# МИРОВАЯ ЭКОНОМИКА И МЕЖДУНАРОДНЫЕ ФИНАНСЫ

UDC: 339.54
JEL: F13

## The effect of sanctions on Russian agricultural imports

*E. V. Zhiryaeva*[1], *N. M. Svetlov*[2]

[1] Russian Presidential Academy of National Economy and Public Administration,
North-West Institute of Management,
57/43, Sredniy pr., Vasilyevsky Island, St.Petersburg, 199178, Russian Federation
[2] Central Economics and Mathematics Institute of Russian Academy of Sciences,
47, Nakhimovsky pr., Moscow, 117418, Russian Federation

**For citation:** Zhiryaeva E. V., Svetlov N. M. (2020) The effect of sanctions on Russian agricultural imports. *St Petersburg University Journal of Economic Studies,* vol. 36, iss. 4, pp. 653–674.
https://doi.org/10.21638/spbu05.2020.405

This paper contributes to the methodology of trade policy analysis, specifically to the assessments of non-tariff measures. To quantifying the effects of these measures, the proportion between the variables of two gravity equations, describing the situation before and after the embargo is used. The ratio of imports per unit of the supplier's GDP over the two compared periods (2013 and 2017) is different for two groups of trade partners, one of which includes free-trade partners while the other spans the rest of the world (with some exceptions). In the presence of the embargo the gap in the average imports per unit of the supplier's GDP between the two groups is wider. This is a consequence of the emergence of a new trade barrier. This gap allows us to indirectly quantify the trade bans via their tariff equivalent. In this study the methodology is applied to the case of food and agricultural imports. Fish, as well as other products outside chapters 1–24 of Harmonized commodity description and coding system, are excluded. The hypothesis of the study is that the impact of the embargo on the food and agricultural imports does not exceed that of tariff and phytosanitary measures. The study rejects this hypothesis and concludes that the embargo establishes a prohibitive level of protection.

*Keywords:* special economic measure, food embargo, international trade, sanitary and phytosanitary measures, tariff equivalent, indirect estimation.

### Introduction

Intensively trading nations are characterized by a variety of trade regimes that change over time, making it difficult to assess the impact of tariff and non-tariff measures on

trade. However, for specific countries and conditions it may be possible to formalize, under certain assumptions, a set of regulatory methods. This, in turn, makes it possible to carry out such an assessment. The basic measure of import regulation in countries of the Eurasian Economic Union (EAEU) is the common customs tariff at the Most favored nation (MFN) treatment rate. According to the list of preferential goods approved by the EAEU countries[1] and article 36 of the Treaty on the EAEU,[2] imports from two country groups — developing (104 countries) and least developed (48 countries)[3]—provide 75 % and 0 % of the MFN rate respectively.

Non-tariff measures applied to agri-food imports include sanitary and phytosanitary barriers, technical regulations, quotas and prohibitions. In 2012 the Russian Federation joined the WTO and started a phased reduction of import duties with a transition period until 2020, when the tariff quota on pork meat was removed. In 2014, a food embargo was imposed on selected imports from some WTO members, and in 2016 this policy was extended, particularly spanning Ukraine.

The aim of this study is to quantify the effect of Russia's food embargo on imports of food and agricultural products in comparison to the effect of other tariff and non-tariff barriers. Since the embargo was imposed in 2014 and strengthened in 2016, we carry out this assessment via comparison of agri-food import per exporters' GDP ratio in 2013 and 2017.

In turn, the quantitative study enables us to reject the hypothesis that the effect of the food embargo on Russia's agri-food import does not exceed the existing tariff and non-tariff barriers in total, i. e. the embargo plays a secondary role among existing trade barriers protecting the Russian national agri-food market.

It is known from Jan Tinbergen's gravity equation that the volume of trade between countries is proportional to their GDP and inversely proportional to some measure of distance between them. The gravity equation makes it possible to establish a relation between import volumes and tariff and non-tariff trade barriers, which act as economic distance in the denominator of the equation. The patterns established by the gravity equation make it possible to relate the import from a given country (or a group of countries) to its (or their total) GDP. Consequently, differences in import per unit of GDP relate to differences in economic distance between countries, i.e. trade barriers. For example, given two groups of countries — the reference group (which is precisely defined below) consisting of free trade areas (FTA) countries and the rest of the world, such a comparison demonstrates that imports from the rest of the world are 5 times higher than imports from the reference group while GDP from the rest of the world is 50 times higher than GDP of the reference group. The ten times difference obtained indicates that the trade barriers faced by the rest of the world are 10 times higher than that of the reference group (assuming that the corresponding exponent in the gravity equation equals to one).

---

[1] Tariff Preferences for developing and least-developed countries. (2019) Moscow: Eurasian Economic Commission. URL: http://www.eurasiancommission.org/en/act/trade/dotp/commonSytem/Pages/normatBaza.aspx (accessed: 02.11.2019).

[2] Regional Trade Agreements Database. Eurasian Economic Union. (2019) Geneva: WTO. URL:http://rtais.wto.org/UI/PublicShowMemberRTAIDCard.aspx?rtaid=909 (accessed: 02.11.2019).

[3] Tariff Preferences for developing and least-developed countries. (2019) Moscow: Eurasian Economic Commission. URL: http://www.eurasiancommission.org/en/act/trade/dotp/commonSytem/Pages/normatBaza.aspx (accessed: 02.11.2019).

The advantage of the proposed approach is, above all, that it is much simpler than the alternatives available. It reduces to a simple formula, which can be evaluated straightforwardly. It is also important that our approach requires less initial data than constructing a special econometric model aimed at the same purpose. Finally, econometric modeling of Russia's foreign trade is complicated by the transient development of its economy [Livshitz, Livshitz, 2011]. The disadvantage of the technique is that its application is conditional to the circumstances that rarely exist in practice.

## 1. Literature review

**Gravity equation.** J. Tinbergen's gravity equation is the basis for our approach [Tinbergen, 1962]. Gravity models have been applied to analyze international trade since the 1960s originating in studies by J. Tinbergen, P. Poyhonen and H. Linnemann. According to J. Tinbergen, the volume of trade between two countries is proportional to the arithmetic product of the sizes of their markets approximated by corresponding values of gross domestic product (GDP). The proportionality factor differs between pairs of countries depending on the obstacles to bilateral trade.

Initially, the gravity equation was considered as a representation of the empirically observed stable relationship between the size of economies, the distance and volume of their trade. Tinbergen' approach has been applied to various data that proved its validity. In Tinbergen's notation, the gravity equation in economics is written as [Rauch, 2016]:

$$E_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3}, \quad (1)$$

where $E_{ij}$ denotes the export of the country $i$ to country $j$; $Y_i$ — GDP of country $I$; $Y_j$ — GDP of country $j$; $D_{ij}$ — the difficulty for the exporter $i$ to reach a market of $j$ (proportional to bilateral trade costs). The value of $D_{ij}$ may depend on distance between countries that affects transportation costs as well as political obstacles such as tariffs. Other factors, like common language, can influence the measure of resistance to trade as well [Helpman, 2017].

According to C. Herrmann-Pillath, one of the major issues in empirical trade research is the fact that seemingly atheoretical approaches such as the gravity equation work well, whereas the core hypotheses of equilibrium trade theory are more difficult to corroborate [Herrmann-Pillath, 2006]. Gravity equations are the most-used devices for testing for network effects in international trade, e. g. the role of common culture, which presumably are an important determinant of trade costs without being an explicit part of standard trade models.

According to one review [Serrano, Pinilla, 2012], empirical validations of the gravity equation conclude that the equation can be derived from different theoretical models. This is an eclectic vision of trade determinants which includes, in a complementary fashion, the Hecksher–Ohlin model with specialization and the models of the new international trade theory with increasing returns to scale and monopolistic competition [Serrano, Pinilla, 2012].

To construct a model of Russia's grain exports, E. Zhiryaeva proposes an intermediate form of the gravity equation [Zhiryaeva, 2018]. This includes a factor characteristic, namely the gross grain yield, linking the gravity approach to the traditional trade theories.

As this study aims at quantifying trade obstacles, it is essential to obtain the magnitude of Tinbergen's parameter $\alpha_3$, which measures the influence of distance (i. e. trade

obstacles) on the volume of trade. For this purpose, we rely on its estimations from earlier studies.

J. Tinbergen estimates that $\alpha_1$ and $\alpha_2$ are close to 1 and $\alpha_3$ is close to −2 [Tinbergen, 1962]. However, in many consequent studies the estimate of $\alpha_3$ is found close to −1. F. Rauch explains why coefficients on log distance ($\alpha_3$) in estimates of gravity equations have been so persistent near −1 over time [Rauch, 2016]. As he writes, similar gravity equations have frequently been estimated and estimates that do not reject $\alpha_1=\alpha_2=-\alpha_3=1$ have been observed for aggregate trade flows as well as a wide range of goods or services and they have been remarkably persistent over time [Rauch, 2016]. While the reason for the persistence of the coefficients indicating economic size ($\alpha_1$ and $\alpha_2$) is predicted by many of the current international trade standard models [Evenett, Keller, 1998], the persistent role of distance ($\alpha_3$) continues to puzzle economists. K. Head and T. Mayer use a meta-analysis of 1835 estimates of the distance coefficient in gravity type regressions in 161 published papers [Head, Mayer, 2013]. Elasticity of international trade by distance is remarkably stable, hovering around −1 over a century and a half of data. The size coefficients $\alpha_1$ and $\alpha_2$ are also stable and close to 1 [Chaney, 2018].

In one article [Zhiryaeva, Naumov, 2018], where the export from north-western regions of the Russian Federation is estimated, distance is determined by a number of indicators representing:

1) the availability of line vessels for the exporting country;
2) whether the exporting region is located in Europe;
3) the existence of common surface boundaries;
4) the presence of a common sea between trade partners; and finally
5) the existence of trade barriers (the most important for this study).

The estimate of economic distance index (5) was −0.94, which appears closest to −1 among the five mentioned distance proxies.

**Specific factors of agricultural trade.** According to R. Serrano and V. Pinilla, several studies have provided evidence that agricultural trade should be framed within characteristic models of homogenous products and that its theoretical base is easier to reconcile with national product differentiation trade models or reciprocal dumping. These models are based on the idea that countries trade because certain products cannot be substituted and in this case the "reverse home market effect" occurs [Serrano, Pinilla, 2012].

Using a gravity model, the authors compare the impact of various factors upon bilateral trade in agricultural products between 1963 and 2000 for a representative sample of 40 countries. Agricultural trade represents 29.6 % of total trade in 1951, but by the year 2000 it decreases to 8.5 %. The reasons commonly provided by the relevant literature are: expansion of protectionism in the international markets for agricultural products; changes in consumption patterns due to growing incomes and savings on agricultural raw materials due to the technological advances in industry. Moreover, increasing intra-industrial trade, which was typical for manufacturing sectors, appeared less important for international agricultural trade. While many types of trade, such as manufactured products, enjoyed greater multilateral market liberalization, protectionism caused agricultural trade to grow on the base of proliferation of regional trade agreements (RTAs) [Serrano, Pinilla, 2012].

Based on this consideration, we include in the reference group of our study the countries having duty-free access to agri-food markets of the Russian Federation. Thus, the

countries from the reference group have the common path of agricultural bilateral trade evolution at least in their relations with Russia.

**Methods of trade barriers estimation.** A variety of approaches to assessing non-tariff barriers can be found in the literature. First, economic effects of prohibitions and quotas worsen terms of trade for exporting countries and reduce their economic welfare. Second, quantitative restrictions (QRs) create an import substitution effect that harms consumers in the importing countries and, unlike tariffs, generate no revenues for the government. Third, over the middle and long term, QRs discourage companies from enhancing productivity. Finally, from a global perspective, quotas also distort resource allocation [Czaga, 2005].

With regard to the institutional context, the specification of the gravity equation has been refined in many studies, in order to take into account those factors which may limit or stifle trade [Serrano, Pinilla, 2012]. Some studies introduce trade policies into the gravity equation, although their inclusion in the model is admittedly difficult, due to limited or nonexistent data. Nevertheless, many studies have introduced dummy variables to analyze, on the one hand, the effect of regional liberalization produced by the proliferation of RTAs and, on the other, the effects of the multilateral liberalization of international markets. RTAs are dummy variables in the work of R. Serrano and V. Pinilla [Serrano, Pinilla, 2012].

P. Dee and M. Ferrantino argue that non-tariff measures (NTMs) are difficult to quantify. They have no immediate numerical form. That is why they may also be less transparent, which helps governments to avoid public discussion [Dee, Ferrantino, 2005]. B. Bora concludes that NTMs cannot easily be defined, and existing databases are not helpful [Bora, 2005].

Early empirical studies on NTMs for trade in goods have employed an inventory approach based on indices such as frequency ratios and import coverage ratios. Frequency ratios indicate the portion of Harmonized system[4] (HS) tariff lines subject to NTMs, while import coverage ratios imply the share of imports subject to NTMs, i. e. import-weighted frequency ratios. Frequency-type measures are based on the price differentials between the CIF price of imported goods and the domestic price of the same or similar product [Mitsuyo, 2005].

B. Hoekman estimated "tariff equivalents" of barriers to some trade flows, using a set of benchmark and frequency ratios of impediments to trade. He projected "tariff equivalents" for each sector by multiplying arbitrarily defined benchmark values by frequency ratios [Hoekman, 1995].

A. Mitsuyo focuses on the price differentials between the CIF price of imports and the producer price of the domestic substitutes, and uses by-type frequency ratios of NTMs to decompose tariff equivalent of overall NTMs [Mitsuyo, 2005].

A. Deardorff and M. Stern classify various methods of measuring NTMs as following:

— frequency-type measures based on inventory listings of observed NTMs;
— price-comparison measures, focusing on differentials between domestic price and the reference price of compared good, in terms of the price relatives or tariff equivalents expressed as a percentage difference;

[4] HS Nomenclature 2017 edition (2017). Brussels: World Customs Organization. URL: http://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs-nomenclature-2017-edition/hs-nomenclature-2017-edition.aspx (accessed: 29.12.2019).

— quantity-impact measures based on econometric estimates of the models of trade flows;
— measures, that are equivalent to the producer nominal protection coefficient [Deardorff, Stern, 1998].
— P. Dee and M. Ferrantino add modeling to the list, namely:
— partial equilibrium modeling;
— computable general equilibrium (CGE) modeling [Dee, Ferrantino, 2005].

Econometric papers estimate the impact of economic sanctions using a gravity modeling framework. Sanctions increase the bilateral resistance between the sender and the target and therefore decrease the multilateral resistance towards all other trading partners [Oranen, 2017]. S. Evenett uses the gravity model to estimate the impact of economic sanctions of eight advanced economies on the imports from South Africa. The conclusion is that sanctions adversely affected South African exports [Evenett, 2002]. An overview of econometric methods and the importance of key explanatory variables in the econometric analysis of sanctions presents in the study of G. Hufbauer, J. Schott, K. Elliott and B. Oegg [Hufbauer et al., 2009]. In gravity modeling the impact of an embargo is in general modeled through an estimation of dummy coefficients proxying the economic sanction, i. e. import or export embargo, etc. on merchandise trade [Askari et al., 2003]. An investigation of E. Rasoulinezhad reveals significant negative effects of financial and non-financial sanctions on Iran-Russia trade during 1994–2013. Both financial and non-financial sanctions are taken as dummy variables in gravity equation [Rasoulinezhad, 2016].

None of the studies mentioned represent prohibitions as an increment of economic distance. However, those that include both import taxes and prohibitions allow calculating the incremental import tax that would have the same effect on trade as the active prohibitions. This observation leads to the idea of tariff equivalent of a prohibition, which has played the key role in elaborating the methodology of this study.

## 2. Empirical base

**Justification of a hypothesis.** Though above mentioned works demonstrate an effect of embargo on import trade flows, the *hypothesis of our work is as following: the impact of selective embargo on imports in Russia is not superior to that of tariff and phytosanitary measures*. The basis for the hypothesis is the fact that Russia has not achieved full food self-sufficiency, and therefore imports from banned countries can be shortly replaced by other exporters, and the influence of the embargo on Russia's gross imports of each agri-food product can appear insignificant.

Table 1 shows the level of production and consumption of selected food products in the Russian Federation proving that no excess of production over consumption has been achieved after enforcing trade bans. Commodity groups where there is no excess of production over consumption are included in the table 1.

Rice, soybeans, beef, pork, a number of dairy products (butter, cheese) and fish oil are those products that should necessarily be imported to satisfy domestic demand. Meanwhile Russia's imports of beef, pork, butter, cheese and some other milk products from a number of countries appear to be under embargo.

**Time period.** In 2012 the Russian Federation joined the World Trade Organization (WTO). Therefore, 2013 can be considered a full year corresponding to the terms of liberal

*Table 1.* **Consumption and production of agricultural products in RF, thousands tons**

| Commodity | Consumption | | Production | | Production / Consumption | |
|---|---|---|---|---|---|---|
| | 2013 | 2017 | 2013 | 2017 | 2013 | 2017 |
| *Cereals* | | | | | | |
| Rice | 748.2 | 762.6 | 623.6 | 658.1 | 0.8 | 0.9 |
| *Oilseeds* | | | | | | |
| Soybean | 4028.1 | 4753.0 | 1636.3 | 3868.0 | 0.4 | 0.8 |
| *Meats* | | | | | | |
| Beef and veal | 2534.3 | 2161.3 | 1633.3 | 1630.0 | 0.6 | 0.8 |
| Pig meat | 3559.1 | 3703.5 | 2816.2 | 3500.0 | 0.8 | 0.9 |
| *Dairy* | | | | | | |
| Butter | 453.5 | 410.1 | 293.0 | 320.0 | 0.6 | 0.8 |
| Cheese | 852.6 | 836.3 | 448.7 | 640.0 | 0.5 | 0.8 |
| Skim milk powder | 189.5 | 181.2 | 59.4 | 79.8 | 0.3 | 0.4 |
| Whole milk powder | 71.3 | 83.4 | 29.5 | 38.8 | 0.4 | 0.5 |
| *Fisheries* | | | | | | |
| Fish oil | 1.8 | 6.1 | 1.1 | 5.0 | 0.6 | 0.8 |

Based on: OECD-FAO Agricultural Outlook 2019–2028. URL:https://stats.oecd.org/viewhtml.aspx?QueryId=91990&vh=0000&vf=0&l&il=&lang=en (accessed: 29.12.2019).

trade. After 2012 Russia's import duties decreased in compliance with the schedule. Trade in 2013 was not truly free even with FTA countries. This short period (August 2012 —August 2014) of relatively free trade is unique for Russia's trade policy. Thus, data on Russia's imports from 2013 represents a situation when both tariff and non-tariff trade barriers were minimal both in the reference (FTA) group of the countries and the rest of the world. For this reason, we use this year as the origin for our study.

Later on the situation changed: while Russian trade policy towards FTA countries remain unchanged (with some exceptions), part of the rest of the world faced an agri-food trade ban by Russia.

As a result of the [Presidential Decree from…], an opportunity emerged to build a simple model for quantifying the effect of the ban on the food and agricultural trade. As a result of the decree, the import ban was initially implied to food products originating from the European Union, the United States, Australia, Canada and Norway. After 2015 the embargo was in place against Iceland, Liechtenstein, Albania and Montenegro, and since 2016 against Ukraine.

As the basic terms of trade with the reference group of Russia's trade partners remained unchanged after 2013, the aggregated year 2017 trade data from this group is expected to change mainly in line with the GDP of the trade partners (as the gravity model suggests). If the effect of the trade ban does not exceed the effect of phytosanitary measures (which are applied to both reference group and the rest of the world) in compliance with the hypothesis then the growth of the GDP should drive the difference between Rus-

sian agri-food imports in 2013 and 2017 from the rest of the world as well. Otherwise, the hypothesis is rejected and the effectiveness of the trade ban is confirmed.

**Tariffs and non-tariff measures.** Table 2 presents data on tariff barriers both as the simple (unweighted) average and trade weighted average tariffs specified in the tariff profile of the WTO country. The data reflect the MFN tariff estimated across all tariff lines of agricultural products, including zero rate lines. Liberalization, which occurred during the period under study, is reflected in the reduced tariff level in 2017 compared to 2013.

*Table 2.* **Level of customs tariffs on agricultural imports in the Russian Federation**

| Tariff | Year | Tariff level |
|---|---|---|
| Trade weighted average tariff | 2013 | 14.8[1] |
| | 2017 | 11.6[2] |
| Unweighted average MFN applied | 2013 | 12.2[3] |
| | 2017 | 10.2[4] |

Based on: [1]World tariff profiles (2015). Geneva: WTO. URL: https://www.wto.org/english/res_e/booksp_e/tariff_profiles15_e.pdf (accessed: 29.12.2019); [2]World tariff profiles (2019). Geneva: WTO. URL: https://www.wto.org/english/res_e/booksp_e/tariff_profiles19_e.pdf (accessed: 3.12.2020); [3]World tariff profiles (2014). Geneva: WTO. URL: https://www.wto.org/english/res_e/booksp_e/tariff_profiles14_e.pdf (accessed: 29.12.2019); [4]World tariff profiles (2018). Geneva: WTO. URL: https://www.wto.org/english/res_e/booksp_e/tariff_profiles18_e.pdf (accessed: 29.12.2019).

The simple average tariff is defined as the following [Trade statistics…, 2009]: the mean (average) value of tariffs in a country or region's full tariff schedule, or a part of the schedule. The unweighted average tariff does not adjust for the significance of different products in the trade profile, so a high tariff on an insignificant product may overstate the degree of protection. It does not provide information on tariff peaks.

Trade weighted average tariff is the sum of the tariffs in a country or region's tariff schedule (or part of the schedule) multiplied by a weighting factor representing the product's importance in the country or region's trade. As with the simple average, this index may mask tariff peaks. It has a tendency to understate the level of protection because very heavily protected products are imported less (because of the high tariff), and therefore receive a small weight.

Calculations are based on the simple average of MFN applied tariffs. Results based on the trade weighted average tariffs are also provided for comparison. In assessing the level of the agricultural tariff, the WTO does not take into account customs duties on fish. For this reason, fish and fish products of chapter 03 of Harmonized commodity description and coding system (HS) are excluded from the estimation of tariff equivalent of the embargo. The WTO includes a number of non-food agricultural items in the calculation of the average tariff.[5] They are not taken into account in the paper because they are not food and are not subject to the embargo.

[5] Agreement on Agriculture covers the following products: HS Chapters 1 to 24 less fish and fish products, plus HS Codes 2905.43 (mannitol), 2905.44 (sorbitol), 33.01(essential oils), 35.01 to 35.05 (albuminoidal substances, modified starches, glues), 3809.10 (finishing agents), 3823.60 (sorbitol n.e.p.), 41.01 to 41.0 3 (hides and skins), 43.01(raw furskins), 50.01 to 50.03 (raw silk and silk waste), 51.01 to 51.

A number of assumptions are adopted in assessing the tariff equivalent of non-tariff measures other than the embargo. Sanitary and phytosanitary measures are the most significant in this category. We assume that they apply equally to the two groups of compared countries. For example, in 2017, measures against the violation of veterinary and sanitary requirements and norms of the EAEU were extended to individual enterprises of Belarus, Lithuania, Thailand, Peru, Argentina, New Zealand, Vietnam, Turkey, Poland, the Republic of Moldova, Kazakhstan, Uruguay, Colombia, Serbia and Ukraine [FAO, 2018]. An additional rationale for this assumption is that sanitary and phytosanitary barriers are applied independently of the trade regime. The preamble to GATT article XX states that such measures should not be imposed to restrict trade in a disguised manner [World Trade Organization, 1999]. The WTO SPS agreement requires that any sanitary measure should be based on an international standard or scientifically based [World Trade Organization, 1999].

Technical regulations in the field of food trade are not of great importance, as most of the requirements fall into the category of sanitary and phytosanitary measures. Other requirements (such as labelling) are based on international standards, it means that all countries should be treated equally.

As for tariff quotas, they are certainly different for the two groups of countries. For imports from the rest of the world quotas for meat and poultry are the most significant. In fact, the liberalization of tariff quotas for the rest of the world took place in 2012, and the level of quotas did not change during the period 2013–2017. Quota distribution among exporting countries including the EU and the US remained unchanged. In this regard, we assume that the gravity models of international trade applied by other authors are true for Russia as well. With regard to these models, the authors have proved their neutrality to third-party factors via the evidence of normal distribution and zero mathematical expectation of the residues of regression equations. On this basis, we believe that in our case there is also neutrality to factors not taken into account in our model, that is, their total effect is a normally distributed random value with zero mathematical expectation.

In addition, in the cases of Serbia and Vietnam, restrictions on trade occurred and are still occurring within the FTA. After making the free trade agreement between the EAEU and Vietnam in 2015, a tariff quota for rice imports from Vietnam was introduced. For this reason, Serbia and Vietnam are excluded from the reference group of countries and from the subsequent calculations.

**Physical distance.** Information about physical distance is retrieved from International trade center (ITC) Trade map database. The source of the ITC data for the geographical distance is the CEPII database [Mayer, Zignago 2006]. It measures the average distance between two countries corresponding to a geographical weights between main economic centers of each country.

Figure 1 demonstrates a weak correlation between physical distance and imports in the case of Russia using the data from ITC Trade Map. More formally, the Pearson correlation coefficient does not significantly differ from 0 for significance level $\alpha = 0.05$. These data correspond to [Traekorova, Pelevina, 2014]. The distance in their findings has a negative coefficient in export equation, but it is positive in the case of import. For this reason, the physical distance between countries is not taken into account in our study, unlike economic distance.

0 3 (wool and animal hair), 52.01 to 52.03 (raw cotton, waste and cotton carded or combed), 53.01(raw flax), 53.02 (raw hemp) [World Trade Organization, 1999].

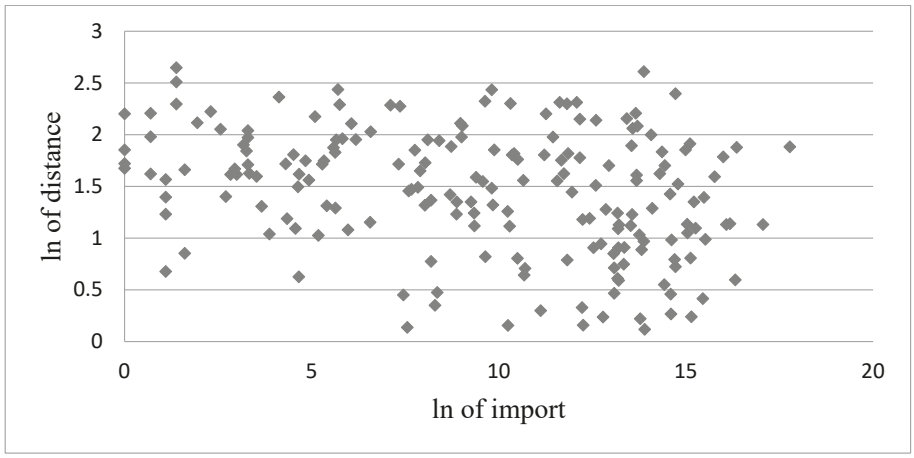


*Fig. 1.* Interconnectedness between import into the Russian Federation and physical distance from the exporting country

Based on: ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

**List of products.** Table 3 presents the list of food products spanned by this study (except of chapter 3 of HS).

**Reference group.** Our method involves a comparison between two groups of countries. The group of the rest of the world should be large enough to permit estimating the tariff equivalent of the embargo as a whole for the foreign trade of the Russian Federation. The reference group of countries should not be too small in order to be representative. For each of the two groups — the reference group and the rest of the world — a corresponding gravity equation is written. The groups differ in two factors of economic distance. One factor is the embargo and the other is the customs tariff. Customs duty is not applied on imports from the reference group and tariffs at the MFN are applied for the rest of the world. The reference group includes all countries having free trade agreements with EAEU or with the Russian Federation, except of Serbia and Vietnam. The composition of both groups is different in 2013 and 2017: in 2013 Ukraine is included in the reference group as a member of FTA, while in 2017 it belongs to the rest of the world group because Russia denied it a free trade regime since 2016.The legislation of EAEU countries for a number of commodity groups also establishes duty-free trade with least developed countries (LDC).The share of LDC in world exports of goods and services is insignificant, it slumped from 1.0 % in 2011 to 0.9 % in 2017 [United Nations documents, 2019]. For this reason LDC were also excluded from both groups.

Commonwealth of Independent States (CIS) free trade area countries account for a significant share of food and agricultural supplies. Goods from these countries come duty-free. The assessment on the share of the country in imports of the Russian Federation indicates the redistribution of supplies among the countries of the group. Belarus, which has occupied a quarter of the Russian meat market, almost three quarters of the milk market, more than a half of the market for processed meat products and almost one third of the markets for sugar and flour products, appears to be benefiting from the embargo for the largest number of HS chapters (Figure 2).

*Table 3.* **List of products under examination**

| HS chapter | Name of chapter | Codes under embargo* | Tariff preferences | WTO list of covered products |
|---|---|---|---|---|
| 1 | Live animals | 0103 | No | Yes |
| 2 | Meat and edible meat offal | 0202, 0203, 0206, 0207, 0209, 0210 | Yes, except of 0203, 0207 | Yes |
| 3 | Fish | 0301–0306 | Yes, except of 0305 | No |
| 4 | Dairy produce; birds' eggs; honey | 0401–0406 | Yes | Yes |
| 5 | Products of animal origin, not elsewhere specified | | Yes | Yes |
| 6 | Live trees and other plants; bulbs, roots | | Yes | Yes |
| 7 | Edible vegetables | 0701–0714 | Yes, except of 0701–0706, 070700, 070960 | Yes |
| 8 | Edible fruit and nuts | 0801–0813 | Yes, except of 080810 | Yes |
| 9 | Coffee, tea, maté and spices | | Yes | Yes |
| 10 | Cereals | | 1006 | Yes |
| 11 | Products of the milling industry | | Yes | Yes |
| 12 | Oil seeds and oleaginous fruits | | Yes | Yes |
| 13 | Vegetable saps and extracts | | Yes | Yes |
| 14 | Vegetable plaiting materials | | Yes | Yes |
| 15 | Animal or vegetable fats and oils | 1501–1503 | Yes, except of 1509, 1517–1520 | Yes |
| 16 | Preparations of meat, of fish or of crustaceans | 1601 | Yes | Yes |
| 17 | Sugars and sugar confectionery | | No | Yes |
| 18 | Cocoa and cocoa preparations | | 1801, 1802 | Yes |
| 19 | Preparations of cereals, flour, starch or milk | 1901 | No | Yes |
| 20 | Preparations of vegetables, fruit, nuts | | Yes, except of subheadings from 2001, 2002, 2009 | Yes |
| 21 | Miscellaneous edible preparations | 2106 | 2104 | Yes |
| 22 | Beverages, spirits and vinegar | | No | Yes |
| 23 | Residues and waste from the food industries; prepared animal fodder | | No | Yes |
| 24 | Tobacco | | 2401 | Yes |

Based on: * —The Decree of the Government of the Russian Federation of August 7, 2014 no. 778 "On measures to implement the decrees of the President of the Russian Federation of August 6, 2014 No. 560, of June 24, 2015 No. 320, of June 29, 2016. No. 305, of June 30, 2017 No. 293, of July 12, 2018 No. 420 and of June 24, 2019 No. 293" (as amended and supplemented). URL: http://base.garant.ru/70712500/ (accessed: 29.12.2019).

Ukraine, which has left the FTA, lost almost wholly the agri-food market of the Russian Federation by 2017, except of chocolate (3 %) (Figure 3).

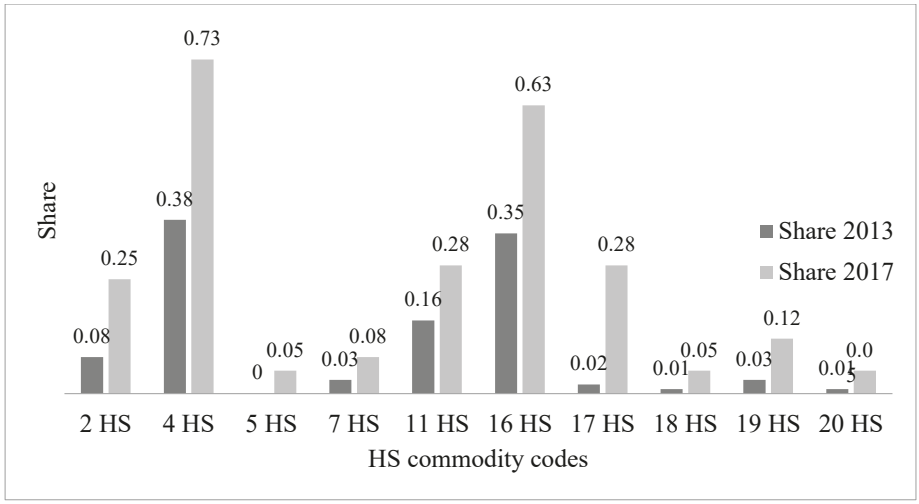


*Fig. 2.* Share of Belarus in the import of Russian Federation

Based on: ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

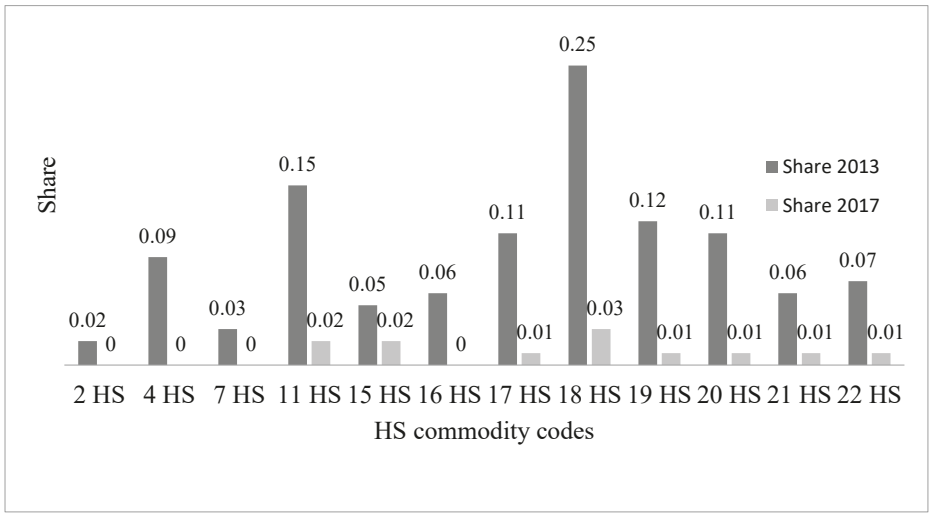


*Fig. 3.* Share of Ukraine in the import of Russian Federation

Based on: ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

Table 4 provides a complete list of the countries included in the reference group along with the data on GDP and Russia's agri-food import from it.

*Table 4.* **GDP and import by HS codes 1–2, 4–24**

| Country | 2013 | | 2017 | |
|---|---|---|---|---|
| | GDP (bln doll.) | Import (thousand doll.) | GDP (bln doll.) | Import (thousand doll.) |
| Armenia | 11.121 | 245 330 | 11.537 | 276 667 |
| Azerbaijan | 74.16 | 296 451 | 40.67 | 448 591 |
| Belarus | 75.496 | 2 872 052 | 54.439 | 3 550 524 |
| Georgia | 16.141 | 168 756 | 15.158 | 226 933 |
| Kazakhstan | 236.635 | 351 658 | 159.407 | 234 541 |
| Kyrgyzstan | 7.335 | 18 529 | 7.565 | 38 701 |
| Moldova | 9.359 | 230 065 | 9.556 | 241 421 |
| Tajikistan | 8.506 | 1795 | 7.144 | 2009 |
| Turkmenistan | 39.198 | 536 | 37.926 | 3772 |
| Uzbekistan | 57.7 | 98 046 | 48.826 | 156 489 |
| Ukraine | 179.572 | 2 012 504 | – | – |
| Free trade, sum ($j = F$) | 715.223 | 6 295 722 | 380.691 | 5 179 648 |

*Note:* «–» — excluded from calculations (embargo).

Based on: International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

**Rest of the world.** The rest of the world group brings together the countries under the Russia's agri-food embargo along with the countries that are not subjected to it. Serbia, Vietnam and LDC are excluded from the rest of the world group. These are countries subject to the MFN tariff, as well as those subjected to a reduced tariff for a number of products (developing countries under the generalized system of preferences). This approach is justified by our goal: to assess the tariff equivalent of the embargo affecting trade in general (rather than trade with advanced economies, for example). The United States, the European Union, Canada, Australia, Norway, Ukraine, Albania, Montenegro, Iceland, and Liechtenstein are under the embargo. The EAEU countries apply the tariff rate reduced by 25 % to certain imports from a list of 104 developing countries.

Table 5 shows the actual tariffs applied by the Russian Federation to certain subgroups of countries within the rest of the world group. It demonstrates that tariff preferences for developing countries are moderate, that is why we can use average MFN agricultural tariff estimated by WTO in calculations for the rest of the world group. There were no changes in the tariff treatment of developing countries during 2013–2017.

In our calculations for the rest of the world, we use the simple (unweighted) average and weighted average MFN tariffs calculated by the WTO.

Table 6 includes data on GDP of the both reference groups of countries and import from it.

*Table 5.* **Tariffsfaced by advanced economies and developing countries in 2018**

| HS chapter | Highest tariff | Lowest tariff | Tariff for advanced economies and MFN | Tariff for developing countries | Tariff for developing countries in comparison with MFN (%) | GSP for developing countries is applied for this chapter |
|---|---|---|---|---|---|---|
| 1 | 3.5 | 0 | 3.5 | No import | – | No |
| 2 | 47.5 | 0 | No import | 35.6 | – | Yes, exceptions |
| 4 | 14.5 | 0 | 14.5 | 10.9 | 75 | Yes |
| 5 | 6.9 | 0 | 6.9 | 5.2 | 75 | Yes |
| 6 | 5.1 | 0 | 5.1 | 3.8 | 75 | Yes |
| 7 | 11.3 | 0 | 11.3 | 8.5 | 75 | Yes, exceptions |
| 8 | 4.5 | 0 | 4.5 | 3.4 | 76 | Yes, exceptions |
| 9 | 2.7 | 0 | 2.7 | 2 | 74 | Yes |
| 10 | 3.4 | 0 | 3.4 | 3 | 88 | Yes, rice |
| 11 | 8.9 | 0 | 8.9 | 6.7 | 75 | Yes |
| 12 | 3.2 | 0 | 1.7 | 1.3 | 76 | Yes |
| 13 | 5 | 0 | 5 | 3.8 | 76 | Yes |
| 14 | 8.6 | 0 | 8.6 | 6.5 | 76 | Yes |
| 15 | 8.6 | 0 | 8.6 | 7 | 81 | Yes, exceptions |
| 16 | 16.3 | 0 | 16.3 | 12.2 | 75 | Yes |
| 17 | 20.3 | 0 | 18.6 | 18.6 | 100 | No |
| 18 | 4.3 | 0 | 3.8 | 3.8 | 100 | Yes, 1801, 1802 |
| 19 | 11.3 | 0 | 10.8 | 10.8 | 100 | No |
| 20 | 9.5 | 0 | 9.5 | 7.3 | 77 | Yes, exceptions |
| 21 | 11 | 0 | 11 | 10.1 | 92 | Yes, 2103, 2104 |
| 22 | 23.6 | 0 | 23.6 | 23.6 | 100 | No |
| 23 | 5.6 | 0 | 3.9 | 3.9 | 100 | No |
| 24 | 6.7 | 0 | 6.3 | 6.7 | 94 | Yes, 2401 |

Based on: International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

*Table 6.* **GDP and import**

| Country | 2013 | | 2017 | |
|---|---|---|---|---|
| | GDP (bln doll.) | Import (thousand doll.) | GDP (bln doll.) | Import (thousand doll.) |
| Whole world | 76749.9 | 40301456 | 80050.96 | 27192509 |
| Free trade, sum ($j = F$) | 715.223 | 6295722 | 380.691 | 5179648 |
| Russian Federation ($i = R$) | 2297.13 | 0 | 1577.525 | 0 |
| Serbia | 45.52 | 214660 | 41.471 | 412096 |
| Vietnam | 170.565 | 296110 | 220.408 | 323662 |
| LDC | 899.806 | 326472 | | 291834 |
| Rest of the World ($j = B$) | 72621.66 | 33168492 | 77830.87 | 20985269 |

Based on: International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019)

## 3. Methodology

This paper develops an express assessment method for tariff equivalent of non-tariff barriers.

Formally, existing techniques, which are outlined in studies of P. Dee, M. Ferrantino, A. Deardorf, M. Stern and Z. Kutlina-Dimitrova can be used for a more precise evaluation [Dee et al., 2005; Deardorf et al., 1998; Kutlina-Dimitrova, 2015].

However, these techniques require data from a large number of countries and/or long-term dynamics, and for all observations, non-tariff barriers must either vary independently in accordance to Gauss law or be explicitly reflected by the model. In the case of Russia, it is not possible to ensure compliance with this requirement, and still there is a need for such indicator.

The method developed for the purpose of this study relies on the following formulation of the gravity model:

$$I_{ijt} = \frac{G\left(Y_{it}^{\alpha_1} Y_{jt}^{\alpha_2}\right)}{\varphi_{ij}^{\alpha_3}} \varepsilon_{ijt}, \tag{2}$$

which in the logarithmic notation yields the linear form

$$\ln I_{ijt} = \ln G + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} - \alpha_3 \ln \varphi_{ij} + \ln \varepsilon_{ijt}, \tag{3}$$

where $I_{ijt}$ is an import of agricultural products to country $I$ from country $j$; $Y_{it}$ is gross national product (GNP) of country $i$; $\varphi_{ij}$ is a total of import tariff and tariff equivalent of non-tariff trade barriers; $t$ is a year; $\varepsilon_{ijt}$ is a normally distributed random term; $G$, $\alpha_1$, $\alpha_2$, $\alpha_3$ are the parameters.

In contrast to the classical form of the gravity model , we assume (considering the above mentioned non-stationary nature of Russia's economy) that the distance term ($\varphi_{ij}$ above) varies over time, so hereafter we use the symbol $\varphi_{ijt}$ to denote it. Furthermore, the findings of K. Head and T. Mayer [Head, Mayer, 2013] allow us to assume the parameters $\alpha_1$, $\alpha_2$ and $\alpha_3$ equal to 1. Such assumption simplifies the equation to the form:

$$I_{ijt} = G \frac{Y_{it} Y_{jt}}{\varphi_{ijt}} \varepsilon_{ijt} \tag{4}$$

and makes it possible to construct simultaneous equations to numerically calculate the unobservable $\varphi_{ijt}$ from observable data.

Within the framework of our study, the domains of indices $i$ and $j$ are defined as follows: $i \in \{R\}$, $j \in \{F; B\}$, where $R$ denotes the Russian Federation, $F$ the rerence group of countries and $B$ the rest of the world group. So, the only obstacle to Russia's import from exporter $F$ are non-tariff measures (excluding embargo), which are mostly phytosanitary restrictions. Their tariff equivalent, i. e. the import tax rate that is as hampering as these restrictions, is further denoted as $s$. As for Russia's import from exporter $B$, it is hampered, in addition to the phytosanitary restrictions, by the import tariff at the rate $\tau_t$ and prohibitions, which are expressed via their tariff equivalent $b_t$.

The standard gravity model commonly assumes $\ln\varepsilon_{ijt} \sim N(0; \sigma)$. We presume that for each $i$, $j$ and $t$ the term $\ln\varepsilon_{ijt}$ remains sufficiently close to its modal value, i. e. zero.

Since Russia's trade partners are aggregated in as few groups as two, each containing at least ten countries, this presumption naturally follows from the law of large numbers.

Consequently, we have $\varepsilon_{ijt} \approx 1$, so the equation transforms to:

$$I_{ijt} \approx G\frac{Y_{it}Y_{jt}}{\varphi_{ijt}}. \quad (5)$$

Finally, following the reasoning from the previous section of this paper, we introduce the assumption that the effect of possible variation of tariff equivalent of restrictions $s$ in time and between countries is captured within $\ln\varepsilon_{ijt}$.

In conjunction with the definition of exporters $F$ and $B$, this assumption implies that

$$\varphi_{RFt} = s,\ \varphi_{RFt} = s + \tau_t + b_f, \quad (6)$$

where $\tau_t$ are tariff barriers; $b_t$ — tariff equivalent of food embargo.

In order to simplify further expressions, we now introduce two variables as follows:

$$\beta_t = \frac{Y_{Bt}}{Y_{Ft}},\ \delta_t = \frac{I_{RBt}}{I_{RFt}}, \quad (7)$$

where $\beta_t$ is the ratio between GDP of the rest of the world ($Y_{Bt}$, group $B$ countries) and countries of the reference group ($Y_{Ft}$, group $F$) in year $t$; $\delta_t$ is the ratio between imports to the Russian Federation of goods from the rest of the world ($I$ , group $B$ countries) and countries of the comparison group ($I_{RFt}$, group $F$) in the year under study.

Note that $\delta_t$ can be represented via $\beta_t$ and $\varphi_{ij}$:

$$\delta_t = \frac{I_{RBt}}{I_{RFt}} = \frac{GY_{Rt}Y_{Bt}}{\varphi_{RBt}} / \frac{GY_{Rt}Y_{Ft}}{\varphi_{RFt}} = \frac{Y_{Bt}}{Y_{Ft}} / \frac{\varphi_{RBt}}{\varphi_{RFt}} = \frac{\varphi_{RFt}}{\varphi_{RBt}}\beta_t. \quad (8)$$

From (6) and (8) it follows that

$$\frac{\beta_t}{\delta_t} = \frac{\varphi_{RBt}}{\varphi_{RFt}} = \frac{s + \tau_t + b_t}{s}. \quad (9)$$

This formula is very convenient in the sense that the values of $\beta_t$, $\delta_t$ and $\tau_t$ can be derived straight from the empirical data, while the relation of unobserved distances $\frac{\varphi_{RBt}}{\varphi_{RFt}}$ shows how many times the barriers (in their tariff equivalent) hampering Russia's import from exporter $B$ surpass the import barriers between Russia and exporter $F$. As a result, this relation enables us to calculate $s$ and $b_{2017}$(with the preciseness limited by the gap between the adopted assumptions and the reality) from the empirical data via $b_{2013}$, $\beta_t$, $\delta_t$ and $\tau_t$, where $t \in \{2013; 2017\}$. Unlike $b_{2017}$, the value of $b_{2013}$ is known a priori: it is close to zero, because we define $b_t$ as a tariff equivalent of food embargo. The so called "counter-sanctions" were enforced a year later.

More specifically, by we have:

$$\frac{\beta_{2013}}{\delta_{2013}} = \frac{s + \tau_{2013} + b_{2013}}{s} \text{ and } \frac{\beta_{2017}}{\delta_{2017}} = \frac{s + \tau_{2017} + b_{2017}}{s}. \quad (10)$$

Hence, using $b_{2013} = 0$, we obtain formulae for $s$ and $b_{2017}$:

$$s = \frac{b_{2013} + \tau_{2013}}{\frac{\beta_{2013}}{\delta_{2013}} - 1} \text{ and } b_{2017} = \left( \frac{\beta_{2017}}{\delta_{2017}} - 1 \right) s - \tau_{2017}. \quad (11)$$

Subject to the assumptions that, first, 1 is a true value of $\alpha_1$, $\alpha_2$ and $\alpha_3$; second, $\varepsilon_{ijt} \approx 1$; third, 0 is a true value of $b_{2013}$, the hypothesis that the impact of selective embargo on imports is not superior to that of tariff and phytosanitary measures should be rejected for year $t$ in the case $b_t > s + \tau_t$.

## 4. Parameters of gravity equation and assessment of trade barers

As it follows from the previous section, in order to test the hypothesis of this study for year 2017, we need to determine the parameters of the gravity equations for both years 2013 and 2017 using the methodology from the previous section. Determining them enables us to test the above mentioned inequality $b_t > s + \tau_t$ and reject the hypothesis if it is found to be true.

Table 7 provides the data required to calculate the gravity equation parameters for the year 2017. Table 8 provides the similar data that are required to make calculations for year 2013.

*Table 7.* **Statistics of agricultural imports and GDP of the Russian Federation, 2017**

| Parameter | Import of the Russian Federation, thousand doll. | Parameter | GDP, current prices, bln doll. |
|---|---|---|---|
| Free import sum ($I_{RF2017}$) | 5 179 648 | $Y_{F2017}$ | 380.691 |
| Import from the whole world | 27 192 509 | $Y_{W2017}$ | 80 050.96 |
| Import from the rest of the world ($I_{RB2017}$) | 20 985 269 | $Y_{B2017}$ | 77 830.87 |
| $Y_{R2017}$ | | | 1577.525 |

*Notes:* $Y_{W2017}$ is world product in 2017; other symbols that are used in the table are introduced above.

Based on: previous calculations, tables 2 and 6; International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

*Table 8.* **Statistics of agricultural imports and GDP of the Russian Federation, 2013**

| Parameter | Import of the Russian Federation, thousand doll. | Parameter | GDP, current prices, bln doll. |
|---|---|---|---|
| Free import sum ($I_{RF2013}$) | 6 295 722 | $Y_{F2013}$ | 715.223 |
| Import from the whole world | 40 301 456 | $Y_{W2013}$ | 76 749.9 |
| Import from the rest of the world ($I_{RB2013}$) | 33 168 492 | $Y_{B2013}$ | 72 621.66 |
| $Y_{R2013}$ | | | 2297.13 |

*Notes:* $Y_{W2013}$ is world product in 2013; other symbols that are used in the table are introduced above.

Based on: previous calculations, tables 2 and 6; International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

Table 9 contains the values of the main analyzed indicators for the year 2017. In 2017 the value of gross Russia's agri-food import from the rest of the world was 4.05 times larger than from the reference group of countries ($\delta_{2017}$). The GDP of the rest of the world was 204.4 times higher than that of the reference group ($\beta_{2017}$).

*Table 9.* **Parameters of gravity equation for 2017**

| Parameter | Value |
|---|---|
| $\delta_{2017}$ | 4.05148 |
| $\tau_{2017}$ | 1.102 (10.2 %) |
| $Y_{F2017}$ | 380.691 |
| $Y_{B2017}$ | 77 830.87 |
| $\beta_{2017}$ | 204.4463 |

Based on: previous calculations, tables 2 and 7; International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

As it follows from formula (11) and Table 9 data, trade barriers to the countries of the rest of the world $\varphi_{RB2017}$ should exceed barriers to trade with reference countries ($\varphi_{RF2017}$) by 50.46 times.

The simple average tariff of the Russian Federation on agricultural trade according to the WTO tariff profiles in 2017 was 10.2 %. The $\varphi_{RF2017}$ barriers for the reference area in 2017 are mostly (according to our assumption) sanitary and phytosanitary measures (denoted by $s$), and for the rest of the world the barriers $\varphi_{RB2017}$ include $s$, tariff $\tau_{2017}$=10.2 % and embargo $b_{2017}$.

For year 2017 we get the ratio:

$$\frac{0.102 + s + b_{2017}}{s} = 50.5\,. \qquad (12)$$

Table 10 shows the values of the main analyzed indicators for the year 2013.

*Table 10.* **Parameters of gravity equation for 2013**

| Parameter | Value |
|---|---|
| $\delta_{2013}$ | 5.268417 |
| $\tau_{2013}$ | 1.122 (12.2 %) |
| $Y_{F2013}$ | 715.223 |
| $Y_{B2013}$ | 72 621.66 |
| $\beta_{2013}$ | 101.53708 |

Based on: previous calculations, tables 2 and 8; International Monetary Fund. World Economic Outlook Databases. URL: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx (accessed: 29.12.2019); ITC. Trade Map. URL: https://www.trademap.org (accessed: 29.12.2019).

In 2013, imports from the rest of the world were 5.27 times higher than imports from the reference group of countries ($\delta_{2013}$). The GDP of the rest of the world was 101.5 times higher than that of the free trade countries ($\beta_{2013}$). This means that trade barriers $\varphi_{RB2013}$ for the rest of the world should be 19.3 times higher than trade barriers for comparison countries ($\varphi_{RF2013}$):

$$\varphi_{RF2013} = \frac{\varphi_{RB2013}}{19.3}. \quad (13)$$

The simple average tariff of the Russian Federation on agricultural trade $\tau_{2013}$ according to the tariff profiles of the WTO countries in 2013 was 12.2 %. Barriers $\varphi_{RF2013}$ for the reference group in 2013 were, according to our assumption, sanitary and phytosanitary measures ($s$) and for the countries of the rest of the world barriers $\varphi_{RB2013}$ include $s$, $\tau_{2013}$ (12.2 %) and embargo $b_{2013}$. As embargo in 2013 had not yet been enforced, the $b_{2013}$ takes zero value.

For 2013 we get the ratio:

$$\frac{0.122 + s + 0}{s} = 19.3. \quad (14)$$

To assess the impact of phytosanitary measures ($s$) and bans of 2017 ($b_{2017}$) on imports, we solve simultaneous equations (12) and (14). We receive tariff equivalents of the embargo (without fish) of 2017 like $b_{2017} = 0.228 = 22.8\,\%$ and phytosanitary measures like $s = 0.0066 \approx 0.7\,\%$.

Thus, when comparing 2013 and 2017, the impact of sanitary and phytosanitary measures on food trade in the Russian Federation can be estimated by rounding in about 1 % of the tariff equivalent, and prohibitions — at 23 % of the tariff equivalent. This clearly rejects the hypothesis of this study and concludes that the effect of the embargo on Russia's agri-food imports exceeds the effect on those caused by both tariff and phytosanitary measures. So, the embargo plays the dominant role in protecting the domestic agri-food market from supply outside FTA.

The calculations above are based on the simple average tariff for agricultural products. For comparison we provide the similar estimates based on trade weighted average tariff.

In this case, the phytosanitary barriers amount to 0.008 (0.8 %), embargo to 28 % in tariff equivalent. The conclusion about the hypothesis remains unchanged.

Thus, the embargo on the import of food products from a number of Western countries has an impact on the import of goods covered by chapters 1, 2, 4–24 HS as large as either a simple average tariff rate of 23 % or a weighted average tariff rate of 28 % in 2017.

## Conclusion

Quantifying the influence of the food import embargo on Russia's agri-food imports and, consequently, on the degree of market protection against imports is important for economic policymaking. The level of protection we have determined for Russian agricultural producers in 2017 as a result of special economic measures amounts 23 % of the tariff equivalent, expressed in an unweighted average tariff rate (excluding fish). The overall level of customs tariffs and phytosanitary measures in sum was estimated as 10.9 % (10.2 % + 0.7 %).

Similar estimates expressed in the equivalent to the trade weighted average tariff are 28 % and 12.4 % (11.6 % + 0.8 %) correspondently. Given that the embargo was imposed on particular trading partners but not on the countries as a whole, the result has theoretical significance, echoing the widely known view that a tariff of 20 % or higher is prohibitive. Hence, our hypothesis of a small impact of the food embargo compared to the customs tariff and sanitary and phytosanitary measures should be rejected. In the studied case, the single measure, i.e. embargo, has the prohibitive level.

The contribution made to methodology is in the way the gravity equation is applied. We explore the ratios established by the gravity equation and the coefficient values at the variables of the gravity equation estimated in many earlier studies. The ratio between the parameters of the two equations describing the situation before and after the embargo is used. The ratio of imports over the two compared years differs from the ratio of GDP between two groups of trading partners, one of which is the group of free-trade partners and the other is the rest of the world. This difference, which, in the absence of an embargo, could be explained only by the impact of the customs tariff, since it was assumed that sanitary and phytosanitary measures were applied unselectively in both groups, in the presence of an embargo increased because of the emergence of the new trade barrier.

## References


Askari H. and others (2003) *Case Studies of U.S. Economic Sanctions: The Chinese, Cuban, Iranian Experiences*. Praeger, ABC-CLIO. 304 p.

Bora B. (2005) "The Quantification and Impact of Non-Tariff Measures" in Dee F. and Ferrantino M. (eds) *The Effects of Non-Tariff Measures and Trade Facilitation.* APEC Secretariat and World Scientific Publishing Co. Pte. Ltd. 674 p.

Chaney T. (2018) The Gravity Equation in International Trade: An Explanation. *Journal of Political Economy*, vol. 126(1), pp. 150–177.

Czaga P. (2005) OECD "Trade Policy Studies.The Role of Non-Tariff Barriers in World Trade" in *Looking Beyond Tariffs. Import Prohibitions and Quotas.* Paris, OECD Trade Policy Studies, OECD Publishing. 304 p. URL: https://doi.org/10.1787/9789264014626-en (accessed: 29.12.2019)

Deardorff A., Stern M. (1998) *Measurement of Nontariff Barriers*. Ann Arbor: University of Michigan Press. 152 p.

Dee P., Ferrantino M. (2005) "Introduction" in Dee F. and Ferrantino M. (eds) *The Effects of Non-Tariff Measures and Trade Facilitation.* APEC Secretariat and World Scientific Publishing Co. Pte. Ltd. 674 p.

Disdier A., Keith H. (2008) The Puzzling Persistence of the Distance Effect on Bilateral Trade. *The Review of Economics and statistics,* no. 90, pp. 37–48.

Evenett S. (2002) The Impact of Economic Sanctions on South African Exports. *Scottish Journal of Political Economy,* vol. 49, no. 5, pp. 557–573.

EvenettS., Keller W. (1998) On Theories Explaining the Success of the Gravity Equation. *NBER working paper 6529.* Cambridge, National Bureau of Economic Research. 53 p. URL: https://www.nber.org/papers/w6529.pdf (accessed: 29.12.2019).

Head K., Mayer T. (2013) Gravity Equations: Workhorse, Toolkit and Cookbook. *CEPII Working Paper,* no. 27. 70 p. URL: http://www.cepii.fr/pdf_pub/wp/2013/wp2013-27.pdf (accessed: 29.12.2019).

Helpman E. (2017) *Understanding Global Trade*. Moscow, University of Gaidar Institute. 312 p.

Herrmann-Pillath C. (2006) The True Story of Wine and Cloth, or: Building Blocks of an Evolutionary Political Economy of International Trade. *J. Evol. Econ*., no. 16, pp. 383–417.

Hoekman B. (1995) "Assessing the General Agreement on Trade in Services" in Martin W. and Winters L. (eds.) *The Uruguay round and the developing economies. World Bank Discussion Paper.* Washington, The Word Bank. 480 p. URL: http://documents1.worldbank.org/curated/pt/644371468766802486/pdf/multi0page.pdf (accessed: 29.12.2019).

Hufbauer G., Schott J., Elliott K., Oegg B. (2009) *Economic Sanctions Reconsidered*. Third Edition. Washington, Peterson Institute of International Economics. 248 p.

*International trade and development*. (2019) United Nations Documents. Report of the Secretary-General. New York, UN. URL: https://undocs.org/A/74/221 (accessed: 29.12.2019).
Kutlina-Dimitrova Z. (2015) The Economic Impact of the Russian Import Ban: a CGE Analysis. Trade. *Chief economist note,* iss. 3. 23 p. URL: https://trade.ec.europa.eu/doclib/docs/2015/december/tradoc_154025.pdf (accessed: 29.12.2019).
Livshitz V., Livshitz S. (2011) *Systems Analysis of Russia's Non-Stationary Economy (1992–2010): Market Reforms, Crisis, Investment Policy*. 2nd ed. Moscow, Maroseyka. 510 p.
Mayer T., Zignago S. (2005) *Market Access in Global and regional Trade. CEPII Working paper 2.* URL: http://www.mafhoum.com/press8/236E14.pdf (accessed: 29.12.2019).
Mitsuyo A. (2005) "Estimating Tariff Equivalents of Core and Non-Core Non-Tariff Measures in the APEC Member Economies" in Dee F. and Ferrantino M. (eds) *The Effects of Non-Tariff Measures and Trade Facilitation.* APEC Secretariat and World Scientific Publishing Co. Pte. Ltd. 674 p.
Oranen T. (2017) *Russian Counter-sanctions and Trade Deflection: Evidence from Finland.* Master's essay (First year). Lund, Department of Economics Lund University. URL: http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8928030&fileOId=8928031 (accessed: 29.12.2019).
Presidential Decree from August 6, 2014, N 560 (2014) *On the application of certain special economic measures to ensure the security of the Russian Federation* Rossiyskaya gazeta. No. 176(6448). URL: https://rg.ru/2014/08/07/sankcii-dok.html (accessed: 29.12.2019).
Rasoulinezhad E. (2016) Investigation of Sanctions and Oil Price Effects on the Iran-Russia. Trade by Using the Gravity Model. *Bulletin of the St. Petersburg University*. *Economy,* series 5, iss. 2, pp. 68–84.
Rauch F. (2016) The Geometry of the Distance Coefficient in Gravity Equations in International Trade. *Review of International Economics*, vol. 24, iss. 5, pp. 1167–1177.
*Review of agri-food trade policy in post-Soviet countries 2016–2017*. (2018*).* Rome, FAO. 148 p. URL: http://www.fao.org/3/I9313RU/i9313ru.pdf (accessed: 29.12.2019).
Serrano R., Pinilla V. (2012) The Long-Run Decline in the Share of Agricultural and Food Products in International Trade: a Gravity Equation Approach to its Causes. *Applied Economics,* vol. 44, iss. 32, pp. 4199–4210.
Tinbergen J. (1962) *Shaping the World Economy*. New York, Twentieth Century Fund. 330 p.
Traekorova E., Pelevina K. (2014) Gravity model of BRICS's foreign trade. *Journal of Saratov University*, vol. 1, no. 2, pp. 133–142.
*The Legal Texts. The Resultsof the Uruguay Round of Multilateral Trade Negotiations.* (1999) World Trade Organization New York, Cambridge University Press. 660 p.
UN Economic and Social Commission for Asia and the Pacific. Trade Statistics in Policymaking. (2009) *A Handbook of Commonly Used Trade Indices and Indicators.* Revised Edition. URL: https://www.unescap.org/sites/default/files/0%20%20Full%20Report_27.pdf (accessed: 29.12.2019).
Zhiryaeva E. (2018) Regulation of Foreign Economic Activity at the Regional Level in Global Conditions of the WTO. *The abstract of the thesis for a degree of the Doctor of Economics.* St. Petersburg, Saint-Petersburg State University. 39 p. URL: https://disser.spbu.ru/files/disser2/1586/aftoreferat/BzvY3G3YCY.pdf (accessed: 29.12.2019).
Zhiryaeva E., Naumov V. (2018) Global and local Trade Streams Assessment in the Subjects of the Northwestern Federal District Trade. *Management Consulting*, no. 5, pp. 113–129. URL: https://www.acjournal.ru/jour/article/view/863/858 (accessed: 29.12.2019).

Received: 09.09.2019
Accepted: 17.09.2020

Authors' information:

*Elena V. Zhiryaeva* — Dr. Sci. in Economics, Associate Professor; Zhiryaeva-ev@ranepa.ru
*Nikolai M. Svetlov* — Dr. Sci. in Economics, Professor; nikolai.svetlov@gmail.com

## Влияние санкций на сельскохозяйственный импорт России

*Е. В. Жиряева*[1], *Н. М. Светлов*[2]

[1] Российская академия народного хозяйства и государственной службы при Президенте Российской Федерации, Северо-Западный институт управления, Российская Федерация, 199178, Санкт-Петербург, Средний пр., 57/43
[2] Центральный экономико-математический институт РАН, Российская Федерация, 117418, Москва, Нахимовский пр., 47

**Для цитирования:** Zhiryaeva E. V., Svetlov N. M. (2020) The effect of sanctions on Russian agricultural imports. *Вестник Санкт-Петербургского университета. Экономика*. Т. 36. Вып. 4. С. 653–674. https://doi.org/10.21638/spbu05.2020.405

Статья вносит вклад в методологию анализа торговой политики, в частности в оценку нетарифных мер. Для получения количественной характеристики эффекта данных мер использованы соотношения между переменными двух гравитационных уравнений, описывающих ситуацию до и после эмбарго. Уровень импорта, приходящегося на единицу ВВП торговых партнеров, за два сравниваемых периода (2013 г. и 2017 г.) различен для двух групп, в одну из которых входят партнеры по свободной торговле, а в другую — страны остального мира (за некоторыми исключениями). При наличии эмбарго разрыв в среднем импорте на единицу ВВП поставщика между двумя группами шире, что обусловлено появлением нового торгового барьера. Этот разрыв позволяет косвенным путем дать количественную оценку эффекта торговых запретов через их тарифный эквивалент. В настоящем исследовании предложенная методология применяется к импорту продовольственной и сельскохозяйственной продукции, за исключением рыбы и других продуктов, выходящих за рамки групп 1–24 Гармонизированной системы описания и кодирования товаров. Гипотеза работы заключается в том, что влияние эмбарго на импорт продовольственной и сельскохозяйственной продукции не превышает воздействия тарифных и фитосанитарных мер. Исследование отвергает эту гипотезу; в нем сделан вывод, что эмбарго устанавливает запретительный уровень защиты.

*Ключевые слова:* специальная экономическая мера, продовольственное эмбарго, международная торговля, санитарные и фитосанитарные меры, оценка торговых барьеров.

Статья поступила в редакцию: 09.09.2019
Статья рекомендована в печать: 17.09.2020

Контактная информация:

*Жиряева Елена Васильевна* — д-р экон. наук, доц.; Zhiryaeva-ev@ranepa.ru
*Светлов Николай Михайлович* — д-р экон. наук, проф.; nikolai.svetlov@gmail.com