

## Artículo de investigación

**A study of the characteristics of food import dependence of the countries****Исследование особенностей продовольственной импортозависимости стран****El estudio de la dependencia alimentaria de los países**

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Written by:

**Veronika Yu. Chernova**<sup>210</sup>

ORCID: 0000-0001-5951-9091

SPIN-ID <https://elibrary.ru>: 8717-3795**Vladyslava I. Noha**<sup>211</sup>

ORCID: 0000-0002-7156-5493

SPIN-ID <https://elibrary.ru>: 3023-4402**Abstract**

The causes of import dependence in different countries are studied in the article. It is shown that food import dependence is in one degree or another inherent in many countries, including the developed ones, which are food products exporters at the same time. It is revealed that the import dependence of countries with high and low GDP per capita, the value added level in agriculture and the availability of land resources differ significantly. Based on the results obtained, it is concluded that countries with a high level of GDP per capita, a high added value level in agriculture and high availability of agricultural land resources are import-dependent, as a rule, for certain groups of food products. Countries with low GDP per capita, a low value-added level in agriculture and low availability of agricultural land resources import all or many of the staples.

**Key Words:** Food import dependence, agri-food policy, agriculture, food security.

**Аннотация**

В статье исследованы причины возникновения импортозависимости в разных странах. Показано, что продовольственная импортозависимость в той или иной степени присуща многим, в том числе развитым, странам, являющихся одновременно и экспортерами продуктов питания. Выявлено, что между импортозависимостью стран с высоким и низким уровнем ВВП на душу населения, уровнем добавленной стоимости в сельском хозяйстве и обеспеченностью земельными ресурсами имеются существенные различия. Полученные результаты привели к выводу, что страны с высоким уровнем ВВП на душу населения, высоким уровнем добавленной стоимости в сельском хозяйстве и высокой обеспеченностью сельскохозяйственными землями, импортозависимы, как правило, по отдельным группам продовольственных товаров. Страны с низким уровнем ВВП на душу населения, низким уровнем добавленной стоимости в сельском хозяйстве и невысокой обеспеченностью сельскохозяйственными землями, импортируют все или многие из основных продуктов питания.

**Ключевые слова:** продовольственная импортозависимость, агропродовольственная политика, сельское хозяйство, продовольственная безопасность

<sup>210</sup> Cand.Sci. (Economic), Associate professor. Department of Marketing, Peoples' Friendship University of Russia (RUDN University), Russian Federation; Department of Advertising and Public Relations, State University of Management, Russian Federation.

<sup>211</sup> Lecturer assistant. Department of Marketing, Peoples' Friendship University of Russia (RUDN University), Russian Federation.

## Resumen

En el trabajo se exponen los factores que influyen en la dependencia alimentaria de los países. Se ha demostrado científicamente que la dependencia alimentaria es característica de muchos países, entre ellos los países desarrollados que al mismo tiempo son los exportadores de productos alimenticios. Se ha descubierto que el nivel de la dependencia alimentaria de los países depende de su PIB per cápita, el valor agregado en el sector agrícola y los recursos agrarios disponibles. Los resultados del estudio demuestran que las naciones con un PIB per cápita elevado, un alto valor agregado en el sector agrícola y los recursos agrarios suficientes dependen de las importaciones de algunos productos alimenticios, mientras que las naciones con un PIB per cápita bajo, un bajo valor agregado en el sector agrícola y una falta de recursos agrarios importan todos o la mayoría de los productos alimenticios básicos.

**Palabras clave:** Dependencia alimentaria, política agroalimentaria, sector agrícola, seguridad alimentaria.

## Introduction

A country's ability to become completely self-sufficient in food depends on the current agricultural and food policy, effective state management of available resources, developed infrastructure, and technical and technological security. However, even countries with all the resources for agricultural production have political and economic reasons for trade and food purchases from abroad (Wegren, & Elvestad, 2018).

Currently, the list of countries importing a large number of food products includes the USA, Germany, Japan, Great Britain, as well as China and Russia. Food imports do not mean food insecurity in the country (Kuzmin, 2015, 2016). In fact, many of the world's largest food-importing countries are also among the largest exporters (Porkka *et al.*, 2017). However, due to the strategic importance of the agri-food sector, the vast majority of countries seek the highest possible self-sufficiency in food (Baer-Nawrocka, & Sadowski, 2019). Various strategies are used to achieve food self-sufficiency: production scale-up; improvement of the distribution of food produced domestically; reduction of losses and waste; expansion of methods and means of production; expansion of types of food produced domestically; improvement of production technologies; implementation of information and communication solutions (Shuval-Sergeeva *et al.*, 2017), innovative activity (Smirnov, 2017), etc. Their choice and combination are determined by many factors and sometimes constitute a difficult managerial task. In this connection, the aim of this study is to assess import dependence, as well as to analyze the causes of its occurrence in different countries and the options for transforming agri-food policies.

## Literature review

The causes of import dependence and the prospects for its reduction are analyzed in a number of works. The experience of implementing the policy of reducing import dependence in Japan is revealed in (Lebedeva, 2007; Markarian, 2017; Muchetu, 2019), the development of Brazil's agri-food sector is revealed in (Pereira *et al.*, 2012), the solution to the food security problem in China is revealed in the work (Erokhin, 2018), EU food security is studied in detail in (Kotyza, & Slaboch, 2014), etc.

The extent to which food security is ensured through domestic supply varies widely around the world (Baer-Nawrocka, & Sadowski, 2019; Shevchuk *et al.*, 2016). Domestic production provides the basis for food security in developed countries with high GDP per capita, including North America, Australia, New Zealand – essentially those countries that, although not provided with a large area of arable land, but show high production intensity (Nagyová *et al.*, 2016).

International trade contributes significantly to food security in the countries of the Middle East (Faridi, & Sulphrey, 2019) and North Africa, as well as in individual countries of South America, which are net importers of food products. The most problematic food situation continues to affect sub-Saharan Africa and Central Asia (Woldemichael *et al.*, 2014).

Significant changes have taken place in the global food supply in recent decades: over the past 50 years, the world's population has doubled, while food production practices have shifted from traditional farming to more intensive and industrialized production (Porkka *et al.*, 2013). Growing wealth and urbanization have changed food consumption habits. At the same time, the

climate change intensifies the competition for natural resources. Porkka *et al.* (2017) found out that food imports are almost universally used to overcome local restrictions on domestic growth, but are implemented to varying degrees and with varying degrees of success. For example, the manufacturing shocks caused by various causes in exporting countries pose a risk of food shortages in countries dependent on food imports.

Due to the transnational interconnectedness of markets, globalization can balance the instability of local production, but this can make the country more dependent on food imports and worsen food security (Jaworska, 2018). However, Peterson (2016) notes that the participation of countries in international trade imposes restrictions on the choice of measures and options for agri-food policies. Food imports correlate positively with physical and economic affordability of food, but negatively correlate with the stability of the food system (Jaworska, 2018).

Serrano and Pinilla (2014) show in their article that less developed countries export products with a low level of processing, while developed countries have largely monopolized the market for products with a high degree of processing. Serrano and Pinilla rightly argue that the key to improving agricultural exports is to increase the export of high value-added foods. Moreover, the growth potential of food production and the resulting food security depend on both natural and economic factors. However, Kołodziejczak (2018) revealed that not all EU countries are fully self-sufficient; their import dependence on fruits and some vegetable crops is especially high.

The brief literature review showed that due to the strategic importance of the agri-food sector, the vast majority of countries are striving for the greatest possible autonomy in food production. Although international trade can largely compensate for the lack of domestic production, international trade instruments can only be used if the country has sufficient resources. Therefore, further the authors will consider the question of assessing the degree of import dependence on food among different countries and their decision strategies.

## Method

Import dependence in the current study is calculated as the ratio of net imports to food supply:

$$Imp = \frac{(I - E)}{(P + I - E)} \cdot 100\%, \quad (1)$$

where *Imp* is the coefficient of import dependence, showing the share of net imports in the volume of food supplies to the domestic market; *I* is the value of imports; *E* is the value of food exports; *P* is domestic food production.

The coefficient of import dependence can take both positive and negative values. If the value of exports exceeds the value of imports, the import coefficient takes the values  $Imp < 0$ . If the value of exports is less than the value of the import, the coefficient of dependence takes the values  $Imp > 0$ . The higher the value of the coefficient *Imp*, the more the country relies on imports to provide population food. The FAO database was used to calculate the coefficient of import dependence (FAO, n.d.).

Due to the fact that the potential for food production and the resulting self-sufficiency and import dependence depend both on natural factors (Kołodziejczak, 2018) and economic factors (Baer-Nawrocka, & Sadowski, 2019), the authors grouped countries by the level of GDP per capita, which characterizes the level of economic development, and the level of value-added in agriculture per capita. This allowed defining the main reasons inherent in each group of countries for the emergence of import dependence and the direction of the implementation of the policy of production incentive and reduction of dependence on food imports.

In the framework of the study, the authors used the method of correlation analysis. Pearson's correlation coefficient is calculated by the formula:

$$r = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_j - \bar{Y})}{\sqrt{\sum_{i=0}^n (X_i - \bar{X})^2 \sum_{j=1}^n (Y_j - \bar{Y})^2}} \quad (2)$$

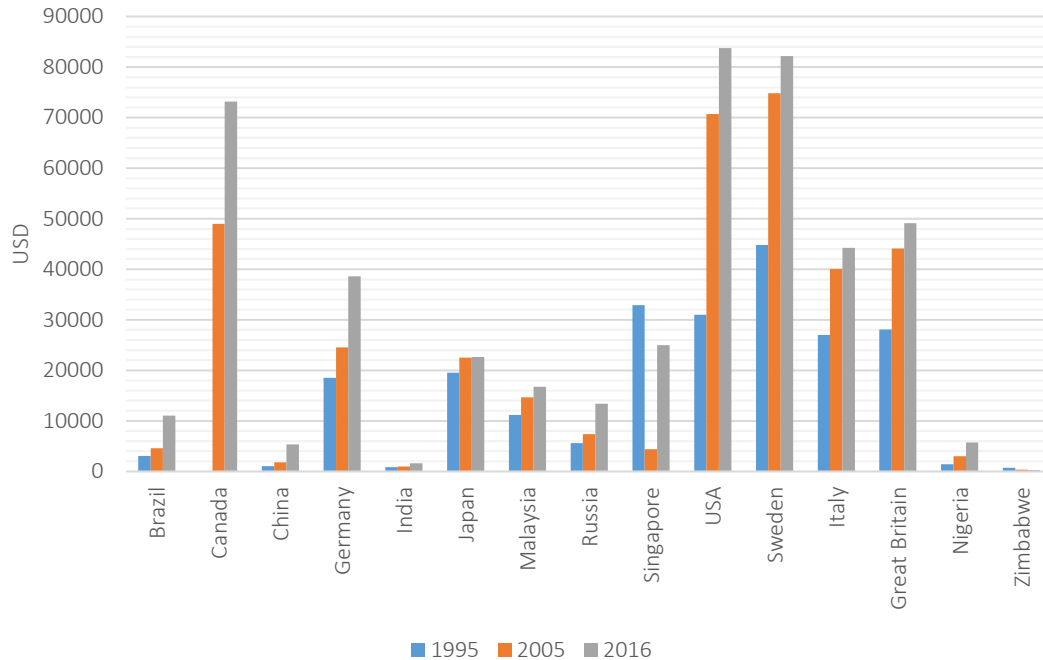
Pearson's correlation coefficient can take values between +1 (positive correlation) and -1 (negative correlation). The closer the coefficient is to the border of the range, the stronger the correlation of the parameters that it represents. A zero value of the coefficient indicates the absence of correlation.

## Results and Discussion

Countries producing food products with very high added value, as a rule, are highly developed

countries of Europe (Sweden) and North America (USA, Canada) (Fig. 1). European countries manufacture products with a lower value added. Among the BRICS countries,

Russia has the highest level of added value, followed by Brazil and China. India's food products are characterized by low added value.

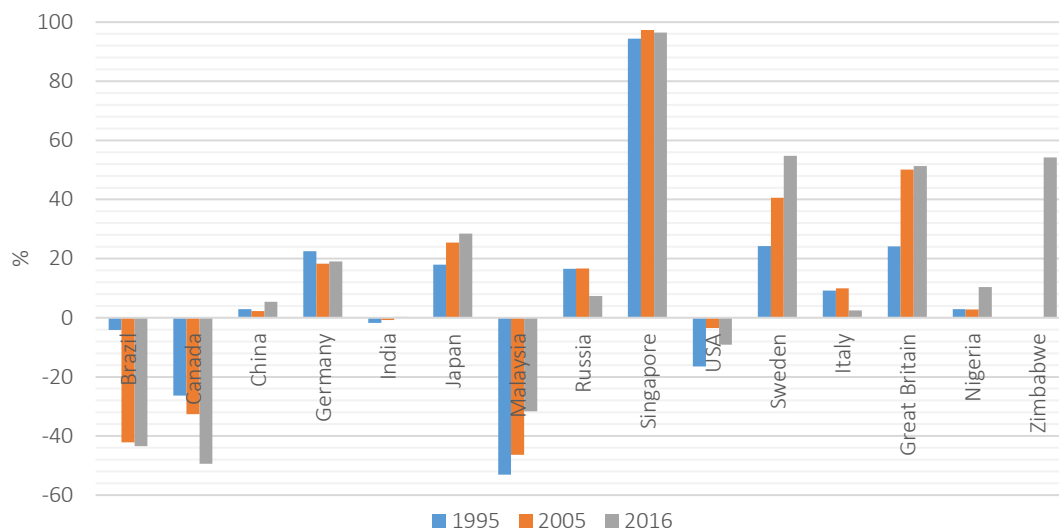


**Fig. 1.** Added value in food production  
Source: FAO Database.

The highest level of food import dependence was observed in Singapore (more than 97.3% in 2005), which was reduced to 96.45% by 2016. Singapore's foreign trade volume is about 3.5 times higher than GDP (Tortajada *et al.*, 2015), and the total volume of agricultural imports in 2018 reached 9.9 billion US dollars (more than 90%) (Singapore – Agricultural Sectors, 2019). As for the European countries, a high level of import dependence, approximately equal in value to Zimbabwe (54.22), is observed in Sweden (54.76%), Great Britain (51.35%) (Fig. 2). The

import dependence of Germany (19.2%), which has a sufficiently high availability of land resources, is slightly lower than that of Japan (28.5%).

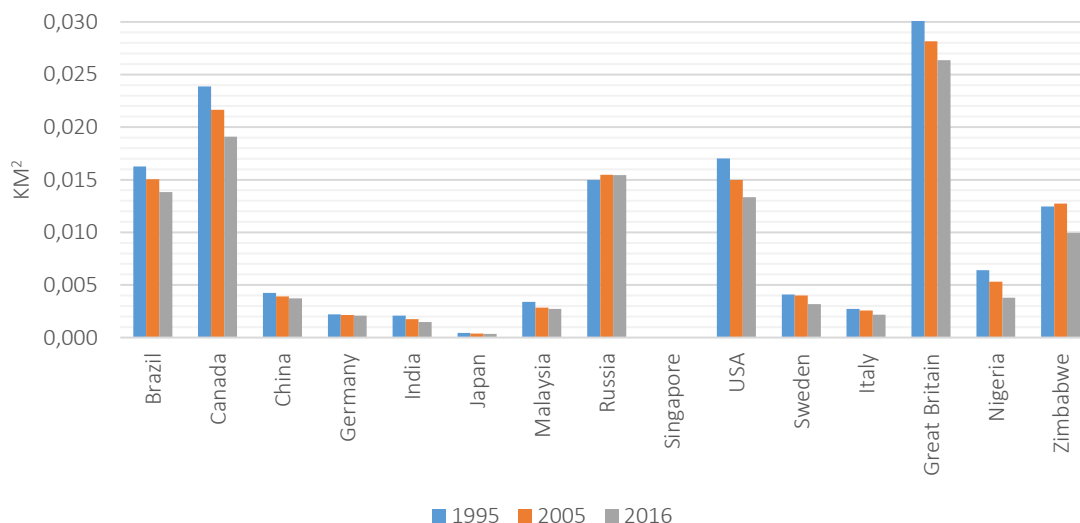
The import dependence of the USA, Canada, Brazil and Malaysia is negative: -9%, -49.4%, -43.39%, -31.6%, respectively. However, this result only indicates that the country's export volume is much higher than the overall import volume and cannot be interpreted as the absence of import dependence for all product groups.



**Fig. 2.** Food import dependence of the countries  
Source: FAO Database

The availability of land resources for the countries studied varies significantly from high (0.0263 km<sup>2</sup> per capita in the UK) to extremely low (about 0 km<sup>2</sup> per person in Singapore). The countries with low land security include Japan;

the countries with a high population include India. High availability of land resources suitable for agriculture is characteristic of the USA, Canada, Russia, and Brazil (Fig. 3).



**Fig. 3.** Provision of countries with agricultural land per capita  
Source: FAO Database.

For economically less developed countries, there is a negative correlation between import dependence and GDP per capita, which shows that the lower the level of GDP, the higher the

import dependence. However, in countries with a high level of GDP per capita, the correlation between its level and import dependence is positive (Table 1).

**Table 1.** The correlation coefficient of the parameters of the conditions of import dependence of countries

Countries	GDP per capita, dollars/person	Added value in food production, USD per person	Provision of agricultural land per capita, km <sup>2</sup> /person
Group of countries with low GDP per capita *	r = -0.9995	r = -0.5540	r = 0.9960
Group of countries with high GDP per capita *	r = 0.5609	r = -0.4720	r = -0.3504

The countries with low GDP per capita are characterized by a higher correlation between import dependency and value added in food production (countries, manufacturing products with higher added value, are less import-dependent). A positive correlation between import dependency and the provision of agricultural land per capita in underdeveloped countries indicates their narrow export specialization to the detriment of providing the population with a variety of food products.

The largest food producers in the EU-28 are the countries of the EU-15: Germany, Italy and Spain, and, also, the UK in the case of some products. Among the EU-13 countries, only Polish agriculture has reached the level of agricultural production comparable to the level in these countries. In general, the EU-28 is currently self-sufficient in terms of food production, with the exception of fruit production, the demand for which is covered by domestic production by about 2/3 (Kołodziejczak, 2018).

The USA is the largest exporter and importer of food products. Moreover, since 2016, imports have grown more rapidly than exports. For example, in 2018, export growth amounted to 1% and its volume reached 140 billion USD, while imports grew by 6% and reached 129 billion USD (United States Department of Agriculture Economic Research Service, 2019). More than half of fresh fruits and almost a third of fresh vegetables that Americans buy nowadays come from other countries. The growth in food imports, mainly from Latin America and Canada, is due to such factors as the improvement of container transportation and storage technologies; the development of new varieties and cultivation technologies that allowed the transfer of agricultural production to other neighboring countries (for example, to central Mexico); the increase in the flow of migrants; lower tariffs and other barriers to imports. As a result, the share of imported fresh fruits consumed in the United States, according to the

Department of Economic Research Economic Services, has more than doubled from 23% in 1975 to 53.1% in 2016. Imports of fresh vegetables grew by more than 5 times from 5.8% to 31.1%. A significant increase in the consumption of many crops, including mangoes (consumption growth per capita of 1850% between 1975 and 2016), and others was accompanied by a decrease in the consumption of crops that were traditionally grown in the United States.

From the beginning of the 20th century, Japan has almost never covered the needs of its population for food products with its own production. Only in the late 1950s, first of all, due to high yields of rice, and also due to the very low level of food consumption in general, the level of self-sufficiency in agricultural products was at an acceptable level. The ratio of self-sufficiency in food products as a ratio between the value of created and consumed food products decreased from 86% to 66% from 1965 to 2015, while the security ratio, calculated taking into account the number of calories contained in produced and extracted food products for the same period, decreased from 73% to 39% (Markarian, 2017). In the countries with a high level of GDP per capita, a high level of added value in agriculture and a high supply of agricultural land, it is usually reduced to initiatives at the local level to develop local production and consumption.

Sub-Saharan Africa is a net importer of food products with very low self-sufficiency ratios and high import-dependency ratios, respectively. Unlike economically developed countries, they import many of the staple foods, including meat and fish, some fruits, milk and dairy products, fresh and frozen vegetables, coffee, tea and spices, cereals, butter, wheat and other products. Food imports in these countries account for a significant share of all imports.

The presence of import dependence in India and China is associated with population growth and



urbanization processes, population income growth and inefficient agriculture, unable to meet growing domestic demand. In addition, high losses of the grown crop due to the lack of storage infrastructure play a significant role.

The reasons for the emergence of import dependence largely determine the direction of implementation of the policy to reduce it (Table 2).

**Table 2.** Causes of import dependence and measures to reduce it in different countries

Country group characteristics	Examples	The nature and causes of import dependence	Brief description of import dependence reduction policy
Countries with a high level of GDP per capita, a high level of VA in agriculture and high availability of agricultural land	USA, Canada	for certain groups of food products, mainly for fresh fruits and vegetables to ensure year-round provision of the population and variety of food products	- initiatives for the development of local production and consumption, implemented at the local level
Countries with a high level of GDP per capita, a high or average level of VA in agriculture and with an average availability of agricultural land	EU		- the transformation of agricultural policies into food policies, covering all parts of the supply chain with a focus on the sustainability of the food system; - local initiatives to reduce import dependence and the development of local production and consumption
Countries with a high level of GDP per capita, a high or medium level of rural population in agriculture and with low availability of agricultural land	Japan, Singapore	for many major food groups (Japan), for almost all food groups (Singapore)	- protection of the domestic market for the most sensitive goods, domestic production incentive, including in other countries; - diversification of imports and the development of high-tech agriculture
Countries with an average level of GDP per capita, an average level of VA in agriculture and high availability of agricultural land	Brazil, Russia	for certain groups of food products in connection with highly specialized commodity export orientation and inefficient agricultural production in previous years (Brazil), crisis situation in the economy (Russia)	- modernization of agriculture and food industry on the basis of: stimulating domestic demand, developing infrastructure, increasing productivity, developing previously unused lands, providing state support to agricultural producers, stimulating exports, and applying the latest technologies
Countries with an average level of GDP per capita, with an average or low VA in agriculture and with an average availability of agricultural land	China, India, Malaysia	population growth, low-efficient agriculture (India, China), unable to meet growing demand, lack of storage and processing infrastructure	- creation of a developed network of information and consulting services for the needs of the agro-industrial complex, growth of investments, involvement of unused lands and improvement of land legislation
Countries with low GDP per capita, low or very low VA in agriculture	African countries south of the Sahara	population growth, low-efficient agriculture, highly specialized commodity export orientation	- reduction of food import dependence and the development of national production based on: diversification of agricultural production, improvement of the agricultural efficiency and growth in value added, development of the processing industry

A number of global trends affect food security and the overall sustainability of the agricultural system (FAO, 2017).

1. Population growth. By 2050, the world's population is expected to grow to almost 10 billion, which will lead to an increase in agricultural demand by about 50 percent compared to 2013 under a scenario of moderate economic growth.
2. Diversity of nutrition is particularly sensitive to income (Thome *et al.*, 2019), therefore, economic growth in low- and middle-income countries will accelerate the transition to a diet with a higher consumption of meat, fruits and vegetables, and lower cereal consumption compared to the existing level (Tireuov *et al.*, 2018), which requires changes in the structure and volume of production. Maintaining a high level of waste and food loss.
3. Slowdown in production growth. While investments in agriculture and technological innovation increase productivity, productivity degradation, loss of biodiversity and the spread of transboundary pests and diseases of plants and animals hinder the acceleration of productivity growth, some of which are becoming resistant to antimicrobials. Climate change, which negatively affects the agricultural conditions, threatens crop production, livestock production, fish farming, and fishing.
4. Concentration of production and increased competition. Food production is becoming increasingly capital intensive, vertically integrated and concentrated in fewer enterprises. Complicated business conditions (Litau, 2018).

In the coming years, the food security situation in most countries is expected to escalate and become even more complex than ever.

### Conclusions

The study showed that food import dependence is in one degree or another inherent in many countries, including the developed ones, which are simultaneously exporters of food products. However, there are significant differences between the import dependence of countries with high and low GDP per capita, the level of value added in agriculture and the availability of land

resources. Thus, countries with a high level of GDP per capita, a high level of added value in agriculture and a high supply of agricultural land are import-dependent, as a rule, for certain groups of food products. Countries with low GDP per capita, low value added in agriculture and low agricultural land supply imports all or many of the staples.

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