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Tools for Estimating the Effectiveness of Import-Substituting Modernization: Case in the Agriculture of Russia

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Abstract:

The paper explores the approaches to estimate the effectiveness of import substitution, justifies the need to develop a new tool that allows conducting a comprehensive analysis of the impact of import substitution policies on economic modernization.

The authors' methodology for estimating import-substituting modernization based on an integral indicator is proposed and its practical approval is carried out using agriculture in Russia as an example.

The analysis of the results allows the authors to conclude that the import-substituting modernization process is uneven and slow.

To activate and accelerate the processes, it is necessary to stimulate domestic demand. The developed tools react quite sensitively to changes in the industry and make it possible to identify cause-effect relationships in a structured factorial analysis of processes.

Keywords*:* *Import substitution, agriculture, modernization.*

JEL code: *Q10, O13.*

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1. Introduction

The policy of import substitution is part of the implemented industrial policy aimed at the modernization of national industries and the production of competitive products. Modernization involves the technological re-equipment of the economy sectors on the basis of a high rate of renewal of fixed assets, the growth of innovative activity of enterprises, the implementation of new technologies and advanced management methods, the growth of labor productivity, large-scale investments, and the development of human capital.

The excessively high dependence of the Russian economy on imports in previous years has become a threat to economic security, and dependence on food imports is a threat to the country's food security. From this point of view, import substitution is a necessity; it is recognized by Russian scientists as a relevant but extremely difficult task. Its hasty activation under the influence of political and geopolitical factors caused a healthy skepticism and doubts about its success and effectiveness (Manturov *et al*., 2016) from the point of view of modernization of the economy and its branches (Idrisov, and Ponomareva, 2015). Weak domestic demand for domestic products, according to representatives of Russian business, is a deterrent to the development of national import-substituting industries (Serebryakova *et al.*, 2016).

In order for domestic demand to become the engine of the domestic economy, it is necessary to have some import-substituting domestic products while developing its own technologies and borrowing advanced foreign technologies (Kadochnikov *et al*., 2016). Results research show the importance of the gradualness and flexibility of the transition to a market economy with the use of non-market methods and the preservation of the selective protection of the domestic market from commodity imports (Ivanova and Latyshov, 2018; Burkaltseva *et al.*, 2017; Srinita, 2017).

Despite the high importance of import-substituting modernization for the Russian economy, little attention is paid to the problems of estimating its effectiveness and efficiency from the point of view of the dynamics of the processes that take place. Currently, the main criterion for the effectiveness of import substitution is the share of imports and exports of final products, for which the planned levels are set. For agriculture and food industry, the main groups of food products consider the achievement of food security levels. The reduction of the share of foreign products of goods and the increase in exports are regarded by the Government Commission on Import Substitution as an indicator of the effectiveness of import-substituting modernization (Hearings on import substitution, 2016, 2017, 2018), which distorts the essence of the policy of import-substituting modernization.

Thus, effective management of the processes of import-substituting modernization requires the development of indicators for comprehensive analysis and an objective

estimation of the effectiveness of its implementation. In this regard, it is very timely to develop methodological tools for analyzing the effectiveness of import-substituting modernization.

2. Literature review

The methods of quantitative estimation of import substitution developed and presented in the scientific literature allow estimating the potential of import substitution based on both individual and complex indicators.

Rosstat (Federal State Statistics Service, n.d.) estimates the results of import substitution on the basis of statistical data of national production, imports, the balance of resources and reserves using: indicators of volumes and growth rates of production of the agro-industrial complex and food industry; indicators of volumes, growth rates (reduction) and structure of imports of food products and agriculture; indicators of the balance of commodity resources, with the share of imported goods; indicators of stocks of basic food products.

The methods of quantifying the potential of import substitution based on the revealed comparative advantage (RCA) allows determining the intensity of the country's export of goods in comparison with the global average. The Balassa index (Balassa, 1965) is calculated as the ratio between the share of exports of a certain product in the total volume of exports of Russia and the share of this commodity in the total volume of world exports:

$$RCA = (X_{Ai} / X_{Am}) / (X_{ni} / X_{nm}) = (X_{Ai} / X_{ni}) / (X_{Am} / X_{nm}), \quad (1)$$

where X is export, A is the country of study, i is the product (or industry), m is the group of goods (or industries), and n is the group of countries.

Later, the modifications of Balassa index by Greenaway and Milner (1993) can determine the comparative advantages and "disadvantages" of the country in the production of goods in the presence of intra-industry trade.

The estimation of import substitution based on the analysis of the System of National Accounts (SNA), proposed by Mityakov *et al*. (2013), makes it possible to identify the presence or absence of a trend towards import substitution in certain industries, as evidenced by the decrease (growth) in the indicator of the share of imports in consumption (β):

$$\beta = I_m/Y, \quad (2)$$
$$Y = X + I_m - E_x,$$

where X is the output of the industry's goods; E_x – the volume of export of the studied goods; I_m – the volume of imports of this product.

The methodology for estimating the potential of import substitution based on modernization and export expansion, developed by Lebedev (2010) is based on long-term demand. According to Lebedev, import substitution (in the aviation industry) is the product of the long-term demand in the period t (PS_t), the import substitution ratio of the industry (k_t) and the average cost of an airliner (KS_t):

$$ZI_t = k_t \cdot PS_t \cdot KS_t, \quad (3)$$

where t is a separate year of the prospective period.

According to Lebedev, investments in modernization and development of the production base of the machinery-producing industry contribute to a more rapid diversification of the industry structure due to the medium and high level of technological redistribution, compared with the primary investment in other industries, which in turn leads to higher GDP growth rates (Lebedev, 2010).

From the point of view of Persky *et al*. (1993) an import substitution policy activates some local resources in a way that significantly improves their productivity. In this connection, Perskv proposed to estimate import substitution by the number of additional jobs. The indicator of employment and the rate of specialization in comparison with the national specialization, indices of industrial production and GDP were used in the cluster approach of Feizer *et al*. (2008), the rate of GDP growth – to estimate the effectiveness of import substitution in terms of economic growth (Nurhaliq and Masih, 2016).

The approach to the analysis of import substitution based on the growth of investment volume, the volume of trade and the rate of growth of job creation was used in the work of Adams (2009). To emphasize the importance of import substitution in achieving economic diversification, Irwin (2002) argues that resources become more efficient and productive when they are distracted from agriculture and redistributed to industry.

In the work of Matveeva *et al*. (2015) the effectiveness of the policy of import substitution is viewed as a synthetic category in the context of national security achieved by rational replacement of imported goods with competitive prices and quality of goods of national producers. Ershova and Ershov (2016) proposed a methodology for estimating the effectiveness of measures of state policy of import substitution based on an integrated evaluation of its effectiveness using a system of generalizing and individual indicators. The integral indicator of the efficiency of the development of import-substituting industries allowed the authors to make a rating

of the efficiency of implementation of the import-substituting policies of the regions of the Russian Federation.

The method of evaluation and analysis of import substitution developed by Kadochnikov (2006) is based on the theory of consumer demand. The study of the functions of demand for imported goods in different countries made it possible to identify the main factors determining the functions of demand for imported and domestic goods, to reveal the nature of such dependence and to draw a conclusion about the determining influence on import substitution of the real exchange rate of the national currency.

According to Kadochnikov, a decrease in the real exchange rate of the national currency is a favorable factor for the development of import substitution, which should be used and supported by additional stimulation measures including the creation of favorable conditions for attracting investments. Another important factor in the balance of food markets is the price. Any national food market is more subject to price volatility than the global market. These and other features have allowed finding several sustainable regularities in an influence of changes to prices upon a status of security (Kuzmin, 2016).

The analysis of existing methods for estimating the effectiveness of import substitution revealed their focus on evaluating the potential or feasibility of replacing imported goods, resources and technologies with domestic ones and showed a limited possibility of using them for estimating the effectiveness of import-substituting modernization, which confirms the relevance and timeliness of the development of a methodology for its integrated estimation. The researchers offer different approaches to quantifying the effectiveness of import substitution. Nevertheless, issues that consider the investment-innovative, production-technological, labor and other components remain undeveloped.

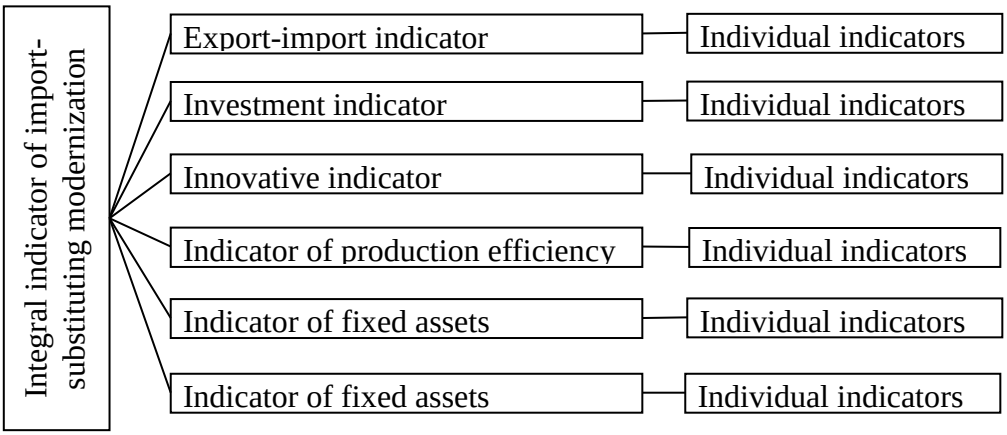
3. Methods

Unlike the existing methods, the approach proposed by the authors is an estimation of the results of import-substituting modernization in the sectors of the economy based on determining the integral index of dynamics. The need to use the integral indicator is due to the complexity of such an economic phenomenon as import-substituting modernization, which requires the analysis of a large amount of information. Individual indicators and their totality, which characterize certain aspects of phenomena, cannot provide a comprehensive and complete estimation of the complex phenomenon and its development trends. In addition, the integral evaluation allows identifying the cause-and-effect relationships of the ongoing processes. The basis of the integral indicator is the group of integrated evaluation

indicators (indicators) that characterize the most significant aspects of the phenomenon.

The methodology proposed by the authors for evaluating the results of import-substituting modernization presupposes the construction of a generalized integral indicator because of partial integral indicators for six blocks evaluating (export-import development, innovative development, investment attractiveness, the efficiency of fixed assets, integrated production efficiency, labor efficiency). As a result, a three-level hierarchy of indicators includes: individual indicators, integrated evaluation indicators and a generalizing integral indicator that includes indicators of all previous levels (Figure 1).

Figure 1. *Composition and structure of the integral indicator of the dynamics of import-substituting modernization*



As a method of determining the integral indicator, the deterministic (functional) method is used in which the effective indicator is presented as a product of factors.

The integral indicator of the dynamics of import-substituting modernization in the authors' methodology is calculated as the geometric mean of six groups of complex indicators that most fully consider all aspects of import-substituting modernization:

$$I = \sqrt[m]{I_{EI} \times I_P \times I_P \times I_{INN} \times I_{INV} \times I_{TR}}, \quad (4)$$

where I – the integral indicator of the dynamics of import-substituting modernization; I_{EI} – the integrated export-import indicator; I_P – the complex indicator of fixed assets; I_P – the integrated indicator of production efficiency; I_{INN} – the comprehensive innovative indicator; I_{INV} – the comprehensive investment indicator; I_{TR} – the comprehensive indicator of human resources; *m* is the number of complex indicators.

Each complex indicator is calculated on the basis of *n* individual indicators:

$$I_j = \sqrt[n]{i_{j1} \times i_{j2} \times i_{j3} \times i_{j4}} \quad (5)$$

where I_j is the *j*-th complex indicator; i_{j1} – the individual indicator of the *j*-th complex indicator (see Table 1); *n* is the number of individual indicators.

To determine the complex indicators of the dynamics of import-substituting modernization, it is proposed to use unidirectional relative values, the growth of which characterizes the improvement of the state of the industry, and which, among other things, makes it possible to characterize the intensity of the processes.

Table 1: *Composition and procedure for calculating integrated and estimated indicators*

Integrated indicators	Individual evaluation indicators
Export-import indicator	$I_{EI} = \sqrt[4]{i_{DE} \times i_{TRE} \times i_{DI} \times i_{TRI}}$, **$i_{DE}$** – change in the share of exports of the industry in the commodity structure of exports; **i_{TRE}** – the growth rate of the export volume of the industry; **i_{DI}** – the reduction of the share of import of the industry's products in the commodity structure of imports; **i_{TRI}** – the rate of decline in the volume of imports of the industry.
Indicator of fixed assets	$I_P = \sqrt[4]{i_{MO} \times i_{OB} \times i_{FV} \times i_{FO}}$, **$i_{MO}$** – change in the share of machinery, equipment in the total amount of fixed assets; **i_{OB}** – change in the renewal ratio of fixed assets; **i_{FV}** – the index of the change in the capital-labor ratio; **i_{FO}** – the index of the change in the output-capital ratio.
Indicator of production efficiency	$I_P = \sqrt[4]{i_{FV} \times i_{DS} \times i_{FR} \times i_{REN}}$, **$i_{FV}$** – the production index; **i_{DS}** – the index of the physical quantity of gross value added; **i_{FR}** – change in the net financial result; **i_{REN}** – change in the profitability of goods sold, products
Innovative indicator	$I_{INN} = \sqrt[4]{i_{IT} \times i_{ZI} \times i_{TI} \times i_{RM}}$, **$i_{IT}$** – change in the share of innovative goods, works, services in the total volume of goods shipped, works performed, services; **i_{ZI}** – change in the share of costs for technological innovation in the total volume of shipped goods, works performed, services;

Integrated indicators	Individual evaluation indicators
	i_{TI} – the growth rate of costs for technological innovation; **i_{RM}** – change in the number of high-performance jobs
Investment indicator	$I_{INV} = \sqrt[4]{i_{IK} \times i_{DI} \times i_{IM} \times i_{DII}}$, **$i_{IK}$** – the index of the physical quantity of investments in fixed capital; **i_{DI}** – change in the share of investments aimed at reconstruction and modernization in the total volume of investments in fixed assets; **i_{IM}** – the index of the physical quantity of investment in machinery, equipment, vehicles, carried out during reconstruction and modernization; **i_{DII}** – change in the share of investments in machinery, equipment, vehicles in the total volume of investment in fixed assets aimed at reconstruction and modernization
Labor force indicator	$I_{TR} = \sqrt[4]{i_{PT} \times i_{TO} \times i_{ZP} \times i_{CH}}$, **$i_{PT}$** – the index of change in labor productivity; **i_{TO}** – change in the level of labor productivity in the industry as a percentage of the average one for the economy; **i_{ZP} –** change in the level of wages in the industry as a percentage of the average one for the economy; **i_{CH}** – the change in the average monthly accrued wages

***Source*:** Prepared by the authors.

The export-import indicator is calculated as the geometric mean of the four individual evaluation indicators:

$$I_{EI} = \sqrt[4]{i_{DE} \times i_{TRE} \times i_{DI} \times i_{TRI}}. \quad (6)$$

Together, the integrated indicators not only reflect the effectiveness of import substitution itself as a substitute for imported products for the domestic (export-import indicator) but also make it possible to fully estimate the change in the innovative, investment, technological, production components of the state of the industries. Thus, the effectiveness of import substitution processes is considered in conjunction with the efficiency of modernization processes in the national economy.

4. Results and Discussion

Modern agriculture becomes an increasingly high-technology branch of the economy, which should provide safe and high-quality food for the population of the country. In Russia, in the last two or three years, agriculture has been used as an example of an industry that has benefited from the policy of import substitution (Idrisov, 2015). In this regard, practical approval of the methodology for estimating

the dynamics of import-substituting modernization was carried out using agriculture as an example (Table 2).

Table 2: *Estimated indicators of the effectiveness of import-substituting modernization in agriculture in Russia in 2014-2016, %*

Evaluation indicators	2014	2015	2016
Export-import indicators	112.42	111.31	111.71
i_{DE}	122.58	123.68	127.65
i_{TRE}	122.12	86.95	107.50
i_{DI}	98.56	95.20	106.56
i_{TRI}	108.25	149.93	106.46
Indicators of fixed assets	98.81	99.99	114.30
i_{MO}	99.21	97.61	101.90
i_{OB}	93.02	97.50	128.20
i_{FV}	103.70	104.50	-
i_{FO}	99.60	100.50	-
Indicators of production efficiency	172.58	118.89	94.22
i_{FV}	103.50	102.60	104.80
i_{DS}	102.00	102.60	103.20
i_{FR}	280.20	159.59	96.10
i_{REN}	300.00	118.96	75.84
Innovative indicators	110.31	86.42	105.31
i_{IT}	-	-	-
i_{ZI}	-	-	-
i_{TI}	-	-	-
i_{RM}	110.30	86.42	105.31
Investment indicators	89.55	96.24	117.75
i_{IK}	96.00	90.90	118.80
i_{DI}	96.55	102.38	102.32
i_{IM}	81.70	91.50	137.00
i_{DII}	84.90	100.74	115.44
Labor force indicators	98.33	109.74	103.28
i_{PT}	103.3	104.50	103.50
i_{TO}	98.71	103.84	97.45
i_{ZP}	81.33	119.76	102.26
i_{CH}	112.70	111.60	110.30
Integral indicator of the dynamics of import-substituting modernization	*110.92*	*103.20*	*107.47*

Source**:** Prepared and calculated by the authors on the basis of Federal State Statistics Service, n.d.

The results of the analysis of import-substituting modernization using the method developed by the authors show that during 2014-2016, in agriculture, the processes of import-substituting modernization took place unevenly, with the slowdown of almost all processes in 2015 and their moderate growth in 2016.

The decrease in the integrated indicator by 7.72% in 2015 is largely due to a marked decrease in the production efficiency of agricultural organizations (from 172.58% to 118.89%). At the same time, three indicators – the indicator of fixed assets, the innovative indicator and the investment indicator – had a value of less than one hundred percent, which reflects the dynamics of the decline in innovation and investment activity and renewal of fixed assets. In 2016, against the backdrop of increasing efficiency in the use of fixed assets, the growth of innovations and investments, the integral indicator of the dynamics of import-substituting modernization increased by 4.27% compared to 2015 but did not reach the level of 2014 due to the continuing decline in production efficiency.

The decrease in production efficiency in the analyzed period was caused not by the decrease in production volumes but by the decrease in absolute and relative cost performance indicators – a slowdown in the growth rate of the balanced financial result by 120.61% in 2015 and 63.49% in 2016 and changes in the profitability of goods sold by 181% in 2015 and another 43.12% in 2016.

The reasons for such a significant drop in profit and profitability are both the decline in real incomes of the population as the main consumers of the final agricultural output and in the growth of the costs of agricultural producers for the production of products. The fall in real disposable money income began in 2014 – 99% of the level of 2013 and continued in 2015 (97%) and 2016 (94%).

Despite the positive results of import substitution, Russian agriculture remains highly dependent on imported raw materials, equipment, and technologies, which, given the devaluation of the national currency, has led to a marked increase in production costs.

For example, in dairy cattle breeding, the import of genetic resources of cattle increased in value terms from $7.7 million dollars in 2016 to $15.6 million dollars in 2017. At the same time, the USA and Canada account for 67.5% and 25.3% of the total amount of genetic resources imported in 2017. Despite the significant range of measures and the amount of state support, domestic cattle breeding is currently unable to meet the needs of the industry in the cattle breeding stock in full, and farming enterprises continue to import many live-stock for farms.

During the period of activation of the policy of import substitution in agriculture, an increase in the volume of exports and the share of exports of the industry was noted,

while the decline in the indicators in 2015 in value terms was not accompanied by a decrease in the indicators in physical units. The largest decrease in imports was in 2015 (149.93%) but in 2016, it was replaced by its reduction at a moderate pace.

One of the main indicators of modernization is the indicator of fixed assets. The growth in the share of machinery and equipment in the total amount of fixed assets and a noticeable increase in the renewal ratio of fixed assets characterize the efficiency of modernization processes, which is confirmed by the growth of the return on assets and the ratio of assets. The innovative indicator is calculated by the indicator of the change in the number of high-performance jobs, which somewhat underestimated the indicator of innovation activity.
The index of the physical quantity of investments in fixed capital aimed at reconstruction and modernization in the analyzed period increased by 22.8%, the index of change in the share of investments aimed at reconstruction and modernization in the total volume of investments in fixed assets by 5.77%, the index of the physical quantity of investments in machinery, equipment, vehicles, carried out during the reconstruction and modernization – by 55.3%, and the indicator of the change in the share of investment in machinery, equipment, vehicles in the total amount of investment in capital stock aimed at reconstruction and modernization – by 30.54%. As a result, the growth of the indicator of investment activity was 28.2%.

The change in the indicator of labor resources was less than 5%, mainly due to the growth of wages in agriculture in comparison with the growth of wages in the economy, with an insignificant growth in the index of changes in labor productivity in agriculture (0.2%) and a decline in labor productivity in the industry in comparison with the average level for the economy.

The practical approval of the developed methodology and calculating the integral index of import-substituting modernization make it possible to conclude that the processes of import-substituting modernization in agriculture are uneven and slow, and to identify the reasons for the slowing down of the processes. The analysis showed that to activate and accelerate the processes of import-substituting modernization in agriculture, it is necessary to stimulate domestic demand, primarily by increasing the purchasing power of the population; take measures to stabilize the currency; develop measures aimed at enhancing innovation in the industry and measures for stimulating the growth of labor productivity. In general, one can state that in the methodical aspect, the tools developed by the authors are sensitive enough to change the speed of the processes in the industry, to identify causal relationships and they are an effective means of justifying management decisions.

5. Conclusion

The current estimation of the results of import substitution in terms of reduction in volumes and the share of imports does not fully correspond to the goals of the development of competitive production. The methodology proposed by the authors allows for a comprehensive estimation of the effectiveness of import substitution and covers all aspects of modernization: export-import and innovative development of the industry, investment attractiveness, efficiency of use of fixed assets, labor resources and production efficiency. The practical approval of the developed methodology for estimating the results of import substitution in agriculture made it possible to identify gaps in the current policy in Russia in the form of insufficient support for domestic demand for imported substitute products, weak national currency, low productivity growth rates and insufficient innovation in agriculture.

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