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ECONOMIC POLICY

Assessing Multiplier Effects in the Russian Economy: Input-Output Approach

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Abstract—The article presents the calculation of multiplier effects in the modern economy of Russia. The output multipliers by different sectors of the economy have been estimated using a method based on a static input–output model. The article has analyzed the limitations and possibilities of applying a method of calculating the multiplier effects.

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As soon as the whole range of organizational, financial, methodological, and bureaucratic problems were solved, the Federal Service for State Statistics (Rosstat) published basic input–output tables for 2011, which turned out to be a momentous event for statistics and economic analysis in 2017. The meaning of the event for the development of analysis methods and economic forecasting can hardly be overestimated. Suffice to say that, before then, the input–output tables had only been formed twice, i.e., in 1987 (for the RSFSR) and in 1995. It is clear that significant changes have taken place over these years in the structure of the Russian economy, and its actual measure can only be estimated based on the data of an input–output system, manufacturing, and production distribution.

In the Soviet and Russian practice, a symmetric input–output table refers to the input–output model and is considered to be a more comprehensive description of the economy that contains information on all key methods of calculating GDP (with the production, usage, and income determination approach), as well as squares it with cost structure based on the type of economic activity.

The absence of official input–output tables had previously placed Russian researchers in a difficult situation. It impeded the development of highly relevant research under the conditions of economic restructuring, and a renaissance of interindustry calculations and modeling of global economy could not be fully supported by similar calculations based on Russian statistics [1].

One of the spheres of applying an input–output table is estimating the multiplicative effects of developing certain types of economic activities and implementing intensive investment projects. This article deals with the multiplier effect of increase in the output in some sector of the economy. Hereinafter the *multiplier effect* refers to an increase in one of macroeconomic indicators (gross output, GDP, budget income, etc.) caused by the extension of the initial increase in the output in one of sectors over the interindustry relationships. The *multiplier* will be called a ratio of the effect estimate to the initial increase in production that prompted it.

There are two components that can be noted to estimate this multiplier effect.

1. *The effect of increasing operating expenses*. Iterative logic can be used to describe the formation mechanism of the effect. Under otherwise equal conditions, a gain in production by one of the activities means an increase in the current production costs involved. This can turn out to be the output expansion factor in the related sectors (called sectors of the first level of interconnection), which in turn creates the impact of growth in current business demand on production in a wider range of economic sectors (sectors of the second level of interconnection), etc. With each iteration, the additional increase reduces; in other words, it is less and less able to contribute to a resulting increase in the total output.

2. *The effect of increasing value added*. This effect appears due to the additional income generating across the economic actors (households, government, business), which is conditioned by a gain in production in the economy and can be spent to increase final demand (household consumption, government consumption, fixed capital formation). Under otherwise

equal conditions that will result in the expansion of the production volume and the further spread of this impact over interindustry relationships.

Method of estimating the output multiplier effect. Macroeconomic models have gained widespread acceptance in estimating the multipliers for the economy in general [2–4]. Methods based on input–output approach are typically applied to estimate effects at the industry level. Among these calculations, it is possible to distinguish three main types:

(1) calculations within general equilibrium models with integrated input–output tables [5, 6];

(2) calculations within a static input–output model [7];

(3) calculations within a modified input–output model using econometric dependences for modeling impact of additional income on total consumption [8, 9].

General equilibrium models (CGE, DCGE), including input–output tables and the social accounting matrix (SAM), use production functions and a system of equations that reflect the behavior of different economic actors based on concepts of the neoclassical theory. Considering the theoretical nature of key dependences of these kinds of models, the absence of a direct correlation with actual statistics and the scale of interactions throughout the evaluation of multiplier effects, it becomes impossible to talk about the transparency of the results obtained. The second type of calculations, which outline the concept of interindustry relationships and total expenditures in the economy, only allows to evaluate the multiplier effect of increasing operating expenses, while the effect of increasing value added is not taken into account.

This issue is solved by using the modified input–output model, which is characterized by modeling the transition from an increase in output to an increase in income of different economic actors, with further transition to an increase in final demand (by different functional elements) and to an increase in output again.

That is the approach used in this paper to estimate the output multiplier effect. The Fig. 1 presented below provides a general framework for forming the multiplicative effect (or the logic of its estimation).

Assessing the output multiplier effect can be divided into two phases: assessing the effect of increasing operating expenses and assessing the effect of increasing value added (which takes into account the additional increase in gross output following the implementation of the effect of increasing operating expenses).

The assessment of the effect of increasing operating expenses can be conducted using the equation of Leontief static model (a basic equation of an input–output model), which appears as follows:

$$\vec{X} = (E - A)^{-1} \cdot \vec{Y},$$

where $\vec{X}$ is the vector of output by industry; $\vec{Y}$ is the vector of final demand; A is a technical coefficient matrix of direct costs a_{ij}, which shows how much production of ith sector needed for manufacturing a unit of production of jth sector;

$$a_{ij} = X_{ij} / X_j,$$

E is an identity matrix.

In the case of nonzero imports, the equation of the Leontief static model appears as follows:

$$\vec{X} = (E - A^*)^{-1} \cdot \vec{Y}^*,$$

where A^* is an adjusted technical coefficient matrix for which imports were excluded from the interindustry flows as follows:

$$A^* = \begin{pmatrix} a_{11}(1 - imp_{11}) & a_{12}(1 - imp_{12}) & \cdots & a_{1n}(1 - imp_{1n}) \\ a_{21}(1 - imp_{21}) & a_{22}(1 - imp_{22}) & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ a_{1n}(1 - imp_{n1}) & \cdots & \cdots & a_{nn}(1 - imp_{nn}) \end{pmatrix},$$

where imp_{ij} is an import share in the intermediate consumption by sector j of sector i production (in X_{ij} flow) and $\vec{Y}^*$ is the vector of final demand for domestic products.

Under the assumption, that technical coefficients do not change, and the initial increase in output is caused by an increase in final demand (e.g., by an increase in exports), the resulting increase in output can be estimated as follows:

$$\Delta\vec{X} = (E - A^*)^{-1}\vec{Y}^* - (E - A^*)^{-1}\vec{Y}_0^*$$
$$= (E - A^*)^{-1}\Delta\vec{Y}^* = (E - A^*)^{-1}\Delta\vec{X}^0.$$

To estimate effect of increasing operating expenses in the kth sector, the following equation is used:

$$\Delta\vec{X} = (E - A^*)^{-1}\Delta\vec{X}^0$$
$$= (E - A^*)^{-1}\begin{pmatrix} 0 \\ 0 \\ \cdots \\ \Delta X_k^0 \\ \cdots \\ 0 \end{pmatrix} = \begin{pmatrix} b_{1k}^*\Delta X_k^0 \\ b_{2k}^*\Delta X_k^0 \\ \cdots \\ b_{kk}^*\Delta X_k^0 \\ \cdots \\ b_{nk}^*\Delta X_k^0 \end{pmatrix},$$

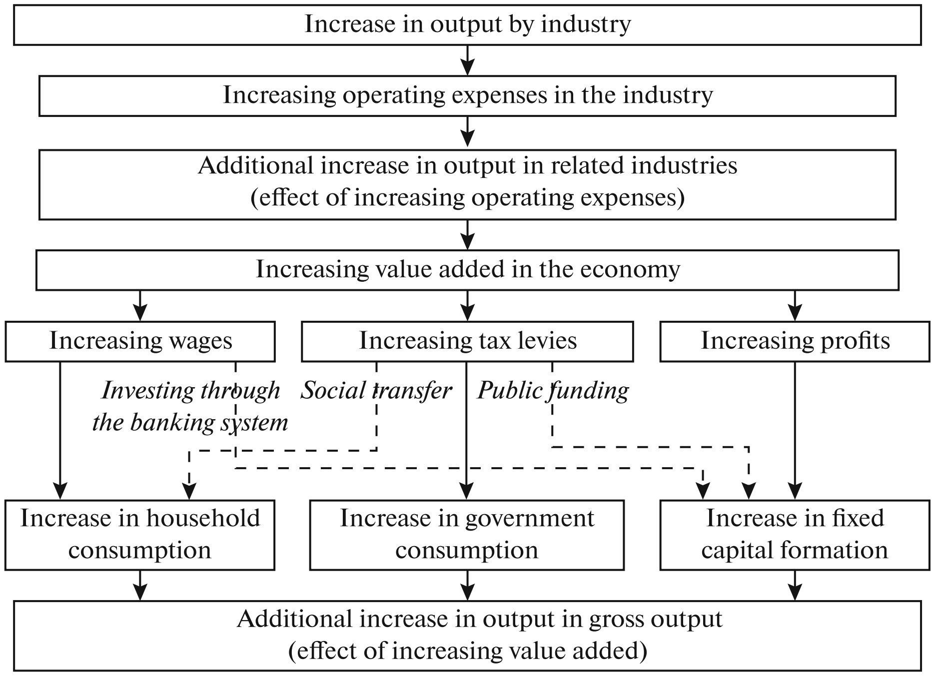

Fig. 1. Logic of forming the output multiplier effect.

where $\Delta\vec{X}^0$ is the vector of the initial increase in output (it is assumed that the entire increase is concentrated in sector k) and b_{ik}^* are the elements of the matrix $B^* = (E - A^*)^{-1}$.

The simple output multiplier of sector k indicates how much gross output will increase due to an increase of total production in sector k (without regard to effect of increasing value added) and calculated as a sum of the components of kth column of matrix B^*:

$$\mu_k^{\text{prod}} = \Delta X \big/ \Delta X_k^0 = \left[\sum_{i=1}^{n}(b_{ik}^*\Delta X_k^0)\right]\Big/\Delta X_k^0 = \sum_{i=1}^{n} b_{ik}^*.$$

The estimate of the effect of increasing value added is made according to the adjusted equation of Leontief static model $\Delta\vec{X} = (E - A^*)^{-1}\Delta\vec{Y}_0^*$. The main task is to determine the increase in the final demand for domestic products generated by the additional income, which is derived from an increase in total production upon the previous effect implementation.

First of all, it is essential to turn from an increase in output to an increase in income for different economic actors. The relationship between output and value added that exists in the economy, as well as the distribution structure of value added, such as employee compensation, taxes, and profits, can also be applied. Thus, the vector of additional tax levies is defined as follows:

$$\Delta\overrightarrow{tax} = \begin{pmatrix} \Delta VA_1 \cdot tax_1 \\ \Delta VA_2 \cdot tax_2 \\ \dots \\ \Delta VA_n \cdot tax_n \end{pmatrix} = \begin{pmatrix} \Delta X_1 \cdot va_1 \cdot tax_1 \\ \Delta X_2 \cdot va_2 \cdot tax_2 \\ \dots \\ \Delta X_n \cdot va_n \cdot tax_n \end{pmatrix},$$

where ΔVA_i is an increase in value added in sector i; tax_i is the share of taxes, including personal income tax, in the amount of value added of sector i; ΔX_i is an increase in output in sector i attributable to the effect of increasing operating expenses; and va_i is the share of value added in the output of sector i.

The vector of the increase in wages is defined as follows:

$$\Delta\vec{w} = \begin{pmatrix} \Delta VA_1 \cdot w_1 \\ \Delta VA_2 \cdot w_2 \\ \dots \\ \Delta VA_n \cdot w_n \end{pmatrix} = \begin{pmatrix} \Delta X_1 \cdot va_1 \cdot w_1 \\ \Delta X_2 \cdot va_2 \cdot w_2 \\ \dots \\ \Delta X_n \cdot va_n \cdot w_n \end{pmatrix},$$

where w_i is the share of wages (excluding personal income tax) in the amount of value added of sector i.

The profit vector is determined as a residual:

$$\Delta\overrightarrow{pr} = \Delta\overrightarrow{VA} - \Delta\overrightarrow{tax} - \Delta\vec{w} = \begin{pmatrix} \Delta X_1 \cdot va_1 \cdot (1 - tax_1 - w_1) \\ \Delta X_2 \cdot va_2 \cdot (1 - tax_2 - w_2) \\ \dots \\ \Delta X_n \cdot va_n \cdot (1 - tax_n - w_n) \end{pmatrix}.$$

The sums of components of vectors $\Delta\overrightarrow{tax}$ and $\Delta\vec{w}$ represent the amount of increase in tax levies and wages, respectively:

$$\Delta\text{tax} = \vec{1}^T \cdot \Delta\text{tax} = \sum_{i=1}^{n}(\Delta X_i \cdot va_i \cdot tax_i),$$

$$\Delta w = \vec{1}^T \cdot \Delta\vec{w} = \sum_{i=1}^{n}(\Delta X_i \cdot va_i \cdot w_i).$$

Here $\vec{1}^T$ is a transposed unitary vector; multiplying it by a vector of the same dimension yields the sum of the second vector's components.

Furthermore, the increase in certain functional elements of final demand is estimated, such as household consumption, government consumption and fixed capital formation. The increase of households consumption of domestic products is defined by the total increase in wages Δw, income elasticity of households consumption c, the vector $\vec{\alpha}$, which presents the industrial structure of household consumption, and the import shares in households consumption[1] as follows:

$$\Delta\vec{c}^* = \begin{pmatrix} \sum_{i=1}^{n}(\Delta X_i \cdot va_i \cdot w_i)c\alpha_1(1 - imp_{c1}) \\ \sum_{i=1}^{n}(\Delta X_i \cdot va_i \cdot w_i)c\alpha_2(1 - imp_{c2}) \\ \dots \\ \sum_{i=1}^{n}(\Delta X_i \cdot va_i \cdot w_i)c\alpha_n(1 - imp_{cn}) \end{pmatrix},$$

where α_i is the average share of sector i in household consumption and imp_{ci} is the average share of imports in household consumption of sector i products.

The increase of government consumption of domestic products is defined by the total increase in tax levies Δtax; the elasticity of government consumption gc; and vector $\vec{\beta}$, which presents the sectoral structure of government consumption, and the shares of import in government consumption as follows:

$$\Delta\overrightarrow{gc}^* = \begin{pmatrix} \sum_{i=1}^{n}(\Delta X_i \cdot va_1 \cdot tax_i)gc\beta_1(1 - imp_{gc1}) \\ \sum_{i=1}^{n}(\Delta X_i \cdot va_1 \cdot tax_i)gc\beta_2(1 - imp_{gc2}) \\ \dots \\ \sum_{i=1}^{n}(\Delta X_i \cdot va_1 \cdot tax_i)gc\beta_n(1 - imp_{gcn}) \end{pmatrix},$$

where β_i is average share of sector i in government consumption and $imp_{gc\,i}$ is the average share of imports in the government consumption of sector i products.

The vector of new investments is obtained by multiplying components of the profit vector $\Delta\overrightarrow{pr}$ and income elasticity of private investment across different economic sectors[2] as follows:

$$\Delta\overrightarrow{inv} = \begin{pmatrix} \Delta X_1 \cdot va_1(1 - tax_1 - w_1) \cdot inv_1 \\ \Delta X_2 \cdot va_2(1 - tax_2 - w_2) \cdot inv_2 \\ \dots \\ \Delta X_n \cdot va_n(1 - tax_n - w_n) \cdot inv_n \end{pmatrix},$$

where inv_i is the share of financial resources allocated for capital expenditures in the operating surplus of sector i.

The vector of an increase in final demand is defined by the matrix of technical structure of fixed capital formation T (this matrix converts the vector of investments into the vector of an increase in demand for investment products of different sectors):

$$\overrightarrow{gfcf} = T \cdot \overrightarrow{inv} = \begin{pmatrix} \sum_{j=1}^{n} t_{1j}[\Delta X_j \cdot va_j(1 - tax_j - w_j) \cdot inv_j \\ \sum_{j=1}^{n} t_{2j}[\Delta X_j \cdot va_j(1 - tax_j - w_j) \cdot inv_j \\ \dots \\ \sum_{j=1}^{n} t_{nj}[\Delta X_j \cdot va_j(1 - tax_j - w_j) \cdot inv_j \end{pmatrix},$$

where t_{ij} is the share of sector i in capital expenditures of sector j.

The vector of an increase in final demand for domestic products used for investment purposes is obtained by multiplying the components of the vector $\Delta\overrightarrow{gfcf}$ and the shares of domestic production in corresponding flows as follows:

[1] The possible increase in household income due to an increase in social transfers (pension, scholarship and unemployment benefits) has not been taken into account here.

[2] Here, the possible increase in investments through the additional public funding and investing personal savings through the banking system are not taken into account.

$$\overline{gfcf}^* = \begin{pmatrix} (1 - imp_{T1})\sum_{j=1}^{n} t_{1j}[\Delta X_j \cdot va_j \cdot (1 - tax_j - w_j) \cdot inv_j] \\ (1 - imp_{T2})\sum_{j=1}^{n} t_{2j}[\Delta X_j \cdot va_j \cdot (1 - tax_j - w_j) \cdot inv_j] \\ \dots \\ (1 - imp_{Tn})\sum_{j=1}^{n} t_{nj}[\Delta X_j \cdot va_j \cdot (1 - tax_j - w_j) \cdot inv_j] \end{pmatrix}.$$

The vector of total increase in final demand for domestic products is defined by summing vectors of an increase in household consumption, government consumption, and fixed capital formation:

$$\Delta\vec{Y}^* = \Delta\vec{c}\,^* + \Delta\overrightarrow{gc}\,^* + \Delta\overrightarrow{gfcf}\,^*.$$

As noted above, the estimate of total output increase can be obtained by placing the vector of final demand for domestic products into the equation of the Leontief static model

$$\Delta\vec{X} = (E - A^*)^{-1}\Delta\vec{Y}\,^*.$$

Basic assumption in the model. The use of the static input–output model to estimate the multiplier effects is driven by the acceptance of a set of assumptions that slightly limit the scope of analysis.

First, the basic structural parameters in calculations are meant to be unchanged, e.g., technical coefficients, the structure of elements of final demand, the structure of value added distribution, elasticities of consumption, and shares of imports. Thus, here, the hypothesis that the cumulative effect of an increase of a certain sector output is not significant in the scale of the economy is implicitly used. This means that the additional demand for domestic products generated by implementing the multiplier effect is satisfied with additional loading of production capacities and/or using of accumulated reserves; in other words, it does not allow for situations of deficits on commodity markets and relevant price increases. A similar assumption can be made with regard to the impact of the multiplier effect on the situation on labor and loan capital markets.

Second, it is expected that an increase in commodity stock in the economy will remain zero. Using an iterative logic to describe the multiplier effect genesis does not mean that this effect is a long-drown-out process. The increase in output can only occur if it is provided with all necessary resources. In fact, this means that the previously accumulated stocks (which were formed by pre-production in the supplying industries) or imports should be used. Later, the stocks are to be restored by means of additional production and/or imports to the previous level. Otherwise (in the case when stocks are maintained at a new, lower level), the main part of the multiplier effect is essentially "left" in retrospect, whereas in the reporting period the estimate of the multiplier effect should correspond only to the initial impulse - the output increase in sector k.

Third, a considerable simplification was permitted in modelling transition from additional income of different economic actors to an increase in final demand. Here, the average income elasticities of consumption were used. Thus, we do not take into account the fact that, as prosperity grows, the income elasticity of consumption gradually declines (saturation effect) and shifts take place in the structure of consumption. In particular, the share of fast-moving consumer goods in household consumption is declining. The presented calculations leave out of account the income differentiation of population, which also considerably determines the growth rate and the structure of consumption expenditures.

Assessing multipliers using Rosstat data. The application of the method presented above to estimate output multipliers of industries based on official input–output tables allows to obtain an overview of the state of the Russian economy and the complexity of particular interindustry relationships.

The most pressing input–output tables were published for 2014. The Table 1 presents values of output multipliers for certain industries (i.e., estimates of an additional increase in the gross output or GDP due to the initial output growth per unit in a selected sector excluding the direct output and GDP increase within the initial impact).

These results indicate that the greatest effect of increasing operating expenses due to the initial increase in output per unit is generated within the sectors marked by a high share of operating expenses in output and rather low share of import in intermediate consumption (for example, electricity, metal fabrication, oil refinery, and chemical production). Low values of the multiplier can be explained by the high share of value added in output (in oil and natural gas extraction or wholesale and retail trade), as well as by the high share of import in intermediate consumption

Table 1. Values of output multipliers for the certain sectors of the Russian economy in 2014 (excluding the direct effect)

Index	Output multiplier effect					
	excluding the increase in value added		including the increase in value added		including the increase in value added at zero import	
	for output	for GDP	for output	for GDP	for output	for GDP
Agriculture, hunting and fishing	0.80	0.38	1.74	0.84	2.67	1.23
Oil and gas	0.57	0.30	1.54	0.83	2.04	1.04
Food production	1.18	0.57	2.05	1.00	3.26	1.50
Textiles and leather products	0.71	0.34	1.49	0.74	3.11	1.43
Oil products and coke	1.15	0.62	2.12	1.11	2.83	1.42
Chemical products, excluding explosives	1.12	0.52	2.02	0.97	3.13	1.44
Rubber and plastic products	1.08	0.48	1.85	0.87	3.49	1.56
Other mineral nonmetallic products	1.23	0.55	2.20	1.04	3.24	1.47
Metals	1.27	0.54	2.16	0.99	3.30	1.47
Machinery and equipment	1.05	0.45	1.97	0.92	3.22	1.44
Office equipment and computers	0.65	0.33	1.40	0.70	3.15	1.46
Electrical equipment	1.09	0.47	1.97	0.92	3.32	1.48
Telecommunication equipment	0.70	0.34	1.57	0.78	2.95	1.37
Motor vehicles, trailers, and semitrailers	0.97	0.41	1.60	0.72	4.00	1.65
Other transport equipment	1.03	0.46	1.99	0.95	3.15	1.44
Electricity, gas, and water supply	1.44	0.65	2.50	1.19	3.21	1.49
Construction	0.85	0.37	1.81	0.86	2.82	1.27
Wholesale and retail trade	0.64	0.35	1.69	0.87	2.45	1.18
Accommodation and food service activities	0.82	0.41	1.81	0.91	2.75	1.30
Transportation and warehousing	0.88	0.45	1.89	0.96	2.75	1.32

Source: Russian Federal State Statistics Service, authors' calculations.
In the presented calculations, the following values of key structural parameters were used: the income elasticity of household consumption was 93%, the income elasticity of government consumption was 58%, the income elasticity of private investment was 73%.

(in machinery and equipment, vehicles, office equipment, electronics, and textiles and clothing manufacturing).

The higher estimate of an increase in output driven by effect of increasing value added for material intensive sectors predetermine the higher estimate of additional growth in GDP at this stage. However, taking into account the shares of value added in output, the total increase in value added after implementing the effect of increasing operating expenses turns out to be comparable for material intensive sectors and for sectors with a high share of value added in output. In this context, estimates of an additional increase in output driven by effect of increasing value added are fairly close for various sectors (on average 0.9–1.0).

It should be noted that the estimates of the effect of increasing value added are influenced by the distribution structure of an increase in value added among business, household, and government because the income elasticity of consumption across the economic actors varies widely. In particular, estimates for oil and natural gas extraction are lower than ones for other sectors. This is explained by the fact that, in the value added distribution structure for the presented sector, the largest share accrues to tax levies, and in the calculations, the income elasticity of consumption for the government was given as lower than for the household and business (58% compared to 93 and 73% respectively).

An additional point is that the share of import in capital expenditures of the particular sector has an impact on measuring the value-added multiplier effect. In sectors with higher shares of imported equipment in total capital expenditures, i.e., in textiles and clothing manufacturing, machinery, metallurgy, and chemical industry, the decrease in measuring the value-added multiplier effect is stronger than in other sectors.

As a result, the values of total increase in output due to the initial increase in output per unit (in other words, the sum of estimates of the operating expenses multiplier effect and value-added multiplier effect, excluding a direct increase in the output within the initial impact) turn out to be higher for the material intensive industries with relatively low share of import in intermediate consumption and capital expenditures. The examples may include the generation and distribution of electricity (output multiplier is 2.50), mineral and nonmetallic production (2.20), metallurgy (2.16), oil refinery (2.12), and food production (2.05). The greatest effect on GDP due to increase of output per unit is expected for electricity, gas and water supply (1.19); oil refinery (1.11); and food production (1.00).

Estimates of multipliers under conditions of zero import deserve special attention, as far as these results allow to assess the potential for import substitution in various economic sectors. Estimates show that the highest additional increase in output under conditions of zero import should be observed in vehicle manufacture (4.00 instead of 1.60 under nonzero import), in rubber and plastic production (3.49 and 1.85, respectively), in manufacture of electrical equipment (3.32 and 1.97), metallurgy (3.30 and 2.16), and food production (3.26 and 2.05). It should be noted that these are the sectors in which dynamic import substitution has been observed in recent years.

However, we should emphasize contradictory impact of imports on multiplier effect estimates. On the one hand, imports that replace domestic production should be considered as a factor that reduces the values of multipliers. On the other hand, the import can fill a shortage of production resources, in the absence of which it is impossible to increase output and generate a multiplier effect.

Possibilities of applying the method. The assessment of multipliers shown in the Table 1 should be carefully interpreted to characterize the importance of various industries or to choose sectoral priorities when developing economic policy. For this purpose, deeper analysis is required, which, in addition to assessing output multiplier effect, should include an analysis of the other effects. For example, to analyse the impact of stimulating investment activity by the government in particular sectors of the economy, not only the output multiplier effects should be taken into account, but also the effect of increasing capital expenditures or reducing unemployment and social transfers, etc.

At the same time, the method proposed for assessing the output multiplier effect has high potential for applications. It can be used as the basis for more complicated calculations of estimating macroeconomic effects for implementing large-scale investment projects and government programs of supporting various sectors of the economy.

REFERENCES

1. V. S. Lisin and M. N. Uzyakov, *A Branch in the System of Interbranch Relations: The Possibilities of Analysis and Forecasting* (TEIS, Moscow, 2002) [in Russian].
2. R. Beetsma, M. Giuliodori, and F. Klaassen, "The effects of public spending shocks on trade balances and budget deficits in the European Union," J. Eur. Econ. Assoc. **6** (2–3), 414–423 (2008).
3. L. Christiano, M. Eichenbaum, and S. Rebelo, "When is the government spending multiplier large?," J. Polit. Econ. **119** (1), C. 78–121 (2011).
4. A. L. Kudrin and A. Yu. Knobel', "Budgetary policy as a source of economic growth," Vopr. Ekon., No. 10, 5–26 (2017).
5. M. E. Burfisher, *Introduction to Computable General Equilibrium Models* (Cambridge University Press, 2017).
6. P. B. Dixon and B. R. Parmenter, "Computable general equilibrium modelling for policy analysis and forecasting," in *Handbook of Computational Economics*, Ed. by H. M. Amman, P. A. Kendrick, and J. Rust, Eds. (Elsevier Science B.V., 1996), **Vol. 1**.
7. R. E. Miller and P. D. Blair, *Input-Output Analysis: Foundations and Extensions* (Cambridge University Press, 2009).
8. P. P. Ghosh, A. Ghose, and D. Chakraborty, "A critical review of the literature on integrated macroeconometric & input-output models," in *The 19th International Input-Output Conference (*Alexandria VA, 2011).
9. G. R. West, "Comparison of input-output, input-output + econometric and computable general equilibrium impact models at the regional level," Econ. Syst. Res. **7** (2), 209–227 (1995).

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