

Spatial Differentiation of Prices for Vegetables in Russia: The Impact of Foreign Markets

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Abstract. The work examines the influence of foreign markets on the spatial differentiation of vegetable prices in Russia using the example of regional tomato markets. To this end, a comparative assessment was made of the spatial differentiation levels of tomato prices calculated before the introduction of the food embargo, which prohibits, including the import of tomatoes from the EU, during the embargo and during the ban on the import of tomatoes from Turkey. The level of spatial differentiation of tomato prices was determined by calculating the volatility indicator. According to the results of the study, it was determined that foreign markets influence the spatial differentiation of tomato prices. Thus, the introduction of the food embargo in 2014 led to an increase in spatial price volatility, and the ban on the import of tomatoes from Turkey in 2016 further aggravated the situation. At the same time, the largest price reactions to the restriction of tomato imports in 2015 were observed in the Far Eastern, Siberian and central regions of the country, in 2016 - in the Volga, Ural and central regions.

1. Introduction

The price level and their spatial dynamics are indicators of the efficiency of the economic system and the optimal distribution of limited resources. Excessive discrepancies in prices for homogeneous products between individual regions of the country, their multidirectional and disproportionate changes may indicate poor integration of regional markets and failure to fulfill the conditions of a single economic space [1].

The level and dynamics of consumer prices also determine the standard of living of the population. A significant spatial price differentiation increases social tension in the country. In this regard, it is necessary to study the spatial price differentiation of the most significant goods, to identify factors contributing to its strengthening, to take appropriate measures to eliminate excessive price differentiation by region.

The intensification of foreign trade relations leads to an increase in the dependence of the national food market on imports and a decrease in food security. On the other hand, the restriction of imports entails a reduction in supply and, as a consequence, an increase in food prices. If the regional markets are integrated among themselves, that is, there are no factors preventing the flow of food products from regions with excess supply to scarce regions, it is likely that the price shock resulting from the

restriction of import supplies will be eliminated in the short term by arbitration. If regional markets are poorly integrated and spatial arbitration is difficult, it is likely that restricting imports will increase spatial price differentiation.

The aim of this work is to identify the influence of foreign markets on the spatial differentiation of vegetable prices. The choice of this product category is due to the fact that vegetables are the most important consumer product sold in competitive markets, which is easily transported and can participate in fast spatial and price arbitration. In addition, the share of imported products in the vegetable market is high and, accordingly, the dependence on foreign markets.

Since the commodity group of vegetables is quite extensive, and the deliveries of their individual species are made from different countries, the impact of foreign markets on the spatial differentiation of prices for vegetables will be evaluated using the example of tomatoes, a popular and ubiquitous vegetable crop that occupies the largest share in the structure of Russian import of vegetables.

2. Studies of spatial price differentiation

The problem of spatial price differentiation was of great interest to many researchers. Researchers such as C. Delgado, M. Ravallion, E. Engle, C. Granger, M. Obstfeld, A. Taylor, B. Baulch, C. Engel, and J. Rogers developed methods for assessing spatial price differentiation and tested them on specific markets [2-7]. And, for example, V. Zant, T. Volraz, C. Galahan, S. Catengueza, B. Kanpenhout conducted empirical studies of spatial price differentiation during periods of economic crises, institutional innovations, and economic transformations [8-12].

The study of spatial price differentiation in Russia was carried out by both domestic (K.P. Glushchenko, G.F. Yusupova, D. Kuligina, N. Raiskaya, Y. Sergienko, A. Frenkel, N.P. Ryzhova) and foreign researchers (D. Berkovits, D. DeYong, B. Goodwin, V. Cohen, P. DeMazi, B. Gardner, K. Brooks) [13-22]. Moreover, most of the work is devoted to the study of the spatial differentiation of food prices during the period of transformation of the economic system.

A few more modern studies aimed at studying the spatial differentiation of prices in the country are devoted to identifying factors affecting this process. Among the factors affecting the spatial price differentiation in the country, the researchers note the underdeveloped infrastructure and high transaction costs that constrain arbitration, differences in wages and shares of non-tradable goods in the structure of the regional economy, regional trade costs, the level of retail monopolization, tariffs on the production of natural monopolies, share of social payments in total income [23-24].

As for the spatial differentiation of prices for vegetables, according to the results of a study previously conducted by the author of this article, it was revealed that within the Russian vegetable market groups of regional markets are distinguished, characterized by special price behavior. Regions with an increased level of spatial differentiation of vegetable prices include the regions of the Far East bordering China, regions with a maximum value of gross regional product per capita, hard-to-reach regions with a low density of railroad tracks, regions with a high share of sales in retail markets and fairs [25].

Also, a study conducted earlier by the author of the article determined the influence of China on the special behavior of vegetable prices in the border Far Eastern regions. The results obtained allowed us to conclude that China does not have a greater impact on price behavior in the regions of the south of the Russian Far East than other regions of the country, which was originally assumed [26].

In the framework of this study, the spatial differentiation of tomato prices will be estimated based on monthly regional price data from 2013 to 2017, presented on the Rosstat website. In the indicated period, the tomato market experienced a double shock, associated, firstly, with the ban on the import of tomatoes from the EU countries (from August 7, 2014), and secondly, with the ban and restriction of their import from Turkey (from January 1, 2016 on May 1, 2018). Assessing the level of spatial price differentiation will reveal the degree of influence of the first and second waves of import restrictions on price dynamics, and, accordingly, determine the impact of foreign markets on the spatial variability of tomato prices.

3. Tomato market in Russia

In 2013-2017 the Russian tomato market was characterized by a rather low level of self-sufficiency, with the exception of 2016, more than half of the domestic consumption of tomatoes was provided by import supplies. 2/3 of the total collection of vegetables accounted for the Southern, Central and Volga Federal Districts. The main producers of tomatoes were households.

In the study period, the own production of tomatoes for the most part was their cultivation in the open ground. The gross harvest of open-field tomatoes was more than 80%, while that of indoor tomatoes was less than 20%.

A short period of harvest of tomatoes in open ground increases the role of greenhouse vegetable growing. The introduction of restrictions on the import of vegetables contributed to the development of the production of greenhouse tomatoes. However, despite the positive changes occurring due to increased investments and protectionist measures of the state, according to the expert and analytical center of agribusiness, Russia's self-sufficiency in sheltered tomatoes remained inadequate in 2017 - 39.5%.

Thus, as a result of the fact that domestic agricultural producers cannot fully provide the country with greenhouse products in the off-season, import plays a significant role in the Russian tomato market.

According to the FCS for 2013-2017, tomato imports had mixed trends - negative in 2014-2016 and positive in 2017. To reduce tomato imports in 2014-2016 restrictions on the import of these products from the EU and Turkey, as well as the depreciation of the ruble. In 2015, compared with 2013, the import of tomatoes in monetary terms decreased by 1.6 times, and in 2016 - by 2.3 times. The maximum volume of imports in the study period (1.11 billion US dollars) corresponded to 2013, the minimum (486 million US dollars) - 2016.

Until 2016, Turkey was the key supplier of tomatoes to Russia, the country accounted for more than half of all imports. Significant imports from Turkey were associated with low prices and a high level of service. In 2016, Morocco became the leader in the supply of tomatoes in Russia, followed by China and Azerbaijan. In 2017, Azerbaijan became the main supplier of tomatoes, which accounted for 27.5%; China (25%) and Morocco (23.5%) were also among the three leaders.

In 2018, the volume of the tomato market in Russia, excluding production volumes of private farms and households, amounted to 1321 thousand tons, while imports amounted to 516 thousand tons of tomatoes. The chain growth rate amounted to 32.2% of the natural market volume.

The main importer of tomatoes in the country is the Central Federal District; in 2017, the region's regions accounted for more than 60% of supplies.

The practical significance of assessing the spatial differentiation of tomato prices and identifying the impact of foreign markets on it is expressed in the need to justify economic policies aimed at reducing regional segmentation and dependence on imports. The effective implementation of specific economic policies, in turn, requires the use of adequate tools for assessing the spatial differentiation of prices, which allows tracking price behavior, including their reaction to various institutional shocks.

4. Methodology for the study of spatial differentiation of prices for tomatoes

It is proposed that tomato price volatility be evaluated using a volatility indicator calculated as the standard deviation of the natural logarithms of price data:

$$V(Ln(\frac{Pa}{Pb})) = \sqrt{\frac{1}{n} \sum_{t=1}^n (Ln(\frac{Pat}{Pbt}) - \overline{Ln(\frac{Pa}{Pb})})^2} \tag{1}$$

where it is a measure of time; *n* is the number of time periods during which price data were recorded; $\frac{Pat}{Pbt}$ is a relative price indicator, calculated as the ratio of the average consumer price in the regional market *a* during time *t*, to the average consumer price in the regional market *b* during time *t*; $Ln(\frac{Pat}{Pbt})$ - percentage price differential (gap between prices).

It should be noted that in empirical studies, when assessing spatial price differentiation, both absolute and relative price indicators are used. However, the use of price indices has certain disadvantages. For example, a regional consumer price index uses weights proportional to the urban population. Accordingly, weights may vary across regions, which will lead to certain errors in the calculation of spatial price volatility. Given this drawback, in contrast to the studies conducted earlier by the author of the article, the assessment of spatial price differentiation will be carried out not by the aggregated relative price indicator - the consumer price index, but on the basis of the absolute values of average consumer prices for tomatoes.

5. Evaluation Results

The spatial differentiation of tomato prices was assessed in 83 subjects of the Russian Federation. To maintain the uniformity of the composition of the studied markets, Crimea and the city of Sevastopol, included in the Russian Federation in 2014, were not included in their number.

In order to determine the level of spatial differentiation of price data for each of the 83 regional markets, 6318 territorial (relative) average consumer prices for tomatoes were calculated, after which their natural logarithms were found, based on which volatility indicators were calculated (82 indicators for each subject of the Russian Federation). Next, the average values of tomato price volatility for each of the studied markets were determined, on the basis of which the average values of volatility for all the studied regional markets were calculated.

The results of assessing the average value of volatility for all the studied regional tomato markets determined that in 2013-2017. The indicator varied from 0.1491 (in 2014) to 0.1871 (in 2016) (Figure 1).

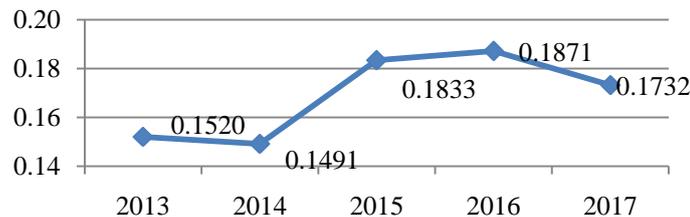


Figure 1. Dynamics of the average value of the volatility indicator of relative prices for tomatoes by regional markets of Russia in 2013-2017.

The food embargo prohibiting, including the import of vegetables from Spain, the Netherlands, Poland and Belgium, which supplied a significant share of tomatoes in 2013, was introduced in the second half of 2014. In this regard, the average value of volatility for the period August-December was separately calculated in 2014, which amounted to 0.1652, which is higher than the value for 2013 by 8.7%, and in 2014 by 10.8%. Thus, already in the short term of the embargo, an increase in the spatial differentiation of tomato prices followed, which continued until 2016.

In 2015, compared with 2013, imports of tomatoes declined 1.6 times, and the spatial differentiation of tomato prices increased 1.21 times. A larger increase in the spatial differentiation of tomato prices in 2015 compared with the first five months of the embargo could be due to the fact that the ban was applied during the tomato harvest period in the country, i.e. the domestic supply was sufficient to offset the deficit in some regions. In addition, many wholesalers, with the beginning of the ban, could continue to sell vegetables purchased before the embargo was introduced without changing their prices.

Also in 2015, the largest chain growth rate was observed for the spatial differentiation of tomato prices in the period under review. The medium-term period of the embargo was not enough to increase domestic tomato production and completely reorient to other suppliers; accordingly, the deficit caused a price shock, which affected the increase in the level of spatial price differentiation in the country

In 2016, tomato imports decreased compared to 2013 even more - by 2.3 times, spatial differentiation increased by 1.23 times. However, the chain growth rate of the tomato price volatility indicator (102.1%) was much lower than the same indicator calculated for 2015 (122.9%).

Thus, the results allow us to conclude that a decrease in tomato imports led to an increase in the spatial differentiation of prices for them. At the same time, based on the calculated growth rates of the volatility index, we can conclude that the first wave of the embargo related to the ban on the import of tomatoes from the EU corresponded to stronger price reactions compared to the second wave of import restrictions, i.e., the ban on the import of tomatoes from Turkey. This in turn may be due to the fact that by 2016 there was a significant increase in domestic tomato production, the growth rate of production in relation to 2013 was 110.9%. It is also possible that new logistics chains have been debugged, allowing domestic tomatoes to be sold in scarce regions. Nevertheless, despite positive changes, the level of spatial price differentiation in 2016 was the highest in the period under review. This suggests that the market did not have enough time to eliminate the impact of institutional changes associated with the sanctions regime, and the ban on tomato imports from Turkey only aggravated the situation.

An assessment of the spatial differentiation of tomato prices by federal districts determined the mixed reaction of certain groups of regions to the embargo. The maximum chain growth rate of volatility in relative average consumer prices for tomatoes in 2015 corresponded to the Central Federal District (128.6%), the Siberian Federal District (129%) and the Far Eastern Federal District (149.3%), and the minimum - the North Caucasian Federal District (102.3%).

In 2016, the highest growth rate of the volatility index corresponded to the Ural Federal District (115.8%) and the Volga Federal District (112.2%). The Central Federal District, which was the main importer of Turkish tomatoes before the ban on their import, was characterized in 2016 by the largest decrease in the relative price volatility of tomatoes compared to 2015 (by 9.7%). Such dynamics may be due to the fact that a significant decrease in supply due to the departure from the market of Turkish tomatoes led to an increase in initially lower prices compared to the average Russian level of tomato prices in the Central Federal District. This ultimately led to a decrease in the spread of relative prices for tomatoes relative to their average value and a decrease in volatility.

6. Conclusions

The study allows us to draw certain conclusions. First, a decrease in tomato imports and its complete ban from individual countries in 2014-2016 contributed to an increase in the spatial differentiation of tomato prices in Russia. Accordingly, foreign markets influence the behavior of tomato prices in the country and their regional volatility. Secondly, a significant difference in the volatility index of relative prices for tomatoes of individual regions of the country indicates the ambiguous effect of foreign markets on the level of their spatial differentiation of tomato prices.

It should also be noted that throughout the country, the introduction of the food embargo in August 2014 entailed stronger price reactions compared to the ban on the import of tomatoes from Turkey in 2016. However, for the Central Federal District, which was the main importer of tomatoes from the EU and Turkey Both the first and the second wave of import restrictions were reflected by significant, but ambiguous changes in the level of spatial price differentiation.

To eliminate and reduce possible price shocks in regional tomato markets, it is necessary to reduce their dependence on foreign markets. This will be facilitated by increasing investment in industrial vegetable growing and limiting imports for protectionist purposes.

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