

ANALYSIS OF IMPORT SUBSTITUTION PROCESSES IN THE MILK AND DAIRY PRODUCTS MARKET USING CLUSTER ANALYSIS

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ABSTRACT

The priority task for domestic agribusiness is to ensure conditions for stable economic growth. To meet international standards, Russian farmers need to maximize production efficiency and increase the level of profitability of agricultural products. Positive economic dynamics in the agricultural sector can be achieved by attracting both extensive and intensive factors of production. Having an ambiguous agro-industrial complex, there is a serious differentiation of the food market sectors in terms of sufficiency, and on the other hand, there is a decrease in demand due to declining population real incomes. To assess the level of import substitution, a cluster analysis was carried out. The taxonomy of regional statistics divided the regions into two groups. Cluster No. 1 (Moscow Region, Tatarstan, Krasnodar and Altai Territories, Bashkortostan, Voronezh Region, etc.) demonstrates serious success in organizing the dairy industry from the perspective of import substitution, since its own production satisfies not only domestic needs, but also ensures the export flow. Cluster No. 2 (Chelyabinsk, Bryansk, Omsk regions, Udmurtia, the Republic of Dagestan, etc.) is polar to cluster No. 1 in terms of technical and economic indicators characterizing the development of the dairy industry. To improve the sustainability of the industry and intensify the processes of import substitution, it is necessary to improve the system of state regulation. The set of necessary measures includes: physical and economic accessibility of loans, review of the regulatory framework in the field of modernization of the rural economy, stimulating the efficiency of agricultural production and using the green box tools (in particular, the food card program).

Disciplinary: Agricultural Economics (Dairy Economics), Management Science.

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1. INTRODUCTION

Domestic agricultural policy is characterized by a system of prohibitive measures in the field of food. The evolution of their actions makes it possible to formulate intermediate conclusions on the intensity of import substitution processes in the agri-food sector (Belova, 2019a).

The process of import substitution is influenced by a whole set of factors. To intensify and increase the efficiency of domestic agricultural production, identification of a systematic combination of determinants is required (Krylatykh, 2011). To do this, a multidimensional grouping of subjects of the Russian Federation will be done according to the level of development of import substitution processes to determine the most rational parameters that provide the highest level of food independence (Zavgorodnyaya et al., 2018).

Russian agricultural policy, intensified in August 2014 under the pressure of sanctions, has delivered benefits in recent years (Martynushkin, 2014). Food production has increased, grain has become an important export item along with oil and gas, critical points of food independence have been reached in almost all types of products. Together with direct state support, the introduction of an embargo on food imports from some countries, that is, a protectionist policy, played a significant role in the success of the Russian agribusiness. But reaching the threshold values of the Doctrine of Food Security in terms of domestic food production has not made food more accessible (Krylatykh and Fedorov, 2013)

For 2013-2018 the agro-food policy of the state made it possible to increase milk production in all categories of farms by 1.1%, including that in agricultural organizations by 11.6% (Konkina et al., 2019). However, the achieved results could not fundamentally change the existing negative trend in the dairy market. Despite a decrease in the share of dairy imports in the product balance by 4.6% to 18.2%, the domestic market remains dependent on foreign producers and processors of milk, and the share of own resources in the dairy market does not reach the level of 90% established as a threshold indicator of the Food Security Doctrine (Kostrova and Martynushkin, 2019).

The globalization of food markets forces milk producers to ensure a steady increase in the competitiveness of the national industry. To achieve this goal, it is necessary to structure production so that milk and dairy products are provided to consumers in the most efficient way possible. The elemental composition of this definition includes low price, high quality, and/or best consumer properties (Kostrova et al., 2019).

At the same time, the pace of development of specialized markets is very different. Therefore, for their more correct comparison and formation of visual structures for organizing import substitution processes, it is advisable to conduct a taxonomy based on cluster analysis (Martynushkin, 2012).

As a rule, a geographical feature is used, as well as established specialization in various types of activities, when clustering economic tasks in the agro-industrial complex. However, the criterion of algorithmization may be broader. Therefore, when assessing the processes of import substitution based on cluster analysis, it is necessary to systematize the factors that determine it in such a way as to evaluate its effectiveness on the one hand and, on the other hand, to determine further development guidelines for the future (Konkina^a, 2019).

Until 2014, when borders were opened and free trade was carried out, imports of meat and dairy products to Russia had systematically increased. The year 2013 was characterized by peak import values. It amounted to 6,724.2 million US dollars for meat products and 4,312.2 million US dollars for dairy products. At the same time, it should be noted that the share of imports in food resources has

steadily increased, while exports have remained at a minimum level. In 2018, imports of meat and meat products amounted to 1.49 billion US dollars (22.04% of the 2013 level), and imports of milk and dairy products amounted to 1.69 billion US dollars (38.06% of the 2013 level) (Konkina^b, 2019).

Import dependence on meat and meat products in 2013 reached 20.9% of the volume of resources. However, with an increase in domestic production by 1.24 times by 2018, this indicator fell to the level of 6.5% and came close to the threshold value of the Food Security Doctrine (Figure 1). Export figures also increased. However, the main changes occurred due to the export of poultry meat (56% of the total volume of meat and meat products in 2018) (Belova and Konkina, 2019).

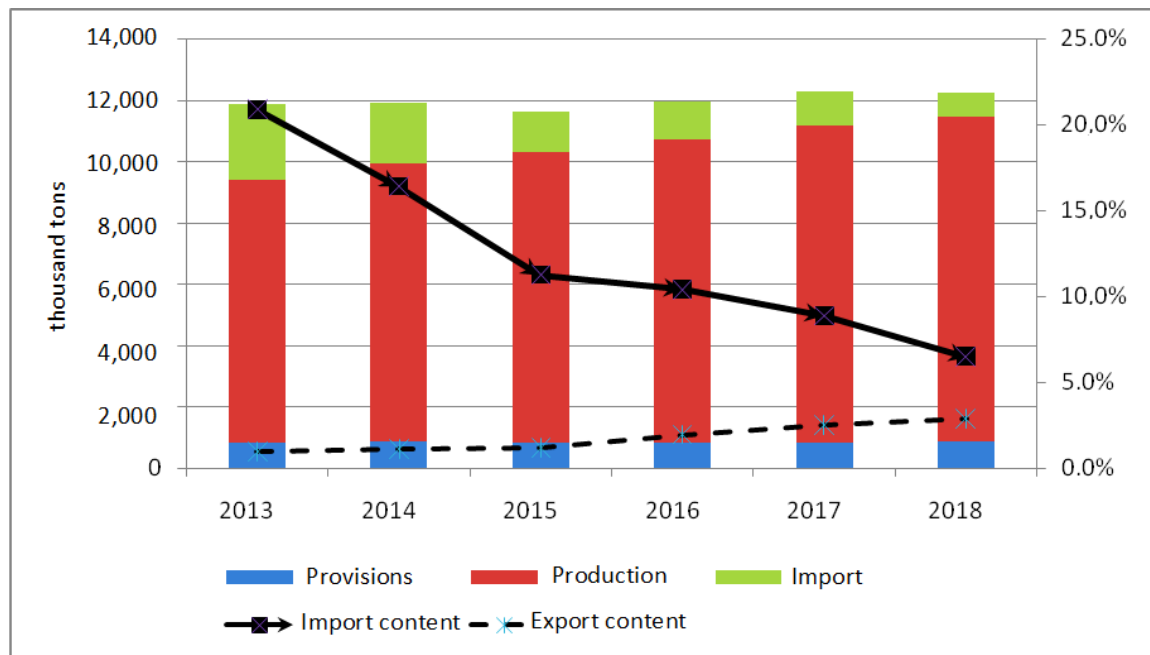


Figure 1. Dynamics and structure of meat and meat products, 2013-2018
Source: [12]. Authors' calculations.

The opposite situation is developing in the milk and dairy products market. In 2018, domestic producers received 30,639.9 thousand tons, which is almost equal to the level of 2013 (only 0.36% more than in 2013). At the same time, the volume of imports decreased, which negatively affected the total volume of dairy resources (Figure 2) (Belova and Konkina 2019).

Milk and dairy products 9,445 thousand tons were imported (in terms of milk) in 2013 and only 5,687.9 thousand tons were imported in 2018. At the same time, the process of reducing dependence on imported milk and dairy products was ongoing. If in 2013 import dependence was 22.5%, then in 2018 it was already 15.0%. However, this situation can hardly be viewed as positive. There is a decrease in food availability with declining real incomes (Konkina and Martynushkin, 2019). According to the official information of Rosstat, the real disposable cash income of the population in 2015 amounted to 96.8%, it was 94.2% in 2016, 98.3% in 2017, and 99.9% in 2018 (in comparison to the previous year). In our opinion, real statistics are far from a genuine "picture of the world." An indirect confirmation of this fact is that credit card holders have become more active in buying products on the installment plan. Another confirmation of the earlier statement is the dynamics of the physical volume index of food retail. It amounted to 9% in 2015, 95% in 2016, 101.1% in 2017 and 101.7% in 2018. Consequently, the level of 2014 in terms of food consumption by the population has not been reached yet (Konkina, 2019c).

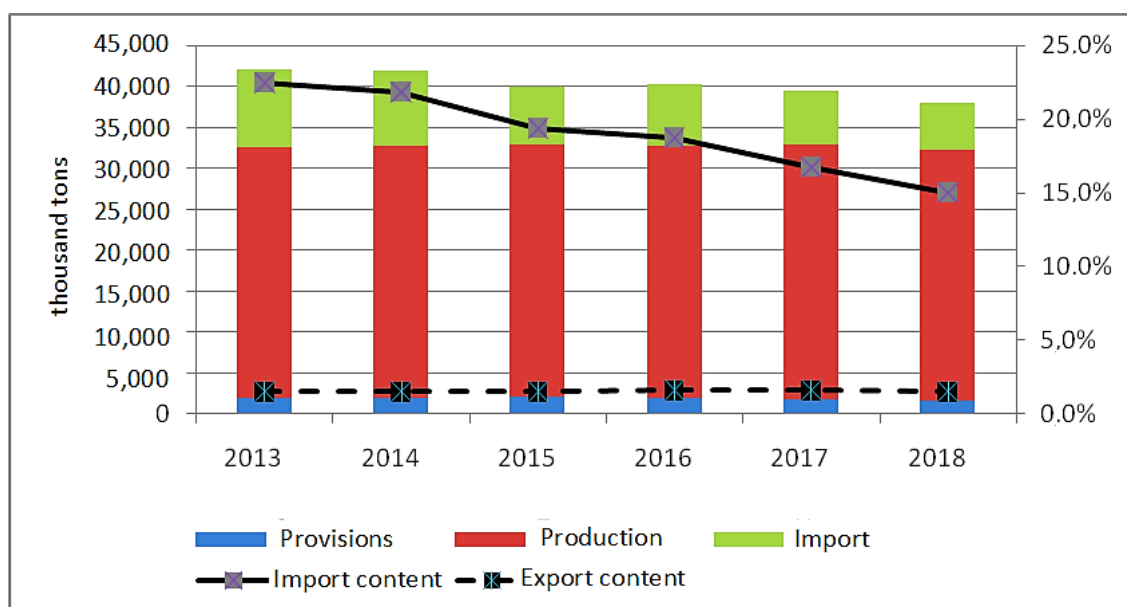


Figure 2: Dynamics and structure of milk and dairy products, 2013-2018
(Source: [12]. Authors' calculations).

The key supplier of dairy products to Russia is the Republic of Belarus. In 2018, its share in total imports of dairy products in the Russian Federation ranged from 71% to 94.7% for different categories of dairy products. In 2018, the Russian government also imposed restrictions on the import of certain categories of dairy products from the Republic of Belarus. Such a situation in the medium term can create favorable conditions for increasing its domestic production (Konkina and Martynushkin, 2018, Namyatova, 2019).

The exports of dairy products from Russia are much lower than their import. So, in 2017 they amounted to 163.3 thousand tons, which is 9.0% (16.1 thousand tons) less than in 2016. The main markets for Russian dairy products are the countries of the Customs Union and some other countries of the former Soviet Union (Ukraine, Kazakhstan, Kyrgyzstan, Turkmenistan, Georgia, Tajikistan, Uzbekistan, Armenia). In small volumes, deliveries are made to China and the USA (Konkina and Martynushkin, 2019).

The consumer price index for food products for 2013-2018 amounted to 138.7%. At the same time, significant fluctuations in the price level were distinguished, which significantly correlated with the state of the sectors of the national economy. As an example, the retail price of butter rose by 79.02% over the earlier designated period, hard and soft rennet cheese by 63.74%, beef by 35.19%, pork by 28.52%, chilled and frozen by 41.33% and chicken eggs by 23.14%.

2. MATERIALS AND METHODS

A comprehensive analysis of import substitution processes in the food market involves the consistent solution of four types of applied tasks, including:

- classification of clustering objects;
- variance analysis of grouping the clustering objects;
- development of scientific hypotheses;
- validation of scientific hypotheses.

The above tasks are solved in parallel since they complement and mutually determine each other.

The proximity is considered the mathematical basis of cluster analysis, as a result of which, using this research method, a space transformation is observed, proceeding from the idea that points of one

set are slightly different from each other, and points of differentiated sets are distant from each other at a certain distance.

Using the Ward method, the objects under study are grouped into clusters, which in the calculations show the smallest increment in the value of V_r . In other words, dispersion is minimized within the clusters. As a rule, the Ward method forms clusters of approximately equal sizes having a hyperspherical shape. The advantage of this method is the ability to adjust the results.

The general rule is to select measures and unifying rules for substantial interpretation (Konkina, 2015aa). In addition to hierarchical cluster analysis (Joining tree clustering), which is often the first step to assess the possible number of clusters, the k-means clustering method is also used. The k-means method allows iterative selection of k-centers for clusters for which the distances inside them are minimal, and the ones between them are maximum.

The significance of the classification can be evaluated using discriminant analysis. Linear discriminant analysis (Fisher) is based on the assumption that the data being analyzed obeys the multidimensional normal law. Two problems are considered in the framework of discriminant analysis:

1) the rule is determined to assign the investigated object to the cluster. To do this, it is advisable to use a linear function.

2) new objects are grouped by classification functions, that is, they are related to the i^{th} class if the value of the classification function S_i is the largest.

The significance of objects' grouping should be assessed using variance analysis. Also, a special characteristic is considered. This is a function of canonical roots, Wilkes λ -statistics. The smaller it is, the better the separation of classes is (Konkina, 2014).

Indicators of the balance of resources were selected as the factors of clustering. This is because they determine the efficiency and intensity of import substitution processes in the dairy market:

- own production;
- product export;
- product import;
- losses;
- personal consumption.

3. RESULTS

Taking into account the above indicators determined for 82 subjects of Russia, which are located in seven federal districts and have a differentiated degree of development of dairy cattle breeding, first, a hierarchical classification was carried out using the Euclidean measure and the Ward consolidation rule (Figure 3).

Analyzing the data of Figure 3, one can conclude that the studied subjects of Russia form two main clusters, which are subsequently divided into small components. First, the differentiation of Russian regions into two classes using the k-means method should be analyzed. The first class consisted of 48 subjects of the country and the second one included 34 subjects.

From the data of variance analysis, it follows that all these variables significantly (statistically) influence the results of clustering.

Table 1: The results of the variance analysis of Russian subjects according to the degree of development of import substitution processes in the field of dairy cattle breeding when forming 2 clusters

Factors for the effectiveness of dairy farming	Estimated value				F (Estimated Fisher-Snedecor Value)
	Between SS (sum of squares)	Cc (degrees of freedom)	Inside SS	cc	
own production, thousand tons	75,887	1	10,831,540	80	0.5605
export of products, thousand tons	19,229,010	1	2,037,491	80	755.0073
import of products, thousand tons	1,414	1	224,064	80	0.5050
losses, thousand tons	0	1	57	80	0.1910
personal consumption, thousand tons	1,686,780	1	1,890,925	80	71.3632

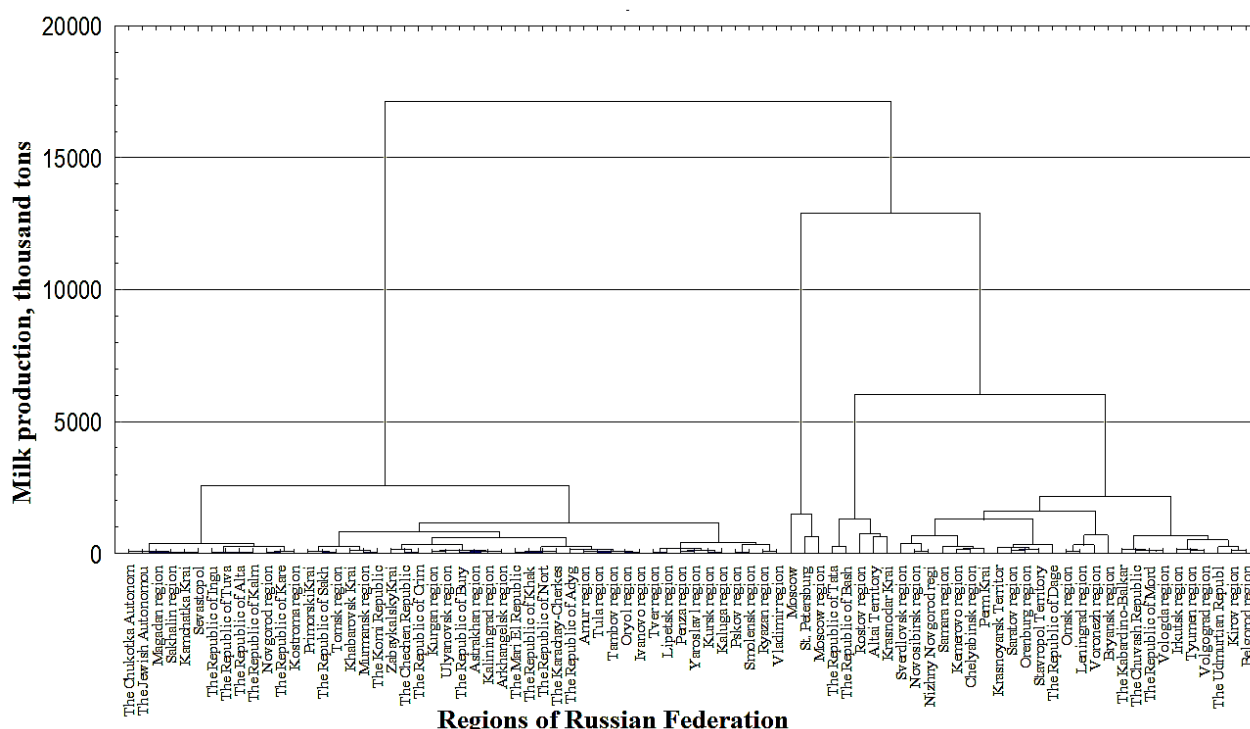


Figure 3: Dendrogram describing 82 subjects of the Russian Federation

Analysis of the information obtained allows drawing the conclusions Table 2.

Table 2: Variables when creating two clusters in the field of dairy cattle breeding in Russia (average values)

Factors for the effectiveness of dairy farming	Average value	
	Cluster 1	Cluster 2
own production, thousand tons	219.000	381.0380
export of products, thousand tons	2,720.367	141.0114
import of products, thousand tons	17.267	39.3886
losses, thousand tons	0.167	0.3835
personal consumption, thousand tons	887.233	123.2886

Cluster No. 1 is characterized by an export orientation. Exports of milk and dairy products almost double personal consumption. This taxon is formed by entities with a traditionally developed dairy industry - Moscow Region, Tatarstan, Krasnodar and Altai Territories, Bashkortostan, Voronezh Region, etc. The above-mentioned regions are characterized by favorable opportunities for ensuring

accelerated growth of the industry. These areas have a competitive advantage in terms of feed conversion and average annual milk yield.

Cluster No. 1 is characterized by good material and technical base and the presence of large investment projects. Generous state support allows not only increase the production of raw milk, but also its successful processing. Excess milk is exported to other regions of the Russian Federation and abroad. The import substitution processes in cluster No. 1 are sustainable. This taxon accounts for 76% of the production of raw milk. The average annual increase in own production is 4.5%.

Cluster No. 2 includes such constituent entities of the Russian Federation as Chelyabinsk, Bryansk, Omsk regions, Udmurtia, the Republic of Dagestan, and others. From technical and economic indicators for the dairy industry development, this entity is polar to Cluster No. 1. Own production is focused primarily on meeting domestic needs. Milk exports are negligible. Serious investment is necessary to intensify import substitution processes.

4. DISCUSSION

Changes in the political context, serious fluctuations in agrarian policy in the continuum of protectionism, and national-conservative management policies were reflected in the dairy industry, depriving it of stability (Table 3).

The pricing of milk and dairy products in the Russian market is influenced not only by internal factors but also by global trends.

Table 3: SWOT analysis of the dairy industry in the context of import substitution processes

Internal factors	External factors
Strengths: high quality; production from natural raw materials; commodity patriotism; advanced modern equipment and technologies in large agricultural holdings; state support for the industry.	Opportunities: expansion of the product range; increase in the number of consumers; reduction in production costs and circulation; high growth in demand for products; with the growth of household incomes, consumption volumes increase; expansion of sales network; opportunities to increase milk production due to potential market capacity.
Weaknesses: the imperfection of the current legislation on the regulation of milk imports; adverse agro-climatic conditions in most of the territory of the Russian Federation; lack of domestic raw materials; monopolism of processors; the disparity in prices for crop and livestock products; rising prices for material and technical resources; unsatisfactory technical and technological conditions of most agricultural organizations.	Dangerous points: drop in demand due to lower incomes; high competition in the industry; unfair competition due to price dumping; seasonal fluctuations in demand; risk of product spoilage; aging human resources.

The agrarian lobby is trying to “catch the wave” of sanctions and effectively use the moment, which inevitably leads to the pressure of short-term strategies and focus on quick-pay projects. This approach contradicts the very essence of the dairy industry, which is the inertial sector of the agricultural sector. Therefore, the illusion of rapid growth should be abandoned due to the low investment attractiveness of the dairy industry, its high capital intensity, and price disparity (Konkina, 2012).

However, the dairy industry has changed dramatically in recent years. The problem of food security is not as acute as in 2014. However, the pace of import substitution processes lags.

The process of import substitution in the food market in general and the milk and dairy products

market, in particular, is accompanied by rising prices, a decrease in consumer demand, and per capita consumption (Table 4).

Table 4: The dynamics of changes in factors affecting milk consumption

Year	Milk production, thousand tons	Import, thousand tons	Export, thousand tons	Market volume, thousand tons	Milk consumption per capita, kg	The price of milk in the consumer market, rubles/l	Import price, US dol/t
2001	32,874.0	4,884.0	605.0	37,153.0	219.0	11.4	213.0
2002	33,462.0	4,989.0	460.0	37,991.0	227.0	12.0	289.0
2003	33,316.0	5,617.0	481.0	38,452.0	231.0	13.5	276.0
2004	31,861.0	6,304.0	479.0	37,686.0	232.0	15.5	287.0
2005	30,826.0	7,115.0	493.0	37,448.0	234.0	17.4	292.0
2006	31,097.0	7,293.0	532.0	37,858.0	237.0	18.8	337.0
2007	31,983.9	7,133.9	582.6	38,535.2	240.0	25.4	492.0
2008	32,226.0	7,315.3	612.3	38,929.0	21.0	28.1	793.0
2009	32,315.6	7,004.9	519.8	38,800.7	243.0	26.8	528.0
2010	31,507.3	8,159.4	459.8	39,206.9	245.0	32.0	759.0
2011	31,204.5	7,955.1	614.6	38,545.0	243.0	32.5	848.0
2012	31,197.0	8,524.8	645.1	39,076.7	246.0	33.9	826.0
2013	29,865.1	9,455.1	628.3	38,691.9	245.0	38.6	1,040.0
2014	29,995.1	9,157.9	628.9	38,524.1	239.0	43.8	1,006.0
2015	29,887.5	7,951.3	606.0	37,232.8	233.0	47.6	691.0
2016	29,787.5	7,578.6	644.8	36,721.3	231.0	51.4	638.0
2017	29,787.3	6,996.9	607.6	36,176.6	230.0	49.0	1,406.2
2018	30,185.0	6,493.0	576.3	36,101.7	225.2	49.6	1,38.6

Source: [12]. Authors' calculations.

5. CONCLUSION

The analysis made it possible to determine that further prospects for the development of the dairy industry will be related, first of all, with an increased intensification of production, introduction of innovations at all stages of the product life cycle, and expansion of the product range. Restrictions on the import of dairy products from several foreign countries and weakening of the national currency will continue to have a positive impact on market development. It should be kept in mind that at present the sanctioning effect is almost completely exhausted.

Among negatively affecting factors, one can single out the decreasing effective demand of the population of the Russian Federation, the prevailing effect of grocery chains and large retailers on the pricing process for milk and dairy products, as well as the desire of milk processors to replace natural dairy raw materials with components of vegetable or artificial origin (Konkina, 2015b).

When determining the direction of economic interventions to create sustainable supply chains of dairy products in Russia, it is important to keep in mind that:

- at present, world prices for raw milk have stabilized at the level of prices in 2014 and do not tend to increase;

- raw milk production costs in Russia have a pronounced upward trend and this growth will continue in years to come;

- if the food embargo is abolished, Russian milk producers will have worse competitive conditions (first of all, due to lower retail prices for imported dairy products and, respectively, raw milk) compared to those that were before the embargo and they won't be able to compete with foreign suppliers on equal terms; (Belova, 2019b).

- a decrease in the share of raw milk producers in the final price of products (after the introduction of the food embargo in Russia) indicates a continuing trend of redistribution of added value in the value chain of dairy products is not in their favor (Belova, 2019a).

At the moment, the milk and dairy products market is entering a new stage of development and

should be aimed at solving such urgent problems as an increase in production efficiency, cost reduction and competitiveness at all stages, as well as export development and, what is most important, stimulating the domestic consumption of dairy products. In this situation and the ongoing decline in the real disposable income of citizens, public authorities need to increase the responsibility by developing a comprehensive program, aimed at increasing the physical and economic availability of milk and dairy products for socially disadvantaged groups. As a mechanism for providing such assistance, international experience in issuing special product cards can be used. They contribute to an increase in the consumption of high-quality food products by these categories of citizens and guarantee the formation of paid demand for products of domestic agricultural producers.

6. AVAILABILITY OF DATA AND MATERIAL

Information about this study can be made available by contacting the corresponding author.

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