

RESEARCH OF FACTORS OF REGIONAL LEVEL OF CONSUMPTION OF MILK AND DAIRY PRODUCTS

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Abstract: The milk and dairy market is the most important component of the Russian food market. However, the real level of development of the milk market in the Russian Federation and in some regions does not ensure the country's food security (Nechitailov, 2019). The main factors negatively affecting the development of the milk market are the low efficiency of dairy cattle breeding, insufficient technical equipment of the industry, a low level of cooperation and integration, the seasonality of milk production, and the redistribution of profits created in agriculture in favor of the processing industry and trade. This important problem is impossible to solve without a highly developed milk market (Rozanova et al., 2019; Proskuriakov, 2018.)

Keywords: Milk Market, Consumption, Factors, Correlation-Regression Analysis, Model

1 Introduction

The milk and dairy market is a multifaceted mechanism with a complex structure, subject to the law of supply and demand. The action of the market mechanism is manifested in complex processes that determine the state of the market, the pace and main proportions of its development (Aleksandrova et al., 2020; Aleksandrova et al., 2020).

Problems of increasing the efficiency of the milk market functioning are the subject of many researches of scientists. However, scientific works have not sufficiently studied the features of its development in the regional aspect. Despite the availability of works by domestic and foreign authors devoted to general and specific aspects of the milk market, further study of the influence of various factors on its functioning is required. Factors include the state of dairy farming, economic relationships between producers, processors and trade of dairy products, as well as the degree of government intervention in the processes of market development (Bittante et al., 2015; Huo & Mu, 2017).

The influence of factors on the production and consumption of milk is manifested ambiguously. A change in one factor by a certain amount under different conditions can give several different values of the result, since the influence of some of them is difficult or impossible to predict.

It is place to mention that, taking the dairy product as the source of many minerals needed for health, in recent days with medical reports of the benefit of these products, people are encouraged to consume.

Russia imported about 281 billion and 121 million dollars in 2012, among which Turkey with 2 billion and

\$ 819 million in exports to Russia ranks 21st (1.1% share).

Iran also ranks 19th with \$ 211 million in exports to Russia. In other words, Iran's share of the Russian market: It is less than 1.1 percent, while Turkey exports 19 times as much to Iran as Russia.

Germany was the largest importer of Russia in 2012 with a 13% share of the value of imports. The chart on the next page shows the share of different countries in imports to Russia. It should be noted that the amount of imports of Russian agricultural and food products in 2012, 39 billion and 912 million. The dollar was 12%, which is 1.1% less than the previous year, 2011.

In general, agricultural and food products accounted for 12% of Russia's total imports in 2012. In this. Last year, Turkey exported \$ 1.282 billion worth of agricultural and food products to Russia. It accounts for 9% of the country's agricultural and food industry exports. In the next page trend chart Russian imports have been depicted in the last 2 years.

2 Methods

Let us consider the following indicators as interdependent outcome variables: Y - milk consumption per capita, kg; X1 - the growth index of real money incomes of the population, thousand rubles; X2 - milk production per capita, kg; X3 - average selling prices of 1 kg of milk by agricultural producers, rubles; X4 - the share of the rural population, %; X5 - the number of people with monetary incomes below the subsistence level, %; X6 - the share of pensioners in the total population, %; X7 - the number of cows per 1000 rural residents, head; X8 - milk yield per cow, kg; X9 - consumption of feed per one conventional head of cattle, c. f. units; X10 - investments in fixed assets per capita, thousand rubles (Table 1).

The greatest connections as a result of correlation analysis were revealed between the following factors:

X2 and X3 - milk production per capita and average selling prices for 1 kg of milk by agricultural producers ($r = -0.945$);

X2 and X10 - milk production per capita and investment in fixed assets per capita ($r = -0.901$);

X3 and X4 - average selling prices of 1 kg of milk by agricultural producers and the share of the rural population ($r = -0.960$);

X3 and X10 - average selling prices of 1 kg of milk by agricultural producers and investments in fixed assets per capita ($r = 0.906$);

X4 and X10 - the share of the rural population and investment in fixed assets per capita ($r = -0.901$);

X5 and X7 - the number of the population with monetary incomes below the subsistence level and the number of cows per 1 villager ($r = 0.966$);

X5 and X8 - the number of the population with monetary incomes below the subsistence level and milk yield per cow ($r = -0.974$);

X7 and X8 - the number of cows per 1000 rural residents and milk yield per 1 cow ($r = 0.972$);

X8 and X10 - milk production per cow and investment in fixed assets per capita ($r = 0.918$).

The strength of the relationship between milk consumption per capita and the presented factor characteristics was determined based on the value of the pair correlation coefficients (Table 2).

In accordance with the Chaddock scale, the index of growth in real money income ($rx1y = 0.637$) and milk production per capita ($rx2y = 0.606$) are the most closely related to milk consumption per capita in the Ulyanovsk region.

A noticeable direct relationship between milk consumption per capita and the share of the rural population ($rx4y = 0.532$), a noticeable inverse relationship with the average selling prices of

1 ton of milk by agricultural producers ($rx3y = -0.577$) and the share of pensioners in the total population ($rx6y = -0.523$). There is a weak relationship with other factors, including a direct relationship with the population with monetary incomes below the subsistence level, and the reverse with milk yield, feed consumption per head of cattle, and fixed capital investments per capita.

Since the inclusion of variables with a high correlation in the regression model leads to the instability of the model (Potts et al., 2017), we exclude the variable X8 - milk yield (choosing in favor of variables X5 is the number of the population with monetary incomes below the subsistence level and and X7 is the number of cows per 1 rural resident);

Table 1: Paired correlation coefficient matrix

Factors	Y	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀
Consumption of milk and dairy products	1										
Growth index of real money income, %	0.637	1									
Milk production per capita, kg	0.606	0.601	1								
Average selling prices for 1 kg of milk by agricultural producers, rubles	-0.577	-0.563	-0.945	1							
Share of rural population, %	0.532	0.612	0.886	-0.960	1						
Population with cash incomes below the subsistence level, %	0.183	0.246	0.835	-0.790	0.702	1					
Share of pensioners, %	-0.523	-0.009	-0.157	0.266	-0.254	0.022	1				
Number of cows per 1000 rural residents, head	0.336	0.301	0.882	-0.821	0.712	0.966	-0.151	1			
Milk yield, kg	-0.241	-0.302	-0.863	0.843	-0.776	-0.974	0.120	-0.972	1		
Feed consumption per 1 cattle head, c. f. unit.	-0.129	-0.177	0.272	-0.301	0.171	0.479	0.325	0.380	-0.363	1	
Fixed capital investments per capita, rubles	-0.296	-0.510	-0.901	0.906	-0.901	-0.902	-0.028	-0.861	0.918	-0.357	1

Table 2: Degree of the relationship between variables

Factors	Paired correlation coefficient r_{xy}	Degree of the relationship between variables
Growth index of real money income, %	0.637	noticeable, direct
Milk production per capita, kg	0.606	noticeable, direct
Average selling prices for 1 kg of milk by agricultural producers, rubles	-0.577	noticeable, return
Share of rural population, %	0.532	noticeable, direct
Population with cash incomes below the subsistence level, %	0.183	weak, direct
Share of pensioners, %	-0.523	noticeable, return
Livestock of cows per 1 rural resident, head.	0.336	moderate, direct
Milk yield, kg	-0.241	weak, return
Feed consumption per 1 cattle head, c. f. unit.	-0.129	weak, return
Fixed capital investments per capita, rubles	-0.296	weak, return

3 Results

For calculations, the "Multiple regression" functionality of the Statistica analytical program was used. In accordance with the obtained results of the correlation-regression analysis, the equation of the regression model of milk consumption per capita of the Ulyanovsk region has the following form:

$$Y = 104.189 + 0.595X_1 + 0.524X_2 - 0.093X_3 + 0.388X_4 + 0.766X_5 - 3.443X_6 - 0.134X_8 + 0.905X_9 + 0.001X_{10}$$

The equation of the correlation-regression model of milk consumption per capita allows us to conclude that between the level of milk consumption and factors X₁, X₂, X₄, X₅, X₉, X₁₀ there is a direct relationship and an inverse relationship with factors X₃, X₆, X₈.

The equation of the correlation-regression model of milk consumption per capita shows that as real money incomes increase in comparison with the previous period by 1 percentage point, the level of per capita milk consumption increases by 0.595 kg. An increase in milk production per capita by 1 kg leads to an increase in its consumption by 0.524 kg. The growing share of the rural population also contributes to an increase in milk consumption - by an average of 0.388 kg. With an increase in the share of the population with money incomes below the subsistence level by 1 percentage point, the level of milk consumption increases by 0.766 kg. Increase in feed consumption per 1 cattle head per 1 c. f. unit, and the amount of investment in fixed assets per capita per 1000 rubles contributes to an increase in the effective indicator by 0.904 and 0.5 kg, respectively.

As the average selling price of 1 kg of milk by agricultural producers by 1 ruble, milk consumption per capita in the region is reduced by 0.09 kg. Due to the increase in the share of pensioners in the total population by 1 percentage point leads to a decrease in the average per capita milk consumption by 3.442 kg. The increase in the number of cows per 1000 rural residents affects the decrease in the effective factor by 0.135 kg.

The value of the multiple correlation coefficient ($R = 0.9445$) indicates that the relationship between the selected factors and the effective trait is strong (Potts et al., 2017; Nurullin et al., 2019; Nurullin et al., 2018). All factors account for 89.2% of the variation in the level of per capita milk consumption.

We estimate the significance of the constructed multiple regression equation using Fisher's F-test. The actual value of the F-test ($F_{\text{fact}} = 8.27$) exceeds the tabulated value ($F_{\text{tabl}} = 2.42$ with $\alpha = 0.05$). Therefore, with a probability of 0.95, we can conclude about the statistical significance of the compiled equation of multiple regression of milk consumption per capita in the Ulyanovsk region, which was formed under the influence of the factors under study.

The significance and reliability of the regression coefficients is verified according to the Student's t-tests. The analyzed coefficient is considered significant if its t-test in absolute value exceeds 2.00, which corresponds to a significance level of 0.05. In our example, we have for the coefficients b₁ and b₂ the following indicators of the Student's t-test: $tb_1 = 2.08$; $tb_2 = 2.61$. Therefore, only these variables are statistically significant.

An assessment of the standardized correlation coefficients shows that of all the factors included in the model, milk production per

capita and the growth of real incomes of the population have the greatest impact.

The X2 on Y influence chart shows that an increase in milk production per capita by 1 kg leads to an increase in the average per capita milk consumption in the Ulyanovsk region by 0.212 kg (Figure 1).

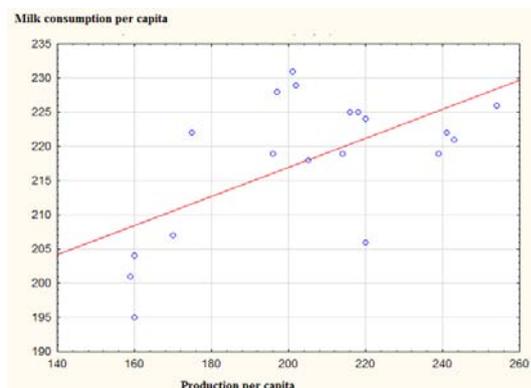


Fig. 1: Milk production on average per capita milk consumption influence chart

The equation for the linear dependence of milk consumption on its production is as follows:

$$Y = 174.46 + 0.212X_2 \tag{1}$$

The X1 on Y influence chart shows that with an increase in the growth index of real incomes of the population, 1 pp. milk consumption per capita increases by 0.851 kg (Figure 2). The equation for the linear dependence of milk consumption on the growth rate of cash income is as follows:

$$Y = 128.63 + 0.851X_1 \tag{2}$$

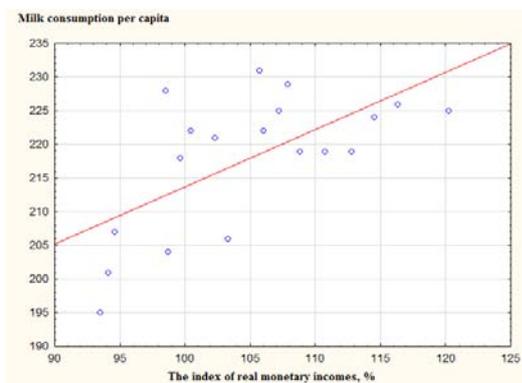


Fig. 2: The real money income growth index on the average per capita milk consumption influence chart

The combined effect of the considered factors on the level of milk consumption per capita has the form $Y = 133.02 + 0.570X_1 + 0.122X_2$ and is reflected in Figure 3.

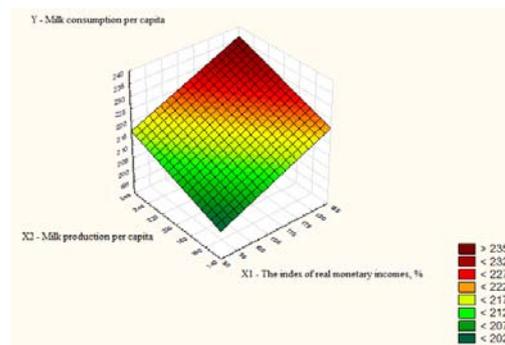


Fig. 3: 3d-chart of the influence of milk production per capita and the growth index of real money income on the level of milk consumption of the population of the Ulyanovsk region

4 Discussion

Russia annually imports 3 billion and 212 million dollars worth of dairy products from different countries of the world. The value of imported dairy products has increased by 11% in the last two years.

Among the importers of dairy products to Russia, Belarus is the largest importer of cheese and butter to Russia, which has a 38% market share of these two items in Russia.

Among Russia's imported dairy products, cheese has the largest share with a share of 22% and a value of 1 billion and 282 million dollars. It should be noted that in 2111, the share of cheese in Russian dairy imports was more than 11 percent.

Each kilo of exported cheese in 2014 had a value of about \$ 2.3. In other words, each kilo of cheese is more than 12 times more valuable for the country than oil. Also, milk has increased 11 times, ice cream has increased 9 times and yogurt has more than doubled for the country.

Kaleh Cheese Exports to Russia: \$ 2.3 per process, more than 12 times oil; Natural Gooda is valued at \$ 9, which is more than 21 times as much as oil, and Paramsan is valued at \$ 12, which is more than 22 times as much as oil.

5 Conclusions

The correlation-regression modeling makes it possible to identify the most significant factors in the consumption of milk and dairy products, to determine the directions of market development in the region.

The correlation-regression analysis showed that the level of consumption of milk and dairy products in the Ulyanovsk region is determined by the level of growth rates of real money incomes of the population and milk production per capita.

In my opinion by introducing the compulsory tagging system, the Ministry is trying to rob the dairy industry which already today has minimal profitability," said Ludmila Manitskaya, chairman of the Russian Dairy Union. "The problem is that equipment for tagging is not manufactured in Russia. It was estimated that the introduction of that system would cost dairy manufacturers Rub115 millionl.8(\$ million) per year, excluding the cost of equipment. Most experts agree that once the new systems are up and running, there would be no room for any counterfeit dairy products in Russia. By bringing order to the domestic market, Russia's government also eyes expanding export potential of the domestic dairy industry. Russia exported dairy products to the value of 235 mill ion, and there are big hopes that this figure will grow in the years to come, as the country has recently been given permission to export dairy products to China.

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