output and gross output of

industries of the Russian economy. Analyzed growth of government spending on products of five types of economic activity: non fixed assets-building subsector of machine-building (mainly production of arms), construction, health care, education, research and development. The calculations were carried out on the period 2014-2017.

For comparability of the calculations' results for each of the above mentioned types of economic activity government spending increased by 1 trillion rubles.

To obtain the more reliable results, it was necessary to evaluate the growth of additional capital assets required to produce additional products in the respective industries. Based on the capital intensity coefficients for each of above-mentioned types of economic activity have been counted increase of fixed assets. Fixed assets put in service in the relevant industry in the first year of the forecast period have been increased by the amount of necessary increase of fixed assets. At the same amount have been changed the total amount of fixed capital put in service in Russian economy.

In Table 1 examines the impact of growth in government spending on gross output as a whole and gives the values of the multipliers for 2014-2017. The gradual decrease in the values of the multipliers for the forecast period is due to the attenuation of growth of investment in fixed assets in the period after 2014. The largest value of the multiplier is 2,404 and is associated with an increase in public spending, aimed at the construction of the whole. Multiplier for marching building is equal to 2,396 in 2014. It is assumed that increases in marching building is domestic production and not imports. Spending on education, health care, research and development also have a positive multiplier effect that is greater than one.

Table 1. Multipliers of public expenditure increase on the purchase of products of various sectors for the gross output of the Russian economy as a whole.

Type of public expenditures increase	2014	2015	2016	2017
Construction	2,404	2,190	2,167	2,088
Machine –building (non fixed assets-building subsector)	2,396	2,134	2,086	2,013
Health care	2,253	2,082	2,046	1,885
Education	2,182	2,084	2,046	1,791
Research and Development	1,540	1,586	1,600	1,284

Source: results of authors' calculations using DIOM

Table 2 shows the types of economic activity, on which most positively and negatively influences the increase in public spending, aimed at the construction. Data are presented for 2014.

Table 2. Positive and negative impact of public spending increase, aimed at the construction on the gross output by kinds of economic activity - the ratio of the predicted values of gross output calculating taking into account the increase in government spending to the gross output without increasing government spending

Positive impact			Negative impact		
The rank	Type of economic activity	Ratio	The rank	Type of economic activity	Ratio
1	Production of machines and equipment	1,375	1	Communication	0,999
2	Construction - fixed assets-building	1,148	2	Wholesale and retail trade, repair, hotels and restaurants	0,997

Table 2 (continuation)

The rank	Type of economic activity	Ratio	The rank	Type of economic activity	Ratio
3	Construction - non fixed assets-building	1,124	3	Textile and clothing manufacture. Manufacture of leather, leather products and footwear	0,994
4	Construction materials production	1,098	4	Other community, social and personal services	0,991
5	Production of ferrous metals	1,088	5	Education	0,990
6	Mining and quarrying, except fuel and energy resources	1,086	6	Public administration and military security. Social Security	0,989
7	Manufacture of fabricated metal products	1,041	7	Health care and social services	0,989
8	Chemical production. Manufacture of rubber and plastic	1,036	8	Manufacture of food products and tobacco	0,988
9	Non fixed assets-building mechanical engineering	1,036	9	Agriculture, hunting and forestry. Fishery and fish breeding	0,988
10	Coke production	1,030			

Source: results of authors' calculations using DIOM

Table 3 shows the sectors that are under positive and negative impacts as a result of the increase in public spending on mechanical engineering. The data in Table 3 shows that there is an increase in the gross output of the construction, mining, production of ferrous and non-ferrous metals, fabricated metal products. This relationship is quite understandable, as increased gross output of related industries. At the same time the data in Table 3 shows that an increase of government spending on the mechanical engineering products, has negative impact on the industries, mainly related to the formation of household consumption (multiplier effect is less than unit).

Table 3. Positive and negative impact of public spending increase in 2014, aimed at the machine building, on the gross output by kinds of economic activity - the ratio of the predicted values of gross output calculating taking into account the increase in government spending to the gross output without increasing government spending

Positive impact			Negative impact		
The rank	Type of economic activity	Ratio	The rank	Type of economic activity	Ratio
1	Production of machines and equipment	1,292	1	Communication	0,995
2	Machine –building (non fixed assets-building subsector)	1,254	2	Wholesale and retail trade, repair, hotels and restaurants	0,994
3	Production of ferrous metals	1,137	3	Textile and clothing manufacture. Manufacture of leather, leather products and footwear	0,993
4	Manufacture of fabricated metal products	1,075	4	Other community, social and personal services	0,988
5	Mining and quarrying, except fuel and energy resources	1,069	5	Education	0,985
6	Chemical production. Manufacture of rubber and plastic	1,053	6	Public administration and military security. Social Security	0,985
7	Research and development	1,044	7	Health care and social services	0,985
8	Production of non-ferrous metals	1,039	8	Agriculture, hunting and forestry. Fishery and fish	0,984
9	Construction of building and structures	1,028	9	Manufacture of food products and tobacco	0,984
10	Production of other fuel and energy minerals	1,027			
11	Coke production	1,024			
12	Construction - non fixed assets-building	1,024			

Source: results of authors' calculations using DIOM

Conclusions based on the results of calculations using the DIOM.

1. Multipliers of government spending increase for gross output of the Russian economy in all analyzed items have values greater than one. This confirms the effectiveness of Keynesian ideas to stimulate economic growth by increasing public spending on final goods of construction, machine building (including defense spending), health care, education, research and development. The highest multiplier effect is achieved with an increase in construction costs (the value of the multiplier in 2014 is equal to 2,4), the lowest - at increasing expenditure on research and development (the multiplier in 2014 equal to 1,5). It should be noted here that the expenses on research and development have an impact on economic growth in the long term and the full effect of their increase may occur much later.

2. Negative impact of growth in public spending on production of a number of sectors (construction, machine-building, research and development) on the dynamics of the gross output of the second subdivision is explained by two factors a) the redistribution of resources in favor of industries producing goods and services primarily for production purposes; b) the fact that the increase in production requires a new fixed assets, which are created in industries that produce primarily first division products.

3. It was assumed in this study that public spending increase needs not only increase of production of any industry, but also needs increase of the corresponding inputs of capital assets. Because of this assumption the most significant multiplier effects associated with fixed-assets building industries. Such multiplier effect can be expected in a situation when the economy does not have adequate reserves of production capacity by economic activities, the demand for products of which from the state increases significantly.

4. Type of economic activity, for the purchase of products of which have been directed additional public spending, in addition to the fixed-assets building industries provide the greatest increase in gross output. For example, if the increase in public spending has been directed to education, the gross output of the industry in 2014 increased by 1,427 times, which is the highest value among all other economic activities, except for machine-building.

5. As a result of calculations were determined the multipliers for some major directions of public spending. It is shown that the acceleration of economic growth in

the short and medium term most effectively provided through the growth of government spending on construction and machine-building products, including defense products. These economic activities have the highest multipliers throughout the forecast period.

The novelty of the results consists in the comparison multipliers of government spending in the economy of Russia, obtained using econometric methods and dynamic input-output model.

References

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