

# Strategic Models of the Influence of Consumer Preferences on Food Demand

## Стратегические модели влияния потребительских предпочтений на спрос на продовольствие

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### **Abstract**

The work raises the problem of ensuring rational norms of food consumption, which is reflected in the edition of the new Doctrine of Food Security. The emphasis is placed on the fact that when implementing measures of socio-economic support aimed at achieving these nutritional standards, it is important to take into account both price and non-price factors. The task is to determine the dependence of the level of demand for products on consumer preferences. To solve it, we used the mathematical apparatus and software for constructing econometric models based on a database of indicators characterizing the level of consumption by type of product per capita in the context of regions on average for 2018-2020. The resulting models made it possible to describe the dependence of the level of demand for some products on the level of demand for others. Revealed the relationship between the level of consumption for a number of main types of products. The conclusion is made about the importance of consumer preferences along with the income of the population and prices for products in the formation of the structure of a healthy diet. The practical value of the re-

sults obtained lies in the fact that, according to the experience of developed countries, the structure of demand determines the structure of supply and, as a result, the structure of producers' income. This should be taken into account when preparing strategic decisions on food security.

**Keywords:** food security, economic affordability, nutritional standards, consumer preferences, demand models

### Аннотация

В работе поднимается проблема обеспечения рациональных норм потребления продуктов питания, которая обозначена в редакции Доктрины продовольственной безопасности от 2020 г. Акцент сделан на том, что при реализации мер социально-экономической поддержки, направленных на достижение данных норм питания, важно учитывать как ценовые, так и неценовые факторы. Задача состоит в том, чтобы определить зависимость уровня спроса на продукцию от потребительских предпочтений. Для ее решения использовался математический аппарат и программное обеспечение построения эконометрических моделей на основе базы показателей, характеризующих уровень потребления по видам продукции на душу населения в разрезе регионов в среднем за 2018-2020 гг. Полученные модели позволили описать зависимость уровня спроса на одни товары от уровня спроса на другие. Выявлена взаимосвязь между уровнем потребления по ряду основных видов продукции. Делается вывод о значимости потребительских предпочтений наряду с доходами населения и ценами на продукты в формировании структуры здорового питания. Практическая ценность полученных результатов заключается в том, что по опыту развитых стран структура спроса определяет структуру предложения и, как следствие, структуру доходов производителей. Это следует учитывать при подготовке стратегических решений по продовольственной безопасности.

**Ключевые слова:** продовольственная безопасность, экономическая доступность, нормы питания, потребительские предпочтения, модели спроса.

### Introduction

Since January 2020, a new edition of the Food Security Doctrine of the Russian Federation has entered into force, the need for which is overdue due to the changed economic situation, the achievement of key principles of the Doctrine 2010 and the formation of qualitatively different strategic guidelines for the development of the agri-food sector.

As noted by academician I.G. Ushachev, one of the most important changes is related to the clarification of the strategic goal to provide the country's population with safe, high-quality and affordable agricultural products, which is supplemented by the need to ensure rational consumption standards for food products [14]. In this context, it is worth noting the category of economic accessibility, which is characterized by the ratio of the formed level of actual consumption per capita with rational nutrition standards, reflected in the Order of the Ministry of Health [1]. Today, these standards are not met for the consumption of a number of main types of products (figure 1), thereby limiting the level of production.

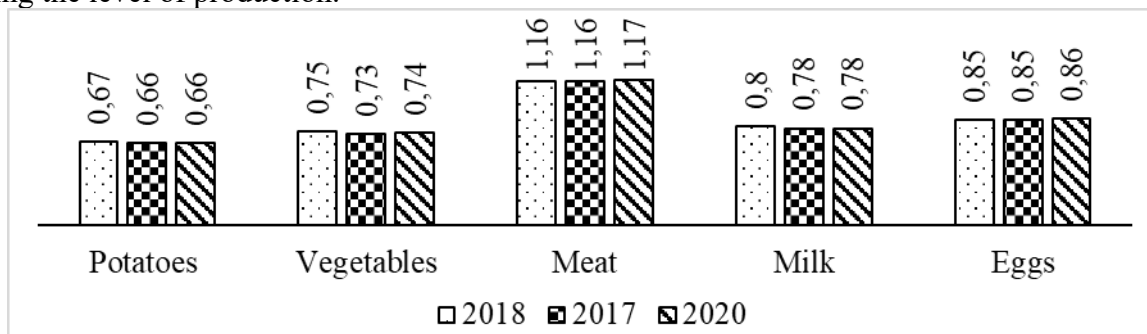


Figure 1 - Ratio of consumption of products per capita with rational norms, coefficient  
Source: compiled by authors

An analysis of the data presented in figure 1 shows that for potatoes, vegetables, milk and eggs, the ratio of per capita consumption with rational standards is significantly lower than one, which confirms the timeliness of the new Doctrine. The state will require little effort to achieve healthy eating standards for every citizen of the country. The Government of the Russian Federation today confirmed the seriousness of its intentions to ensure national food security, introducing targeted social and economic support measures for certain segments of the population and families with children, especially during the coronavirus pandemic. Discussions are already underway on the introduction of product certificates, which, in our opinion, will contribute not only to curbing the regression of the purchasing power of the population, unlike current measures. Such intervention in the agrarian sector is widespread in international strategic planning practices [3] and is reflected in food programmes [6] that increase solvent demand and balance of dietary patterns. In the United States, according to the research of O.G. Ovchinnikov, the structure of demand determines the structure of supply and, as a result, the income of producers [11]. The author of the article believes that these changes should be controlled and targeted.

### Research materials and methods

In the market, including food, the level of consumption of products is determined by price factors. With the growth of incomes of the population and the containment of the growth rate of prices for products, the level of consumption will approach rational standards, and the structure of nutrition, as noted by foreign colleagues [9], will begin to shift from starchy products to fruits, vegetables and livestock products. Under the favorable influence of price factors, the consumption pattern changes in favor of a balanced diet (chicken is replaced by beef, potatoes - vegetables, etc.) [12]. It is impossible to exclude the influence of non-price factors, such as consumer preferences, when the level of consumption of some types of products is influenced by the level of consumption of other types of products. Having tools to describe the nature of such influence [7], manufacturers will be able to more easily navigate the necessary range of products, taking into account the norms of their healthy diet. In this context, both the interests of business and the needs of society are taken into account.

Linear models differ in the ease of interpretation of the results, but when choosing the general form of the model, it must be borne in mind that many important connections in economics are non-linear [2]. The type of production-type regression equation was most widely used in demand and consumption studies [13]. Therefore, the general design of the per capita consumption model is as follows:

$$\ln(C_n) = \sum_{i=1}^n a_i * \ln(C_i)$$

где  $C_n$  – per capita consumption of n-th products;  $C_i$  – per capita consumption of i-th products, i - type of products, with the exception of the studied.

The study is based on the per capita consumption of food products defined by the Doctrine. The initial data have a spatial structure by regions of the Russian Federation on average for 2016-2018. At the initial stage, data were checked for sample uniformity and distribution normality [5]. Extreme values were rejected for a number of regions that differ in the high level of consumption of bread products, potatoes and milk against the background of low incomes of the population. The structure of food costs here is formed in favor of cheap products. The coefficients of variation on the "truncated" matrix of the initial data do not exceed 33%. An assessment of the normality of the distribution of indicators according to the Shapiro-Wilkes and Lilliefors criteria allows us to conclude that this empirical distribution approximates normal.

Econometric analysis was carried out using the Gretl SPT in the following sequence: (1) construction of a regression model, (2) verification of the presence of multicollinearity of regressors by inflationary factors, (3) selection of factors by exclusion from the model of statistically insignificant variables, (4) formation of an adjusted regression model, (5) assessment of the quality of the final regression model and the significance of its parameters [4].

## Results and discussion

Product consumption patterns allow you to describe more than 99% of the dependence of a variable. The quality of models in all cases with excess fits into the norm according to the Fisher criterion (Significance  $F < 0.05$ ). The quality of the model parameters meets the established Student criteria (P-Value  $< 0.05$ ). In no case is the hypothesis of the presence of multicollinearity by the method of inflationary factors confirmed.

Table 2 - Patterns of impact of consumer preferences on consumption of basic products per capita

Products	Appointment	Model	R <sup>2</sup>	P-value (F)
Potatoes	p	$C_b^{0,4456} * C_v^{0,2587} * C_e^{0,3533} * C_s^{0,3296}$	99,87	4,41e-91
Vegetable oil	vo	$C_b^{0,3259} * C_s^{0,2617}$	99,77	8,03e-91
Milk and dairy products	md	$C_f^{0,2783} * C_{mm}^{0,2665} * C_e^{0,2652} * C_{ff}^{-0,1384}$	99,97	4,6e-118
Meat and meat products	mm	$C_{md}^{0,3508} * C_e^{0,3642} * C_{ff}^{0,1702}$	99,94	3,3e-113
Vegetables and melons	v	$C_k^{0,2359} * C_f^{0,2359}$	99,96	1,4e-110
Fish and fish products	ff	$C_b^{-0,5479} * C_f^{0,4484} * C_{mm}^{0,6928} * C_e^{0,3951}$	99,71	1,52e-82
Sugar and confectionery	s	$C_b^{0,3496} * C_f^{0,2359} * C_{mm}^{0,2384} * C_e^{0,2474} * C_{mff}^{0,2373}$	99,93	9,7e-101
Fruit	f	$C_v^{0,4852} * C_{md}^{0,2676} * C_{ff}^{0,1467}$	99,94	8,1e-107
Bread and bread products	b	$C_{md}^{0,1960} * C_s^{0,4239}$	99,97	6,5e-116
Eggs, pcs./year	e	$C_k^{0,1437} * C_v^{0,1301} * C_{mm}^{0,3175} * C_{ff}^{0,1049}$	99,97	1,2e-113

\*C<sub>p...e</sub> – per capita consumption, kg/year

Source: compiled by authors

The resulting models allow you to evaluate the impact of consumer preferences on the level of consumption of each type of product. The demand for potatoes is determined by the demand for 4 types of products (bread, vegetables, eggs and sugar), for vegetable oil - 2 types (bread and sugar), for milk - 4 types (fruits, meat, eggs and fish), for meat - 3 types (milk, eggs, fish), for vegetables - 2 types (potatoes fruits), etc.

A 1% increase in demand leads to:

- for bread products to increase the demand for potatoes by 0.45%, vegetable oil by 0.33%, sugar and confectionery by 0.35% and decrease the demand for fish products by 0.55%;
- for vegetables to increase consumption of potatoes by 0.26% and eggs by 0.13%;
- for eggs, to increase the demand for potatoes by 0.35%, milk and dairy products by 0.27%, meat and meat products by 0.36%;
- sugar to potato growth by 0.33%, vegetable oil by 0.26%, bread products by 0.42%;
- milk and dairy products to increase consumption of meat by 0.35% and bread products by 0.20%;
- meat and meat products to increase demand for milk by 0.27% and eggs by 0.32%;
- for potatoes to increase the level of consumption of vegetables by 0.24% and eggs by 0.14%.

There is a certain interdependence of demand between bread and sugar, vegetables and potatoes, potatoes and eggs, vegetables and fruits, milk and meat, milk and fruits, meat and fish, meat and eggs. This can contribute to the scientifically sound formation of specialization of product manufacturers.

### **Conclusion**

Thus, the results of the study show that the role of consumer preferences is quite large in shaping the structure of a healthy diet. This should be taken into account when implementing the main provisions of the 2020 Doctrine aimed at ensuring rational food consumption standards. Based on the relationship between the level of consumption of some types of products and others, it is possible to achieve a balanced diet, to increase consumer orientation of producers. The models obtained for describing per capita consumption will be able to act in the hands of the authorities as a kind of tool to support the adoption of strategic decisions on food security.

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