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FOOD SELF-SUFFICIENCY OF UKRAINE AS COMPARED TO THE EUROPEAN UNION

Keywords: food self-sufficiency, food security, plant products, animal products, Ukraine

ABSTRACT. Food self-sufficiency is one of the factors determining the food security of individual countries. The purpose of the research was to assess food self-sufficiency in basic plant and animal products of Ukraine in comparison with the European Union. To assess food self-sufficiency, the *SSR_i* index was used, i.e. the ratio of the volume of production of the most important products of plant and animal origin to the volume of their domestic consumption. USDA, FAOSTAT and CSO data were used in the study. The study covered the years 2019-2023. A comparative analysis of the self-sufficiency in basic plant and animal products of the Ukrainian and EU agri-food sectors showed significant differences. Ukraine has high self-sufficiency in cereals and oilseeds, while the EU has only small surpluses of cereals and is a net importer of oilseeds. The self-sufficiency of Ukraine's sugar and vegetable industries is comparable to that of the EU. On the fruit market, by contrast, Ukraine and the EU are not self-sufficient. Ukraine's self-sufficiency on the animal products market is much lower than on the vegetable products market. Ukraine is primarily self-sufficient in poultry, but not in pork and dairy products. The EU is self-sufficient in most animal products. Taking into account the production potential and food self-sufficiency of Ukraine, it should be expected that the future accession of Ukraine to the EU will strengthen the position of the EU in the world market of agricultural raw materials and improve its food security and resilience to crisis phenomena. However, it may pose a threat to many sectors of the EU agri-food sector and force adjustment processes on them.

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INTRODUCTION

In recent years the external environment for doing business in the agri-food sector has changed significantly, determined primarily by the socioeconomic impact of the COVID-19 pandemic and the war in Ukraine. 2020 marked the peak of the pandemic, and 2022 came under pressure from another market-destabilizing factor, Russia's invasion of Ukraine. The war had already shaken the world's already volatile food markets, due to the fact that Ukraine and Russia are major producers and exporters of agricultural commodities. The armed conflict in Ukraine has directly affected the food security of many countries, by reducing the physical availability of some agricultural products as a result of disruptions in their transportation. The negative impact of the war on food security was also marked indirectly, through a marked increase in prices and a reduction in the economic availability of food in many countries, especially those with the lowest incomes.

Therefore, under constantly changing, increasingly difficult external conditions, the issue of ensuring food security has become particularly important, being an element of the socio-economic policy of every state. One of the factors determining food security is the level of food self-sufficiency. Food self-sufficiency of a country is defined as the ability to meet the internal demand for food with production of its own resources, while in a more developed form it means the full availability of food on the internal market, regardless of its source (domestic production or imports) (Clapp, 2017a).

The war in Ukraine has shown how strongly this country is integrated into global agricultural markets and how important it is to the world's food security. Despite the decline in production and exports of most of Ukraine's primary agricultural commodities in 2022-2023, Ukraine continued to be the world's largest exporter of sunflower oil in 2023, the second largest exporter of other oilseeds by value, the fourth largest exporter of corn and rapeseed, the fifth largest exporter of soybeans, and the sixth largest exporter of wheat. It was also among the world's top ten exporters of barley, rapeseed oil and poultry meat (Ambroziak, Szczepaniak, Bułkowska, 2024).

Amid the dynamic changes in the aftermath of the war, the question arises as to how Ukraine's food self-sufficiency was shaped and changed during this period. This issue, especially in the context of future changes in the global economy, including the potential accession of Ukraine to the European Union (EU), may be of great importance. Therefore, the purpose of the article is to assess food self-sufficiency in basic plant and animal products of Ukraine against the EU. This assessment was made on the basis of an analysis of the ratio of production of selected agri-food products to their balance consumption. The self-sufficiency analysis was carried out for the period 2019-2023.

THE ESSENCE OF FOOD SELF-SUFFICIENCY

The concept of self-sufficiency in the economic context refers to a situation in which a country or region is fully self-sufficient, that is, able to meet all its needs with internal resources, without the need to trade with other countries and regions. It is a model that focuses on developing domestic production, reducing dependence on external markets and developing self-reliance in key sectors of the economy. In economic theory, self-sufficiency is presented as a theoretical model in which the economy does not require external sources to function. It is a situation in which a country produces all the goods and services it needs on its own. Such an understanding of the concept was first introduced by List (1930), who noted, that a sufficient quantity and variety of raw materials are needed to achieve such a state. Similar views were represented by mercantilists, who emphasized self-sufficiency through a favorable balance of trade. The economic policy of mercantilism was based on state intervention to limit imports and protect domestic industry, including production for export. They argued that the accumulation of wealth, the source of which is bullion, is crucial to the stability of the economy (Przeździecka, 2020). This belief of the mercantilists was challenged in subsequent years with the development of the classical school of economics. According to Bishop (2009), the implementation of full self-sufficiency, i.e., the complete absence of exports and imports, is very difficult, practically impossible, since no country can produce all the necessary products demanded by its citizens and offer them at competitive prices. Moreover, in the era of globalization, trade links have been formed in the world economy as a result of the optimal allocation of resources, including factors of production. The concept of self-sufficiency should therefore be treated broadly, taking into account global value chains, as a result of which trade links are formed as a result of cooperation between entities operating in different links of these chains.

Food self-sufficiency is generally understood as the degree to which a country or region can meet its food needs from its own domestic production (FAO, 1999). Food self-sufficiency is considered one of the most important factors determining food security (Obiedzińska, 2016) or one of the guarantors of this security (Mikula, 2012). However, it should be noted that food self-sufficiency is not an expression of food security, although the two features may interact (Kwasek, 2018). The concept of food security does not include considerations about the origin of food or a country's ability to produce it, as long as it is physically and economically available, safe and nutritious, and the stability of the food supply over time is ensured (FAO, 2022). Food self-sufficiency is mainly concerned with the dimension of physical availability and focuses on the origin of food, especially the national capacity to produce it in sufficient quantities (Clapp, 2017a).

Depending on a country's level of economic development, its situation in terms of the production potential of the agri-food sector, the ability to purchase food on foreign markets and the efficiency of the distribution sector, and above all, individual government strategies,

food self-sufficiency can be understood and implemented differently. For example, it can be understood as closing the borders to all foreign food trade and concentrating its resources on the agri-food sector so that it can meet all the food needs of the domestic market. In this way, agriculture is prioritized as a source of overall economic growth, as well as a way to develop rural areas. In this view, the definition refers to a country applying total autarky to its agri-food sector. However, such an extreme policy stance is virtually non-existent today, just as there are no countries that depend entirely on foreign food purchases. All countries, even major food exporters that are fully self-sufficient, import at least some of their food or raw materials for its production (Clapp, 2017a; Szczepaniak, 2018). Much more commonly, a country's food self-sufficiency is defined as a situation in which a country meets or even exceeds most of its food needs from its own production, while also trading food. This approach is less categorical about where the food consumed in a country comes from, but still allows inferences about a country's own food production capacity. Countries that are self-sufficient may specialize in food production, but this does not prevent them from importing and exporting food at the same time (Clapp, 2017a).

The increasing level of economic globalization, the opening of economies to external competition, as well as biological and technological advances, mean that food self-sufficiency is changing its character today, and it is now difficult to find examples of autarkic economies. In practice, this involves countries taking advantage of differences in comparative advantages and seeking to balance their food trade. Zero balances achieved in this way can indicate food self-sufficiency. This approach to this phenomenon implies full economic and physical availability of food on the domestic market, regardless of its sources of origin, i.e. from both domestic production and imports (Szczepaniak, 2018). Kapusta (2016) refers to such a state of equilibrium in food trade as the "security optimum". Cango, Ramos-Martín and Falconí (2023), on the other hand, call such an approach "agricultural complementarity", citing the operation of regional blocs, such as the Common Agricultural Policy in the EU, or efforts to integrate Latin American and Caribbean countries. In this way, the policy of optimal food self-sufficiency, which is being implemented, creates opportunities to enrich the domestic food assortment with products that are not produced domestically, while at the same time making it possible to sell surplus food abroad.

In recent years, many countries have seen a growing interest in the idea of food self-sufficiency. Various crisis-like phenomena, such as the 2007-2008 food crisis, the COVID-19 pandemic and the war in Ukraine, have caused great uncertainty in global food markets, manifested in disruptions in global supply chains or volatility in agricultural and energy commodity prices. Against this backdrop, many countries have announced a shift in policies aimed at increasing levels of food self-sufficiency and stepping up efforts to increase the resilience of local food systems (Wittman, Desmaris, Wiebe, 2010; Clapp, 2017b). Although measures to support greater food self-sufficiency might seem justified in many cases, they often face criticism from economists.

STUDY MATERIAL AND METHODOLOGY

Three analytical methods are most often used in assessing the food self-sufficiency of countries. Two of them are based on the analysis of foreign trade results in agri-food products (Szczepaniak, 2018). The foreign trade balance, which is the absolute difference between exports and imports, makes it possible to assess the supply and demand situation in a specific market. A positive foreign trade balance indicates that a country's production is greater than domestic demand and its surplus can be sold on external markets. This may indicate that a country is self-sufficient in the production of a particular good. An assessment of food self-sufficiency in relative terms, on the other hand, is made possible by the index of the coverage of imports of agri-food products by their exports, which is the ratio of exports to imports (Verdoorn, 1960). A country is food self-sufficient if the values of this indicator are greater than or equal to unity. Thus, an analysis of foreign trade performance to some approximation can be used to determine whether a country is food self-sufficient.

However, neither the foreign trade balance nor the import-export coverage ratio should be clearly equated with self-sufficiency, as the intensity of trade, including intra-industry trade, is increasing under conditions of economic globalization. There is a group of countries that specialize in foreign trade in agri-food products, including the re-export of imported products, and that derive significant economic benefits from trade. In such cases, these indicators are not necessarily the result of production greater than demand. Nevertheless, many researchers (including Clapp, 2017b) cite more in-depth studies that prove that most net food-exporting countries are self-sufficient, while most net food-importing countries are not.

The third method of assessing food self-sufficiency is based on the analysis of market balances of individual products, and is specifically used by FAOSTAT (FAO, 2012). In this approach, the food self-sufficiency indicator (SSR_i) is the ratio of production to balance sheet consumption, which in turn expresses production adjusted for the foreign trade balance ($\pm TB_i$), and, in more precise terms, additionally taking into account the change in domestic stocks ($\pm \Delta S_i$). This indicator is most often expressed as a percentage. Self-sufficiency in the market for a given product occurs if the values of the SSR_i indicator are greater than or equal to one hundred. The calculation of these indicators mostly uses data in volume terms, much less often also in value or energy terms (Puma, Bose, Chon, Cook, 2015; Clapp, 2017a).

$$SSR_i = \frac{O_i}{U_i} \times 100 = \frac{O_i}{(O_i + Im_i - Ex_i \pm \Delta S_i)} \times 100 = \frac{O_i}{(O_i \pm TB_i \pm \Delta S_i)} \times 100$$

where: SSR_i – self-sufficiency ratio, O_i – domestic production, U_i – balance consumption, Im_i – imports, Ex_i – exports, TB_i – foreign trade balance, ΔS_i – inventory change.

Regardless of the take, the SSR_i index expresses the degree to which a country's domestic demand for agri-food products is covered by its domestic production. The higher the values of the food self-sufficiency index, the greater the country's ability to feed its population with its own production. This indicator can also be used to assess the food self-sufficiency of individual countries or regions in terms of specific agricultural products of plant and animal origin, making it possible to determine whether they are capable of meeting the demand for the indicated products (Obiedzińska, 2016; Szczepaniak, 2018). The usefulness of this indicator is due, in particular, to the fact that not only export-import relations, but also production data and stock changes are included in the calculation (Clapp, 2017a).

The article used the SSR_i indicators defined above as a method for assessing food self-sufficiency, which was based on market balance analysis. The research used statistics Foreign Agricultural Service of United States Department of Agriculture USDA, FAOSTAT and CSO in quantitative terms. The temporal scope of the research was defined as 2019-2023, i.e., the period immediately before Russia's invasion of Ukraine was included, as well as the period of hostilities in Ukraine.

RESULTS OF THE STUDY

Total grain production in Ukraine more than triples the balance of its consumption, which results in the bulk of this production going to export (Bułkowska, Bazhenova, 2023). SSR_i ratios in the grain market in 2019-2022 fluctuated between 306.1-375.8%, and in 2023 they increased to 406.3% (Table 1). There were significant differences in the level of self-sufficiency in the markets for individual grain species. The largest production surpluses and clear export specialization were in corn (233.1-430.5%) and wheat (306.4-406.3%), and the smaller barley production (179.4-242.0%). Rye production was marginal, as fertile soils made it possible to grow wheat, barley and corn. In comparison, the situation was different in Poland, characterized by a large share of poor soils, mainly able to grow rye and oats.

In the oilseed market, the production also far exceeds the consumption and Ukraine is their major exporter (Bułkowska, Bazhenova, 2023). However, it should be noted that the level of self-sufficiency varied for individual oil crops. The production of rapeseed in

2019-2022 was more than seven times greater than the demand, and only in 2023 the level of self-sufficiency in this area decreased to 450.2%. High consumption of rapeseed meal for feed resulted in slightly lower self-sufficiency. Very high production surpluses over consumption were achieved by Ukraine in the rapeseed oil production. In the sunflower seed market, production was balanced with demand, meaning that seeds were primarily processed into oil by the domestic companies. High variability of production under conditions of relatively stable consumption resulted in changes in self-sufficiency rates in the range of 86.1-154.2%. A by-product of sunflower processing was meal, which was in rather low demand on the domestic market and coupled with large oversupply, was directed for sale on the international market. Sunflower oil production was several times greater than the domestic demand. Ukraine has been a significant exporter of this oil for years (Bułkowska, Bazhenova, 2023). Production of soybeans and soybean meal more than doubled the overall domestic consumption of these products, which are the basis of poultry and swine farming.

In the sugar industry, self-sufficiency was guaranteed almost throughout the period under review (96.0-195.7%), with lower rates occurring only in years with unfavorable weather conditions during the conflict escalation period. Soil and climatic conditions favored the competitive cultivation of sugar beets in Ukraine, but the sugar industry, which requires large modernization investments and structural changes, remained a barrier to the industry's development.

In terms of livestock production, Ukraine has moderate self-sufficiency. Particularly developed and competitive is the production of poultry livestock, which in 2019-2023 was 25.6-39.5% higher than the domestic market demand. The basis for efficient poultry farming was the large resources of grain and protein crops, as well as positive production economies of scale carried out in agrohholdings. Consequently, Ukraine was a competitor of the EU and Poland in the international market (Ambroziak et al., 2024). SSR_i ratios in the dairy and beef markets, which are naturally production-related, were 88.5-103.4% and 107.0-113.9%, respectively. The lack of self-sufficiency in dairy by 2022 and its low rate in 2023 were a consequence of the decline in cow numbers, what was the result of the restructuring carried out in crop production specialized – agrohholdings. The decline in the number of dairy cows was followed by declining beef production, as calves for fattening and cows for slaughter come from dairy cattle operators. Self-sufficiency in the beef market was due to low consumption in the domestic market, as a consequence of high prices and low household incomes (WBG, 2024). In the pork market, there was a difficult supply and demand situation, as production did not meet demand, and self-sufficiency was only 91.8-97.3%. The reasons for this were cyclical and low profitability of the production. Self-sufficiency of Ukraine in the market of animal products was much lower than in the market of plant products, mainly due to the structure and specialization of agrohholding production.

Table 1. Food self-sufficiency ratios SSR_i for selected agri-food products in Ukraine and the European Union in 2019-2023

Specification	Food self-sufficiency ratios SSR_i (%)										
	Ukraine					European Union					
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	
Total cereals	370.6	306.4	375.8	326.8	406.3	108.9	106.1	109.3	102.4	103.9	
– wheat	351.5	292.2	347.4	275.6	343.3	129.4	120.9	127.9	123.2	121.5	
– barley	207.1	193.8	242.0	179.4	181.4	111.5	112.4	114.4	111.0	110.5	
– corn	309.4	233.1	273.5	303.4	430.5	84.5	86.8	87.7	70.0	79.7	
Rape	763.2	904.6	744.4	871.7	450.2	70.4	73.1	77.6	78.9	79.8	
– canola oil	9,150.0	4,066.7	5,433.3	2,500.0	4,266.7	99.6	102.6	99.0	102.4	103.5	
– rapeseed meal	514.0	380.0	570.0	416.0	374.4	100.2	101.7	101.0	100.0	100.1	
Sunflower	99.5	101.6	154.2	86.1	97.6	98.0	96.4	90.3	89.1	97.8	
– sunflower oil	1,343.6	1,075.1	1,272.3	1,486.4	1,570.0	75.0	71.9	83.1	77.0	71.8	
– sunflower meal	478.1	445.4	343.1	340.1	425.2	65.1	70.8	78.5	74.9	71.5	
Soybeans	222.6	196.6	245.0	234.2	270.8	15.7	15.0	16.6	16.4	18.4	
– soybean meal	243.3	164.2	171.2	215.5	194.5	43.5	44.0	43.9	42.2	42.7	
Sugar	123.1	96.0	115.4	151.1	195.7	100.2	91.1	97.5	83.4	89.2	
Beef	113.9	108.9	111.2	107.0	113.4	104.0	105.6	105.4	103.9	104.2	
Pork	96.6	95.9	94.1	91.8	97.3	121.7	127.6	126.1	122.3	117.0	
Poultry	125.6	130.1	133.3	139.1	139.5	114.6	114.3	112.4	110.1	109.1	
Milk	91.0	90.7	90.1	88.5	103.4	118.7	115.8	116.2	114.4	115.5	

Source: own calculations based on USDA Foreign Agricultural Service and FAOSTAT data

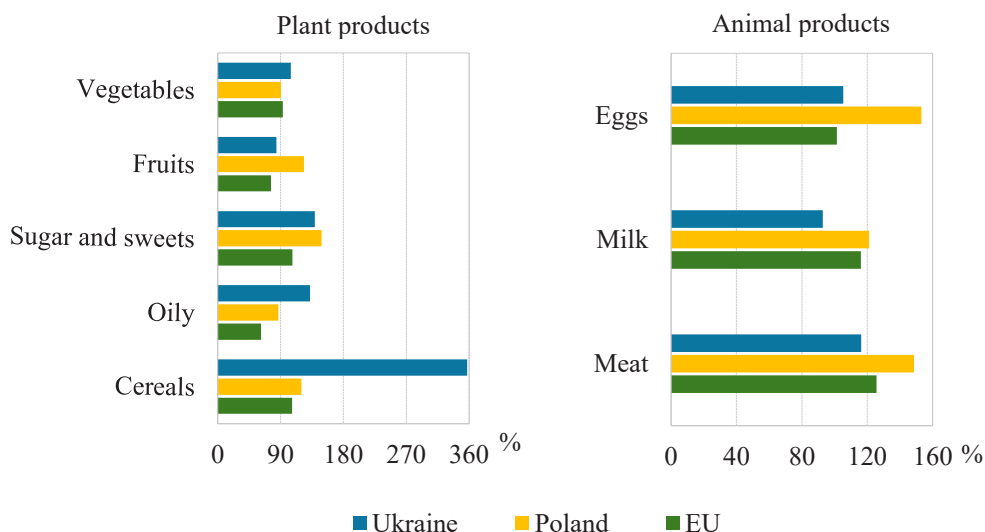


Figure 1. Average food self-sufficiency ratios SSR_i for basic plant and animal products in Ukraine, the EU and Poland in 2019-2023

Source: own calculations based on Foreign Agricultural Service USDA, FAOSTAT and CSO data

A comparative analysis of the 2019-2023 average SSR_i self-sufficiency rates for basic agricultural products of plant and animal origin in Ukraine and the EU, including Poland, confirmed significant differences (Figure 1). Ukraine is characterized by very high self-sufficiency in the production of cereals and oilseeds. Both the EU and Poland, conversely, are net importers of oilseeds, as determined by the high feed demand for soybean meal and esters used as additives in diesel production. In the grain market, the EU and Poland have surplus supply, but it is manifold smaller than in Ukraine. The self-sufficiency of Ukraine's sugar industry is similar to the EU average, but it must be taken into account that sugar beets are grown and processed in nineteen EU countries. Consequently, there are large differences in self-sufficiency between member states, with Poland being one of the large EU sugar producers and exporters, and its self-sufficiency is greater than of Ukraine. In vegetable production, the self-sufficiency of Ukraine, the EU and Poland is similar. The situation is different in fruit production, as Poland is a leading producer and exporter of apples and soft fruits and fruit preserves. However, the fruit market, due to the large role of trade turnover in fruits from other climatic zones, is characterized by a high intensity of intra-industry trade, which makes it possible to consider the self-sufficiency of Ukraine and the EU as comparable.

In terms of animal products, Ukraine has higher self-sufficiency than the EU in poultry, comparable in beef and eggs and lower in milk and pork. Poland has higher self-sufficiency than Ukraine and the EU, including in total meat, eggs and milk. In the Polish meat market, self-sufficiency is mainly determined by large poultry production and very low demand for beef.

CONCLUSIONS

The assessment of self-sufficiency in basic agricultural products of plant and animal origin between Ukraine and the EU, including Poland, showed significant differences. Ukraine has very high self-sufficiency in grain and oilseed crop production. The EU and Poland have small surpluses of cereals, but are net importers of oilseed crops due to high demand for feedstocks and esters as a consequence of first-generation biofuel regulations. The self-sufficiency of Ukraine's sugar and vegetable industry is comparable to its average level in the EU and Poland. In the fruit market, Ukraine and the EU are not self-sufficient due to large imports of products from other climate zones. Poland is a large producer and exporter of fruits and shows high self-sufficiency in this area. In animal product markets, Ukraine is self-sufficient, as determined by developed poultry production and low domestic demand for beef. Ukraine lacks self-sufficiency in the dairy industry. The EU and Poland have self-sufficiency in animal products.

Ukraine's future accession to the European Union will significantly increase the production potential of the EU's agri-food sector and improve its food self-sufficiency, as Ukraine shows a high self-sufficiency in the products which the EU imports, for example, oilseeds, cereals, poultry products. As a result, the EU will strengthen its position as an exporter in the world market for agricultural raw materials and improve its food security and resilience to crisis situations. However, Ukraine's accession to the EU will be very challenging for EU farms and food industry companies due to the great potential and competitiveness of the Ukrainian sector. At the same time, Ukraine's agriculture and food industry will be forced to carry out deep restructuring and adjustment processes to the conditions set by the Common Agricultural Policy. These will require large investments and organizational changes in the process of production and trade of agri-food products, aimed at implementing sustainable and environmentally friendly solutions.

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SAMOWYSTARCZALNOŚĆ ŻYWNOŚCIOWA UKRAINY NA TLE UNII EUROPEJSKIEJ

Słowa kluczowe: samowystarczalność żywnościowa, bezpieczeństwo żywnościowe, produkty roślinne, produkty zwierzęce, Ukraina

ABSTRAKT. Samowystarczalność żywnościowa jest jednym z czynników decydujących o bezpieczeństwie żywnościowym poszczególnych krajów. Celem badań była ocena samowystarczalności żywnościowej w zakresie podstawowych produktów roślinnych i zwierzęcych Ukrainy na tle Unii Europejskiej. Do oceny samowystarczalności żywnościowej wykorzystano wskaźnik *SSRI*, czyli relację wielkości produkcji najważniejszych produktów pochodzenia roślinnego i zwierzęcego do wielkości ich zużycia krajowego. W badaniach wykorzystano dane USDA, FAOSTAT i GUS. Badania dotyczyły okresu 2019-2023. Analiza porównawcza samowystarczalności w zakresie podstawowych produktów roślinnych i zwierzęcych ukraińskiego i unijnego sektora rolno-spożywczego wykazała duże różnice. Ukraina charakteryzuje się wysoką samowystarczalnością w zakresie zbóż i roślin oleistych, podczas gdy UE dysponuje tylko niewielkimi nadwyżkami zbóż i jest importerem netto roślin oleistych. Samowystarczalność ukraińskiej branży cukrowniczej i warzywniczej jest porównywalna z unijną. Na rynku owoców Ukraina i UE nie są natomiast samowystarczalne. Samowystarczalność Ukrainy na rynku produktów zwierzęcych jest znacznie mniejsza niż na rynku produktów roślinnych. Ukraina jest przede wszystkim samowystarczalna w zakresie drobiu, ale nie jest w zakresie wieprzowiny i produktów mleczarskich. UE charakteryzuje się samowystarczalnością w zakresie większości produktów zwierzęcych. Uwzględniając potencjał produkcyjny i samowystarczalność żywnościową Ukrainy, należy przewidywać, że przyszła akcesja Ukrainy do UE wzmocni pozycję UE na światowym rynku surowców rolnych oraz poprawi jej bezpieczeństwo żywnościowe i odporność na zjawiska kryzysowe. Może ona jednak stanowić zagrożenie dla wielu branż unijnego sektora rolno-spożywczego i wymuszać w nich procesy dostosowawcze.

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