INTERNATIONAL TRADE IN FOOD AND AGRO-BASED PRODUCTS IN THE TIME OF COVID-19

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Abstract: The aim of the study is to examine the regional impact of the COVID-19 pandemic and its individual waves on foreign trade in food and agro-based products in the world's largest trading countries. The study was based on the statistical database of the International Trade Centre (ITC). In addition to the basic analysis, use was made of the autocorrelation method to detect special relationships between foreign food trade of different countries. The results show that the pandemic has had the greatest impact on agricultural and food trade in the United States, but it has spilled over to other countries as well, especially its two major trading partners, the European Union and China. Food trade stagnated in the initial period of the pandemic, but later recovered relatively well. The six examined regions can be divided into three groups based on the typical features of their autocorrelation.

Keywords: COVID-19, food, agro-based products, trade

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Introduction

At the beginning of 2020, a new pandemic spread across the globe, leaving no area untouched. Although the initial drastic changes have now subsided, even three years on, it is typical of the epidemic to intensify in new waves. Both the disease (mainly owing to the loss of the workforce and an increase in demand for health products) and government restrictions affected all sectors of the economy. Since the original virus posed an extreme threat to human health, governments introduced significant closures or restrictions (which were minor during later waves) in the initial period to protect people's health and ensure the sustainability of the healthcare system. Those government measures varied widely and differed from country to country, including closing borders, restricting international travel, quarantining areas, declaring curfews, closing restaurants and hotels, working from home, mandatory mask-wearing, restricting personal contact, etc. (Gombkötő 2021). According to Li and Lin (2021), the COVID-19 (coronavirus disease 2019) pandemic has had a much greater impact on the global supply chain than previous coronavirus (severe acute respiratory syndrome – SARS and middle east respiratory syndrome – MERS) pandemics. Food is an essential product, so ensuring the continuity of food supply is

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a fundamental task. In addition, it was observed that when the epidemic broke out, people began to buy certain foodstuffs in unreasonable quantities together with health and hygiene products, which also threatened the safety of food supply. Since, nowadays, a significant part of food products is sold to foreign markets, the government measures taken at different times and the levels of severity have had a significant impact on international trade in food and other agro-based products. In addition, different food-trade patterns can be observed in some countries and regions of the world. Although many studies have addressed the impact of the epidemic and various measures undertaken with regard to agricultural production, food supply or international trade following the outbreak of the epidemic, the impact of subsequent waves in this area has hardly been investigated at all. Since the COVID-19 virus is still spreading, it would be advisable to investigate these topics to determine future patterns.

In contrast to the existing literature, this study aims to examine the impact of the COVID-19 epidemic on trade in agro-based commodities, specifically at the regional level, comparing the world's largest trading countries. By focusing on regional dynamics among major trading nations, the study aims to offer a comprehensive perspective that addresses the specific needs and interests of various stakeholders. By understanding how major trading nations are affected at regional levels, policymakers can tailor their strategies and interventions to address specific challenges and capitalise on emerging opportunities. The findings may help develop targeted policies that enhance resilience and facilitate sustainable trade practices. Researchers and scholars can use our findings as a foundation for further investigation into nuanced regional variations in trade patterns, thereby advancing the understanding of the broader economic implications of global crises. Finally, increased awareness of these dynamics can foster a better understanding of the interconnectedness of global trade and its implications for local economies.

The research is divided into four sections. The literature review provides a comprehensive study of the existing literature on the impact of the COVID-19 pandemic on international trade in agro-based commodities. The next section, materials and methods, presents the research methodology, detailing the data sources and the analytical framework employed in this study. The following section analyses the findings, with a specific focus on regional variations among major trading nations. Finally, the conclusion summarises key observations and proposes avenues for future research in this critical area.

Literature review

Food trade is significantly influenced by both the supply and demand sides of the domestic food market, which was particularly evident in the first period of the pandemic, in the first half of 2020, but some effects were observed in later periods as well. The supply side of the food market was affected by factors such as crop yields as well as some governmental restrictions (e.g., reducing personal contact, imposing curfews and closing certain communal venues, such as cinemas, theatres, museums, catering services like restaurants, and hotels). In addition, the supply of food and agro-based products was also affected by labour shortage in some sectors (animal husbandry, horticulture, fruit and vegetable production) (Seleiman 2020; Stephens et al. 2020; Arumugam et al. 2021; Gruére, Brooks 2021; Mahajan, Tomar 2021), including dairy and meat sectors (Gruére, Brooks 2021), partly due to restrictions on the flow of foreign labour and partly because of illnesses in the labour force. As regards the demand side, consumer behaviour patterns changed significantly. Global shocks, such as the pandemic, an increase in the world demand for food, and panic shopping can be observed. In the first period of the pandemic, demand increased significantly, especially for shelf-stable food (dried or canned food, pasta, milk or milk substitutes), flour and yeast (Bakalis et al. 2020), healthier food (fruits, vegetables, legumes, whole grains, olive oil), mood-enhancing food (alcohol, sweets) (Hughes 2020; Muscogiuri et al. 2020), fresh bread and frozen vegetables (Crisp, 2020) as well as protein-containing food (meat, chicken or fish) (DeBroff 2020). At the same time, demand for expensive and luxury goods decreased (Amare et al. 2020; Bauer 2020). In addition, home delivery and online shopping were preferred to personal purchases (Bakalis et al. 2020; DeBroff 2020).

Both the supply and demand sides of the food market were affected by the fact that some countries introduced export and/or import restrictions on certain products in the early period of the pandemic, in the first quarter of 2020. Import restrictions were primarily for health reasons, as they feared bringing in the virus through food. For instance, Indonesia, Korea and Russia imposed a ban on both wild and live animals and animal products from China in January and February 2020, while Egypt banned imports of garlic, carrots and green ginger from China (Agricultural Trade Promotion Center [ATPC], 2020). From March of the same year, Mauritius restricted imports of animal products from China, Iran, Korea, Switzerland and the EU, Vietnam imposed a total ban on the import of wildlife and related products from around the world, and Iraq and Seychelles increased import duties on agricultural products (ITC 2020). In January 2020, the United States increased the number of bans on imports of agricultural products by 52% over the same period of the pre-pandemic year, in particular by refusing to import agricultural products from China because the pandemic started there. In addition to these import measures, which were reported to the WTO (World Trade Organization), countries also adopted unilateral border controls by refusing entry to certain imports (Chen, Mao 2020). However, it can be seen that the restrictions were mainly on live animals and raw products.

Restrictions on the exports of processed food were less common; only Vietnam and Kazakhstan used this tool in the first wave of the pandemic. Export restrictions are intended to ensure the provision of domestic food supply and maintenance of the quantity of domestic products (Casey, Cimino-Isaacs 2020; Chenarides et al. 2021). Export restrictions were applied primarily to staple food products such as cereals. Between 20 March and 10 April 2020, twenty countries banned the export of various food products, including rice, wheat, oil, fruit, vegetables and eggs (Chen, Mao 2020). According to experts, however, export restrictions may be only applied for a temporary period, as their negative effects on the economy outweigh the benefits. Espitia et al. (2020) state that these negative effects can be a reduction in domestic production (due to a decrease in domestic prices) as well as loss of international market places, a competitive advantage, reputation, confidence in international trade and future business opportunities for exporters. Difficulties for exporting producers to enter the global market can lead to a food-security crisis, especially in the least-developed countries (Rutten et al. 2013). Other negative effects can be a rise in world market prices and disruptions in the distribution of staple foods (e.g. wheat, corn, rice), a reduction in the quantity and quality of food consumed (Fyles, Madamootoo 2016; Aday, Aday 2020; Glauber et al. 2020), as well as a shortage of domestic products (Reddy et al. 2016; Ndemezo et al. 2018; Arianina, Morris 2020). Moreover, local sellers may not find buyers, which will result in oversupply and waste, as well as economic losses. Foods that are not grown locally but are intended for processing will not be available due to constraints and thus capacity utilisation of food-production plants will not meet demand (Gombkötő 2021). As for global food and agro-based product trade, Kerr (2020) stated in his study that the globalisation of agricultural products and international trade in food and agro-based products decreased at the beginning of the COVID-19 pandemic. Li and Lin (2021) showed that the spread of the pandemic in different periods had an asymmetric effect on trade between countries, as different stages in the progression of a pandemic lead to differences in the supply and consumption sides of global trade in different countries. Beckman and Countryman (2021) observed an increase of 2.3%, while Poudel et al. (2020) estimated a decrease of 13–22% in trade in agricultural products.

When it comes to global food trade, it is important to examine one by one the impact of the epidemic on the trade of individual countries, especially because it can be generally stated that the pandemic has negatively affected the trade of almost all countries in the world. Li and Lin (2020) examined the three largest-trading actors in the world (the United States, the European Union and China) in the first wave of the pandemic and found that trade fell to the greatest extent in the United States (by 23%), followed by China (13%) and then the European Union (10%). Countries with closer trade relations with the United States are more vulnerable than the other countries. The EU has a huge international market because of its important trade position;

consequently, the impact of the pandemic on other developed and developing countries intensified. Li and Lin (2020) also found that the pandemic affected most Asian countries (especially the Philippines, Japan, Indonesia, Malaysia, and Thailand), the main reason being the disruption of the normal operation of Chinese export companies, as well as foreign trade restrictions and a sharp decline in exports, leading to supply-side disruptions. Importing countries could not find import alternatives in the short term to cope with China's temporary supply shortages, so their related industries were also affected and their exports limited.

According to Cao et al. (2020), although the COVID-19 had a negative impact on agricultural trade in China in the first wave of the pandemic, in the long term, world food supply and demand for China's food imports remained optimistic. Examining Canada, Kerr (2021) found that the Canadian agricultural sector was severely affected by the pandemic and that pre-COVID characteristics are unlikely to return, while Morton (2020) concluded the same for African countries, adding that the food supply chain of these countries was also severely affected by previous pandemics. According to Seleiman (2020), Brazil and China may be the most affected countries because of border closures and restrictive international trade in fertilisers and crop produce. Developing countries and the least developed countries were hit the hardest by the food crisis due to COVID-19 closures, economic recession, food trade restrictions, and rising food inflation. This is so, because they have capacity shortages to detect viruses on a large-scale, poor infrastructure, inadequate medical resources and high food security risk (Erokhin, Gao 2020; Seleiman et al. 2020). This adverse effect is expected to persist in the long term (Workie et al. 2020; Jumadi et al. 2022). In contrast, according to Elleby et al. (2020), owing to the inelastic demand for most agricultural goods and the short duration of the shock, global food consumption will remain largely unchanged.

The two major agricultural- and food-trading partners of the world are the European Union and the United States (representing more than 30% of global trade), while the three major trading partners (in order of the volume of their trade) are the European Union, the United States and China. In the United States, a relatively high proportion of meat is imported; in China, crops, beef and veal come from imports and in the European Union, most crop consumption is supplied by import (Gombkötő 2017). World agricultural and food exports are highly concentrated. Russia, the European Union, the United States, Canada and Ukraine together accounted for 75% of total wheat exports in 2019–2020. The rice market is equally concentrated, with 75% of exports coming from the top five exporters and almost a quarter coming from India alone. Vietnam's global market share alone is 16% (Glauber et al. 2020). Brazil and the United States supply the largest amount of soybeans, while China accounts for more than 60% of the world soybean imports (Gale et al. 2019). In addition, the major global corn exporters are the United States and Brazil, while the major corn importers are Mexico and Japan (Seleiman et al. 2020). The major exporters of cattle are Brazil, India and Australia, while its importers are the United States, Russia, Japan and Italy. The major exporters of poultry meat are the United States, Brazil and the Netherlands, while importers are China, Hong Kong, Japan and Saudi Arabia. The major exporters of aquaculture are China, Thailand and Indonesia, and importers are Japan, the Netherlands, Italy and the United States.

Materials and methods

The study was based on the statistical database of the International Trade Centre (ITC) and its aim was not to examine long-term characteristics, but the effects of the COVID-19 pandemic and its individual waves; therefore, the data were collected mainly from two years before the pandemic (2018 and 2019) and two years of the pandemic (2020 and 2021), as well as from the first half of 2022. Owing to the short period, both quarterly and monthly data were considered. The main objective of the study was to examine the regional impact of COVID-19 on agricultural and food commodities, so it focuses specifically on countries. Since the mapping of agricultural and food trade globally is beyond the scope of this study, only the world's largest trading countries, the relationships between them, similarities and differences were investigated. In

terms of global trade, it is enough to look at only either exports or imports, as the two are in balance. When the trade between countries is examined, it is important to distinguish between exports and imports. Quantitative data are the most appropriate for analysing trade, but they are not available in all databases, so value data were used instead. As only a few consecutive years were taken into account, the purchasing power of money has presumably declined to a negligible extent, so no adjustment is needed to show a change in trade. The basic analysis was conducted by simple statistical methods (absolute deviation, mean, ratios [dynamic, distribution], matrix, graphical representation), and the autocorrelation method was used to detect more complex relationships.

Results

With regard to the global exports of processed food and agro-based products, the export (and the import) volume gradually increased from 2010 to 2016 by an average of 3–5% per year. From 2016 to 2017, there was a large increase (47%), and then from 2018, it started to decrease. However, in 2019, it still exceeded the level of 2016, but fell back to the level of 2010 in 2020. This is probably due to the impact of the pandemic for the reasons stated earlier, since in 2021, when restrictions and transport were eased, it started to grow again to a small extent. However, other factors may have contributed to the decline in global trade in food products; for instance, African swine fever (in the case of pork), labour shortages and health

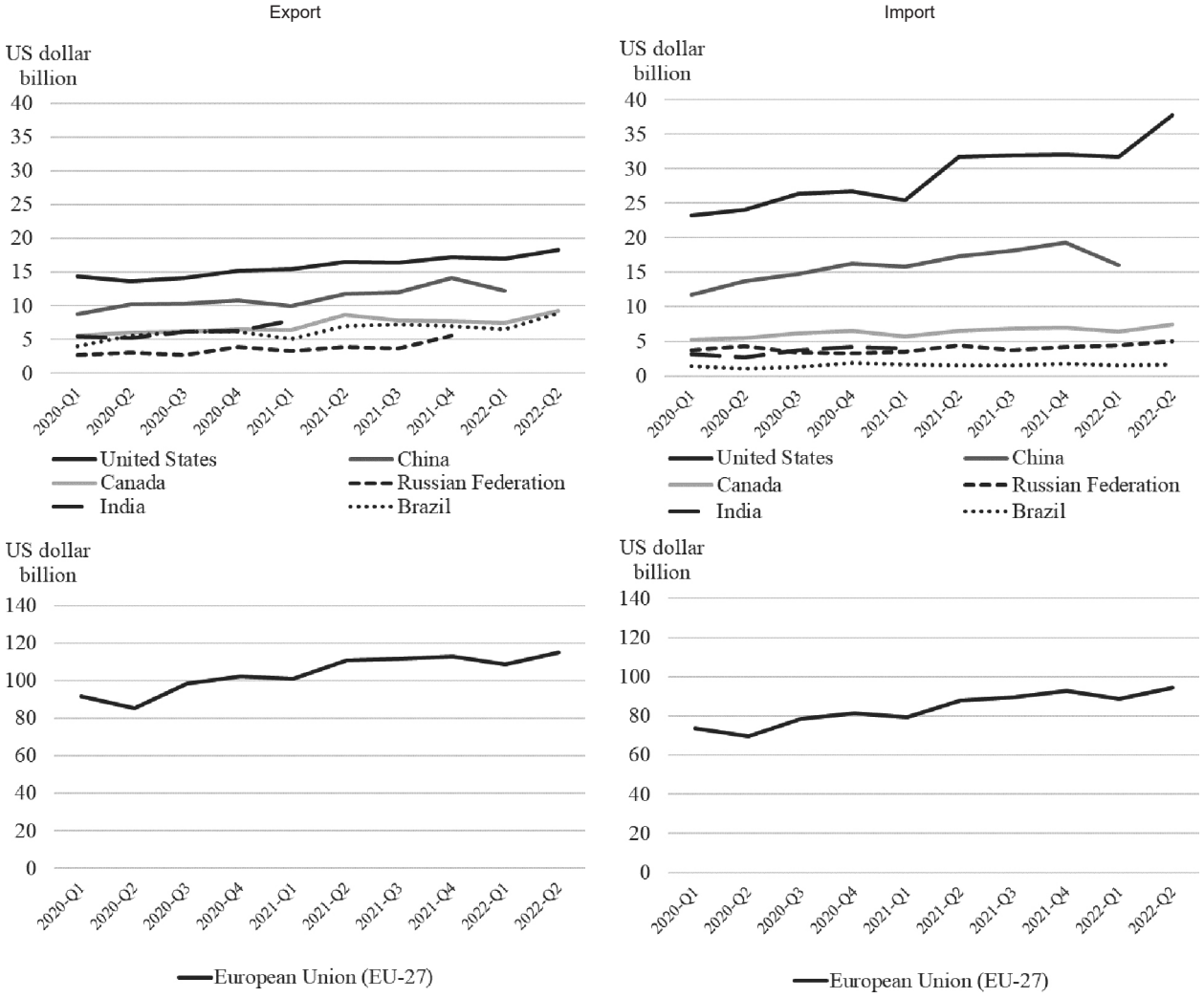

Fig. 1. Trade value of processed food and agro-based products in the main foreign trade countries from the first quarter of 2020 to the second quarter of 2022.
ITC – International Trade Centre.
Source: own study based on ITC Trade Map data.

measures (in the case of fish and fish products) and a generally highly volatile sales nature (in the case of dairy products and fruit).

The top 10 agricultural and food exporters (in descending order) are the European Union, the United States, Brazil, China, Canada, Indonesia, India, Thailand, Australia, Argentina, Russia, Malaysia and Mexico, while the top 10 importers are the European Union, China, the United States, Japan, Russia, Canada, South Korea, Mexico, Hong Kong, India, Saudi Arabia and Indonesia (Gombkötő 2017). On the basis of these data, the study examined agricultural and food trade in the European Union, the United States, China, India, Canada, Russia, and Brazil. The European Union can be studied as a single region, since the foreign trade characteristics of the post-communist economies have become similar to those of the EU-15 (Cieslik et al. 2016). For each year, this study used EU-27 (2020) data, so by removing UK trade data from previous years, the data became more comparable. Data on exports and imports of processed food and agro-based products by country are only available in value terms, so the impact of the pandemic is illustrated with these. As the main goal was to study the impact of the pandemic and its individual waves, the data were plotted from the first quarter of 2020, to the second quarter of 2022 (Fig. 1). For India's trade, data were available only until the first quarter of 2021, while for Russia's trade, data were available until the fourth quarter of 2021. As the EU-27 has the largest trade in the world, and its value is six times that of the second largest, the United States, and while subsequent countries show only a two- to three-fold difference, the EU-27 is represented in a separate graph with an individual scale, so that orders of magnitude can be as close as possible to each other. Thus, the trade data for each quarter can be seen as clearly as possible in Figure 1.

Figure 1 shows that the trend in processed food and agro-based products trade did not follow the same pattern in the countries studied, which is also due to the fact that each wave of the pandemic reached different countries at different times. During the first wave of the pandemic in the first quarter of 2020, both exports and imports experienced a decline in the European Union, the United States and also in China, because of the temporary closure of borders and other epidemiological measures. The same decline in Russia occurred only in the third quarter of the same year, when the second wave of the pandemic began. In the third wave of the pandemic (in the first quarter of 2021), a decline was also observed in the United States, Canada, Brazil and Russia, but its extent did not reach the decline experienced in the first wave, as the products could flow relatively more freely. Thereafter, growth was experienced in all the countries examined except

Table 1. Trade in processed food and agro-based products between major trading partner countries in 2019 and 2020.

2019	Import (Million US dollars)							
Export	Country/ Region	European Union	United States	China	Canada	Russian Federation	India	Brazil
	European Union	–	25,840	10,375	3,566	5,739	632	1,491
	United States	3,880	–	2,093	15,335	188	229	329
	China	3,745	3,954	–	693	824	207	198
	Canada	751	18,163	2,026	–	53	14	44
	Russian Federation	1,550	43	1,283	10	–	164	9
	India	1,842	3,868	1,570	329	187	–	47
	Brazil	5,383	1,520	768	188	129	521	–
2020	Import							
Export	Country/ Region	European Union	United States	China	Canada	Russian Federation	India	Brazil
	European Union	–	24,982	10,573	3,711	5,610	640	1,575
	United States	3,664	–	2,536	14,885	184	209	374
	China	3,590	4,106	–	672	756	146	198
	Canada	795	18,561	2,212	–	46	20	35
	Russian Federation	1,732	81	1,815	12	–	365	23
	India	1,790	3,954	1,543	397	189	–	67
	Brazil	4,793	1,546	1,681	322	89	754	–

Source: own study based on ITC Trade Map data.

for China. In the first quarter of 2022, a decline in processed food and agro-based products trade was observed in all the countries studied (in the European Union and China to a greater extent), but this was no longer related to the COVID-19 pandemic, but rather to the Russian-Ukrainian conflict that began in February 2022. Thus, subsequent waves of the pandemic no longer affected

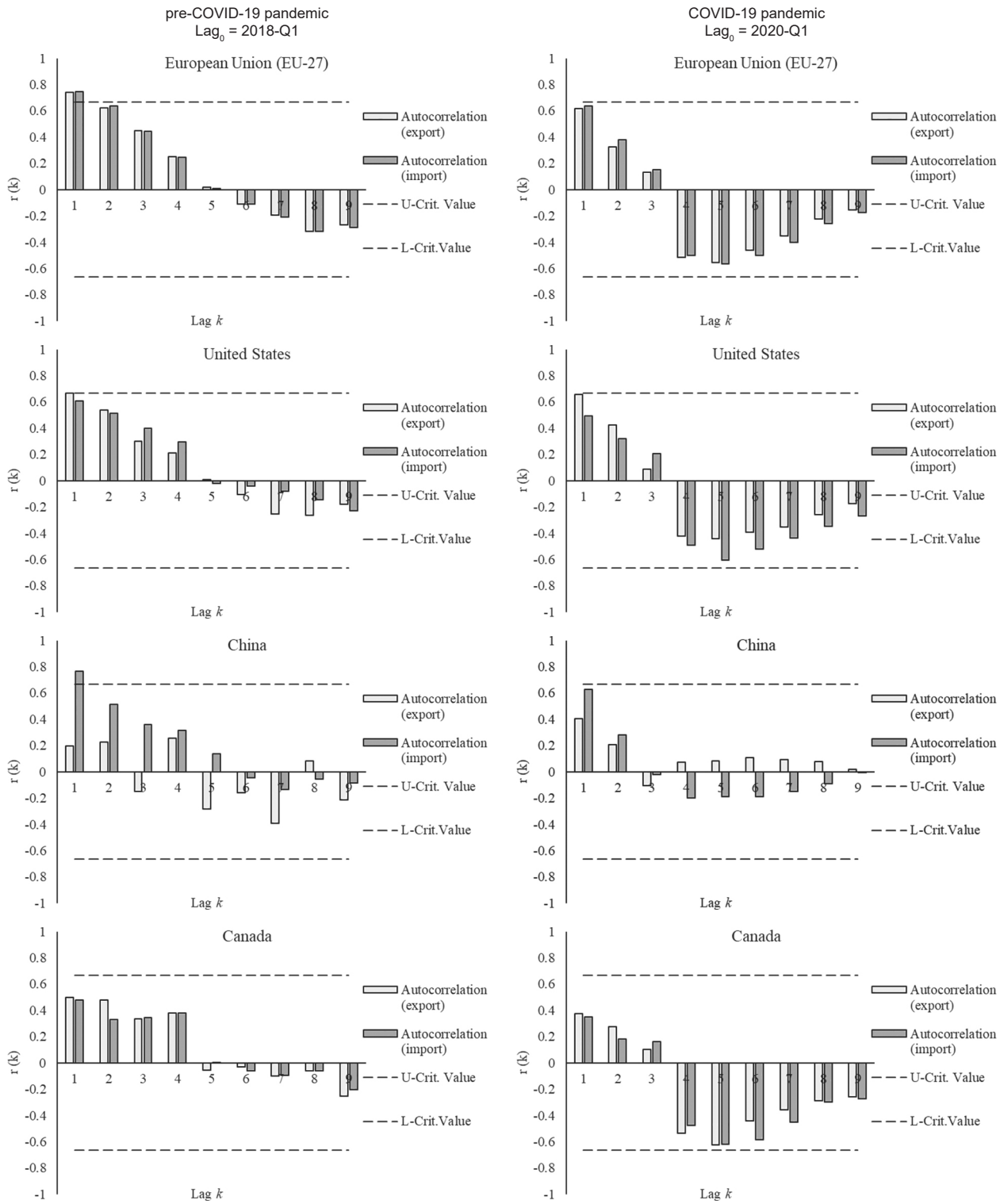

Fig. 2. Autocorrelation.
ITC – International Trade Centre.
Source: own study based on ITC Trade Map data.

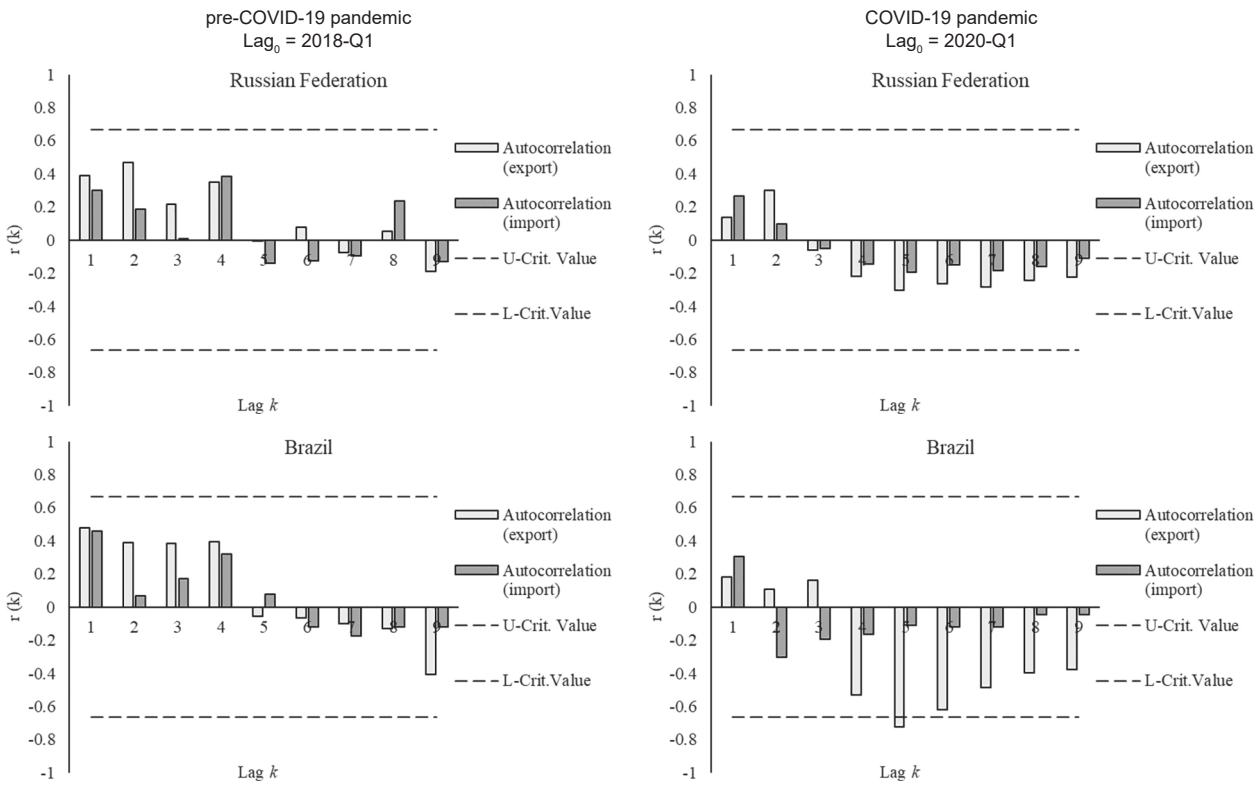

Fig. 2 continued. Autocorrelation.
ITC – International Trade Centre.
Source: own study based on ITC Trade Map data.

trade in processed food and agro-based products as countries were prepared for them.

The product turnover between the major trading partner countries was examined in the year immediately preceding the pandemic (2019) and in the first year of the pandemic (2020) (Table 1) given the available value data. For two consecutive years, the product turnover was still only comparable without bias. The highlighted data refer to those trading connections where the product turnover shows the highest change from 2019 to 2020 in a relative sense. Trade in processed food and agro-based products between countries did not significantly change. Two major changes can be observed; on the one hand, the volume of products exported from Russia to the United States, India and Brazil doubled or tripled, and, on the other hand, the volume of products exported from Brazil to China more than doubled. From Russia to the United States, it was mainly food, frozen products (e.g. frozen crab, fruit, vegetables, and ice cream), cooking oil, wheat, flour, prepared or preserved fish, convenience food, yeast, dry pasta, potatoes, vegetables and fruits prepared or preserved, canned goods, and tobacco. However, it can be observed that imports of luxury goods (e.g. caviar, cocoa powder) to the United States decreased. It is also clear from the type of products that the demand for prepared or preserved food and staple foods increased in line with changes in consumer habits, while there was no demand for luxury goods due to an increase in time spent at home and a decline in GDP (gross domestic product) as well as in people's incomes. India mainly imported cooking oil and yeast, while Brazil imported malt, yeast and tobacco from Russia, i.e. staple foods for which most countries introduced export restrictions; therefore, supply temporarily declined globally. The increase in exports from Brazil to China was clearly due to meat (pork, beef) products arising from the Chinese pig shortage, but the value of yeast and tobacco imports also increased. However, in addition to these products, there was a decrease in most other products as well.

The correlation between agricultural trade during certain periods of the COVID-19 pandemic was examined using autocorrelation. The autocorrelation characteristics of the above period

was compared with the autocorrelation characteristics of the period before the pandemic. As no data was available for India from the first quarter of 2021, autocorrelation was calculated for the world's six largest trading countries (the EU, USA, China, Canada, the Russian Federation and Brazil) (Fig. 2).

The results for each country and region show that the exports and imports of processed food and agro-based products have almost the same autocorrelation; therefore, in the following part they will be assessed as merged (trade). It can also be observed for each country that starting approximately from the fifth period, the direction (sign) of the correlation changes to the contrary (from positive to negative). However, this cannot be attributed to the epidemic, since the negative values in the period before the pandemic represent 2019, the year prior to it. The correlation coefficient for all regions fluctuates between lower and upper critical values (−0.67; 0.67), that is, theoretically, there is no significant correlation between the trade of each period; nevertheless, in some regions, in some periods, a moderately strong (0.5–0.6) correlation can be observed.

The six examined regions can be divided into three groups based on the common characteristics of their autocorrelation. The autocorrelation regarding the trade of the European Union and the United States follows a very similar pattern. In both areas, before the COVID-19 pandemic, the initial periods show a moderately strong correlation, which, however, weakens significantly from periods third and fourth and becomes weaker and weaker moving away from the initial period. At the same time, during the pandemic period, after the initial more rapid weakening, a strong correlation with the first period can be observed from the fourth period (in this case, the fourth quarter of 2020). This means that in the pre-pandemic period, trade in processed food and agro-based products in these countries was not or was only slightly dependent on the trade of earlier periods, while the pandemic significantly affected subsequent trade patterns. In China and in the Russian Federation, no correlation can be detected, either before or during the pandemic, which means that the pandemic has not had any effect on trade in food and agro-based products in these countries.

The third group of the regions includes Canada and Brazil, where in the pre-pandemic period, there was no correlation between trade in food and agro-based products in each year. From the fourth quarter of the first year of the pandemic (2020), a relatively strong negative correlation can be observed. In Canada, both in terms of exports and imports, and in Brazil, only the export value correlated with the export values of the previous periods. Thus, in Canada—similarly to the European Union and the United States—both the export and import of food and agro-based products were affected by the pandemic, while in Brazil, it was only the export.

Conclusion

The COVID-19 pandemic has affected trade in agricultural and food products. So, Kerr's (2020) study can be supported by the fact that food and agro-based products trade decreased at that time. Also, Beckman and Countryman (2021) observed an increase of 2.3%, while Poudel et al. (2020) estimated a decrease of 13–22% in trade in agricultural products. Li and Lin (2021) found that trade fell to the greatest extent in the United States (by 23%), followed by China (13%) and then the European Union (10%). Global food trade fell significantly during the first period of the pandemic, in the first and second quarters of 2020, the main reason being the government measures in response to the outbreak of the pandemic (border closures and import restrictions), as can be seen in ATPC (2020) and ITC (2020) data, and only to a lesser extent because of its health implications (e.g. illness and absence from work). Border closures and import restrictions caused shortages of goods in some countries for a short temporary period, just as shown in the study of Espitia et al. (2020) pointing to the fact that a more extended closure would have severe consequences for the economy. So, it can be stated that this period was extremely short (from two to three weeks) as world trade reacted quickly and the products were provided by other partners (e.g. Russia). In addition to these import measures, which were reported to the WTO, countries adopted unilateral border controls by refusing entry to certain imports (Chen, Mao 2020).

Therefore, the global supply was satisfactory, as it was distributed among the countries. However, in the case of some food products (pork, fish and fish products, dairy products and fruit), the decline is not due to the pandemic and closures but to factors such as African swine fever, labour shortages and health measures and a generally highly volatile sales nature.

The pandemic reached individual regions and countries at different times, and the governments' measures were also different. For this reason, it affected trade (including trade in agricultural products) between countries at different times and to different extents. The largest decline in trade occurred in the United States. However, because of its significant foreign trade activity, it also spread to partner countries (especially the European Union and China). China is a very important country also in Asia. Li and Lin (2021) also established in their study that the pandemic affected most Asian countries (especially the Philippines, Japan, Indonesia, Malaysia, and Thailand) because they were the leading importers of Chinese products. Consequently, there was a supply-side disruption. According to Seleiman et al. (2020), Brazil and China also affect indirectly the agriculture of different countries because they export most fertilisers and crop production. Food trade stagnated in the initial period of the pandemic (even then, only because of temporary border closures) and later recovered relatively, but fluctuated slightly in subsequent waves (but not to the same extent as in the first period).

In the first quarter of 2022, a decline in processed food and agro-based products trade was observed in all the countries examined (in the European Union and China to a greater extent). However, this is no longer related to the COVID-19 pandemic, but rather to the Russian-Ukrainian conflict that began in February 2022.

The six examined regions can be divided into three groups based on the common characteristics of their autocorrelation. The first group consists of the European Union and the United States, where, in the pre-pandemic period, trade in processed food and agro-based products was not or was only slightly dependent on the trade of the earlier periods. At the same time, the pandemic significantly affected subsequent trade patterns. In contrast, Kerr (2021) and Morton (2020) found that Canadian and African agricultural sectors were also severely affected by the pandemic. The second group includes China and the Russian Federation, where the pandemic has not affected trade in food and agro-based products. Canada and Brazil constitute the third group of countries where the pandemic did not affect food and agro-based products trade in the pre-pandemic period but had the opposite effect during the pandemic.

Consequently, despite localisation efforts, the institution of international trade cannot be dissolved entirely as many countries are vulnerable; however, in the future, countries must also prepare locally for similar unexpected shocks.

While this study aims to offer a comprehensive understanding of the impact of the COVID-19 pandemic on international trade in agro-based commodities, it is crucial to acknowledge certain limitations that may influence the interpretation of the findings. Firstly, the temporal scope of our analysis is constrained to specific periods during the pandemic. Given the dynamic nature of the situation, subsequent developments may have influenced trade patterns differently, highlighting the need for caution in drawing absolute conclusions. Moreover, the reliance on available data sources introduces a layer of complexity. Variations in data accuracy and reporting mechanisms among different countries could introduce nuances in the analysis, potentially affecting the precision of the insights. Additionally, external factors beyond the scope of the study, such as geopolitical events or changes in global economic policies, may have impacted agro-based commodity trade in ways that are not explicitly addressed in this research.

When looking forward, there are promising avenues for future research in this domain. A longitudinal exploration of the long-term repercussions of the COVID-19 pandemic on international trade in agro-based commodities could offer insights into recovery patterns and sustained changes in trade dynamics. A deeper dive into regional variations beyond the major trading nations covered in this study would contribute to a more nuanced understanding of the diverse impacts of the pandemic on agro-based commodity trade. Furthermore, investigating the effectiveness of specific policy interventions in mitigating the challenges posed by the pandemic on agro-based commodity trade presents an opportunity for fruitful research. Understanding the resilience

of global agro-based commodity supply chains in the face of unexpected disruptions, such as pandemics, and identifying strategies for enhanced resilience could be another valuable avenue for exploration.

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