4. THE COMPETITIVE ADVANTAGE OF FOREIGN TRADE WITH AGRI-FOOD PRODUCTS

Tudorel ANDREI[1]
Bogdan OANCEA[2]
Andreea MIRICĂ[3]
Lucian Claudiu ANGHEL[4]

Abstract

In this paper, we make a comparative analysis of the competitive advantages of the foreign trade with agri-food products for four East European countries - Romania, Bulgaria, Hungary, and Poland - between 2000 and 2020, dividing this period into two subperiods relative to the year of EU accession. Using the Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) indicators we built an econometric model to assess the extent to which the distribution of RSCA values changes over time as compared to a reference year, in our case 2000. We found that for all four countries, for each year from 2001 to 2020, the distribution of RSCA values has changed significantly over time. This shows that some of the product categories that initially had low RSCA indicator values increased significantly over time, but at the same time product categories that initially had a high RSCA value decreased over time. Therefore, the accession to the EU for each of the four countries has generated important changes in relation to the competitive advantage/disadvantage of the agri-food products.

Keywords: foreign trade, agri-food products, EU accession, competitive advantage of exports and imports

JEL Classification: Q17, C01

[1] *The Bucharest University of Economic Studies, Economic Cybernetics, Statistics and Informatics Faculty, Department of Statistics and Econometrics, Bucharest Romania. E-mail: andrei.tudorel@csie.ase.ro.*

[2] *University of Bucharest, Faculty of Business and Administration, Department of Applied Economics and Quantitative Analysis, E-mail: bogdan.oancea@faa.unibuc.ro , corresponding author.*

[3] *The Bucharest University of Economic Studies, Economic Cybernetics, Statistics and Informatics Faculty, Department of Statistics and Econometrics, Bucharest Romania. E-mail: andreea.mirica@csie.ase.ro.*

[4] *Faculty of Management within The National University of Political Studies and Public Administration, Bucharest, Romania. E-mail: lucian.anghel@facultateademanagement.ro.*

1. Introduction

Romania's foreign trade with agri-food products has undergone important changes with the transition from a centrally-planned economy to a market economy. While during the centrally-planned economy, the export of agricultural products was an important source for securing the surplus of the external trade balance, even at the cost of declining domestic supply, with the political changes of December 1989 amid the need to meet the growing demand for agri-food products, regardless of the source, from own production or imports, the trade balance with agri-food products was in deficit for most of the period 1990-2020. The country's accession to the EU on 1st of January 2007 brought important changes for the foreign trade with agri-food products. The effects of accession were manifested both by the increase in the exports and imports of these product categories, and also by significant changes in the structure of exports and imports in the categories of agri-food products and in the economic areas. These are also immediate effects that have been registered by all Eastern European countries that have joined the European Community (Svobodová, 2014; Smutka, 2016). In Romania, as in the case of the other Eastern European countries that joined the EU, the large increase in the exports of agri-food products due to the natural access to a large free market was accompanied by a massive increase in the imports of agri-food products, and implicitly by an increase in the trade deficit with agri-food products (Bojnec and Ferto, 2009).

The accession of the East European countries to the single market has also allowed access to European funds for modernization of agricultural production and thus for increasing the export capacity of agri-food products. Equally, significant changes have taken place during the pre-accession process in agricultural plant and animal production due to the need to adapt to Community-level regulations and access the pre-accession funds. Under these conditions, Romania has considerably increased its production of plant-based products since the first years after accession, greatly increasing exports of these categories of products. However, in a relatively short period of time, Romania did not have the capacity to overcome all the problems in agriculture in order to increase both the agricultural production of vegetable and animal origin and the capacity to process agricultural raw materials inside the country (Albu, 2017).

The change in the volume of imports, exports and trade balance with agri-food products in Romania is largely dependent on domestic demand and developments in the agricultural production and on the ability to capitalize on its natural potential (Rusali, 2019).

Under the conditions of the global economy, the goods that are subject of international trade are the result of interaction between economic operators from different countries. Only a small share of the exports of goods from a country is the exclusive result of the production of economic agents in a country, the largest part is the result of the interaction between local and foreign economic agents (Zaman, 2020). Therefore, it is important for a country to join the global value chain with as many local economic agents as possible to participate as much as possible to the creation of value added of exported products. The current philosophy of developing the global economy does not help an economic zone to impose economic restrictions to protect its own products as it will lead to economic losses and cost increases (Xi He, 2021).

2. The Econometric Model and the Data

a. The Empirical Methodology

This study assesses the competitive advantage / disadvantage of Romania's agri-food exports before and after Romania's accession to the EU. To enlarge the assessment of this aspect, similar indicators were estimated for Bulgaria (a country that joined the EU at the same time as Romania) and two other countries that joined the EU in 2004 (Hungary and Poland). We computed the Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) to evaluate the competitive advantage / disadvantage of the agri-food products subject to export.

Similar studies use various statistical indicators to assess the competitive advantage. Among the most common found indicators in the literature is the Revealed Comparative Advantage (RCA), which was introduced in the economic literature by Balassa (1965). This indicator assesses the competitive advantage of country *i* for a product category *j* and it is calculated using two categories of information:

- Firstly, at the country level for which the competitive advantage is assessed we need the export volume for a product category (x_{ij}) and the total volume of exports for the product group including the product category for which the indicator is calculated, $x_{i.} = \sum_{j=1}^{n} x_{ij}$, where: *n* represents the number of product categories subject to foreign trade activity which includes the category under consideration;
- Secondly, at the level of the economic zone where the country exports products of the category under consideration, we need the volume of exports of products of category *j* to the countries of this region (x_{rj}) and the total volume of exports for the product categories which includes the category of products subject to evaluation ($x_{r.} = \sum_{j=1}^{n} x_{rj}$).

The Revealed Comparative Advantage (RCA) is determined by comparing the structure of exports of the country for which the indicator $(x_{ij}/x_{i.})$ is calculated with the structure of exports at the level of the economic zone where the country exports $(x_{rj}/x_{r.})$:

$$RCA_{ij} = \frac{\frac{x_{ij}}{x_{i.}}}{\frac{x_{rj}}{x_{r.}}} \quad (1)$$

A second indicator used in the literature to assess the competitive advantage of exporting a product category is Revealed Symmetric Comparative Advantage (RSCA) calculated by RCA normalization:

$$RSCA_{ij} = \frac{RCA_{ij}-1}{RCA_{ij}+1} \quad (2)$$

If the values of RCA are in the range $[0, \infty)$, in the case of RSCA the values are in the $[-1,1]$ range. Sub-unit values for RCA imply RSCA values in the range $[-1,0]$, which shows that this country has no competitive advantage in exporting the product category *j*. Conversely, if the RCA has a supra-unit value, then the values of the RSCA fall within the range [0,1], which is equivalent to saying that the country has a competitive advantage in exporting the product category under consideration.

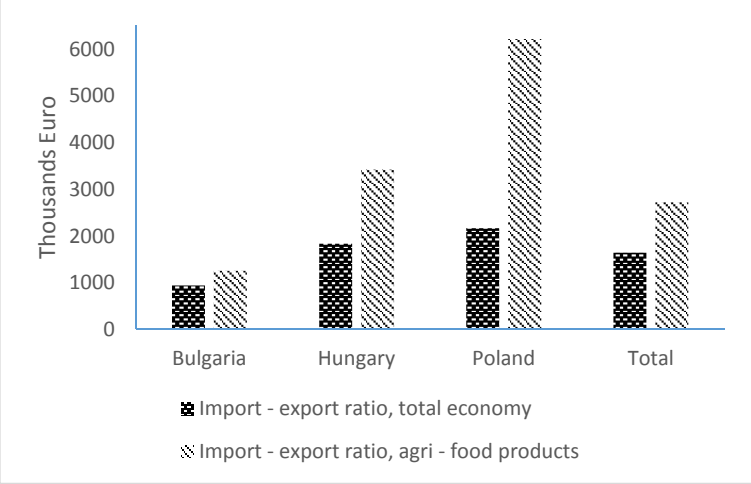
b. The Data Set

For the evaluation of the two indicators, RCA and RSCA, we used the data on exports related to agri-food products for Romania, Bulgaria, Hungary, Poland and the European Union, from

2000 to 2020 provided by the National Institute of Statistics of Romania (2017, 2018, 2020). The data are detailed at four-digit level and SH4 disaggregation and they are expressed in thousands of euros. For each year of the considered period, and for each country 196 values are available, corresponding to the categories of agri-food products from the SH4 classification. Appendix 1 presents the categories of agri-food products (SH2 classification), and within each category are subcategories of agri-food products (SH4 classification). Romania registered a trade deficit in the transition period in relation to all three countries (Bulgaria, Hungary and Poland) in the foreign trade with agri-food products. Figure 1 shows the major imbalances that exist between imports and exports of agri-food products, respectively goods between Romania and the three countries. The most pronounced imbalance is registered in the case of Poland, mainly due to a reduced volume of Romania's agri-food exports to this country.

Figure 1

A Comparison of the Ratio of Imports to Exports of Goods / Agri-food Products for Romania, Bulgaria, Hungary, and Poland



c. The Econometric Model for the Analysis of Changes from 2000 to 2020

The regression model that evaluates the RSCA for each year and each country separately, from the period 2001 - 2020 according to the values of the indicator for 2000 is:

$$RSCA_{ij,t} = \alpha_t + \beta_t RSCA_{ij,1} + \varepsilon_{ij,t} t = 2, \dots, \mathrm{T} \quad (3)$$

where: $RSCA_{ij,t}$ is the comparative advantage of country *i* for product *j* for year t, t = 1, ..., T and $\varepsilon_{ij,t}$ is a white noise error term.

The following equation is obtained from the calculation of the slope of regression line of the simple linear regression model presented above. It allows us to evaluate the extent to which important changes have occurred in the specialization of a country's agri-food export specialization:

$$\frac{var(RSCA_{ij,t})}{var(RSCA_{ij,1})} = \frac{\hat{\beta}^2}{R^2} \quad (4)$$

where: $R^2$is the coefficient of determination obtained by estimating the parameters of the regression model (3).

The regression model (3) assesses the extent to which the distribution of RSCA values changes over time as compared to a reference year, in our case as compared to 2000 (Sanidas, 2011). If $\beta = 1$, then the two distributions did not change significantly between the two time periods. However, if $\beta > 1$, then, during this period, there is a specialization of the country in the export of certain products in the economic zone to which we refer. Conversely, if $0 < \beta < 1$, then the RSCA distribution changes significantly over time: categories of products that initially had low RSCA values increase over time, while product categories that initially had a high value for RSCA decrease over time. If $\beta < 0$ there are significant changes in the hierarchy of product categories in relation to the RSCA values.

3. The Results

a. Characteristics of RSCA Distributions

We computed the values of the RSCA using the SH4 classification of agri-food products subject to foreign trade activity for the pre-accession and post-accession periods. For the two distributions (denoted by X23 for the pre-accession period and by X24 for the post-accession period) defined at the level of each of the four countries under consideration, we computed the statistical indicators presented in Table 1. The Jarque-Bera (JB) test statistics calculated to determine whether the distributions follow the characteristics of a normal distribution show that in the case of the four countries the distributions of the RSCA are not normally distributed, for a significance level of 5% in the pre-accession or post-accession period. In the case of Romania and Bulgaria, the distributions of RSCA in the pre-accession period are much more pronounced asymmetrical than in the case of Hungary and Poland. In the case of Romania, Figure 1 shows that for the trade relationship with the EU countries, for most product categories, our country has a chronic competitive disadvantage. In fact, Romania and Bulgaria differ significantly from Hungary and Poland in terms of characteristics of the RSCA data series, both in the pre-accession and post-accession periods. These results are presented in Table 1 and Figure 2.

Table 1

Statistics for the RSCA Data Series for the Pre-accession and Post-accession Periods

	Romania		Bulgaria		Hungary		Poland	
	X23	X24	X23	X24	X23	X24	X23	X24
Mean	-0.49	-0.42	-0.51	-0.41	-0.32	-0.29	-0.29	-0.30
Median	-0.80	-0.58	-0.83	-0.57	-0.66	-0.63	-0.34	-0.30
Std. Dev.	0.61	0.52	0.62	0.52	0.75	0.74	0.53	0.48
Skewness	1.10	0.84	1.09	0.82	0.64	0.59	0.31	0.18
Kurtosis	2.83	2.67	2.69	2.54	1.76	1.72	1.97	1.91
Jarque-Bera	39.78	23.78	39.85	23.86	25.89	24.70	11.77	10.68
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	196	196	196	196	196	196	196	196

Source: Calculated by the authors.

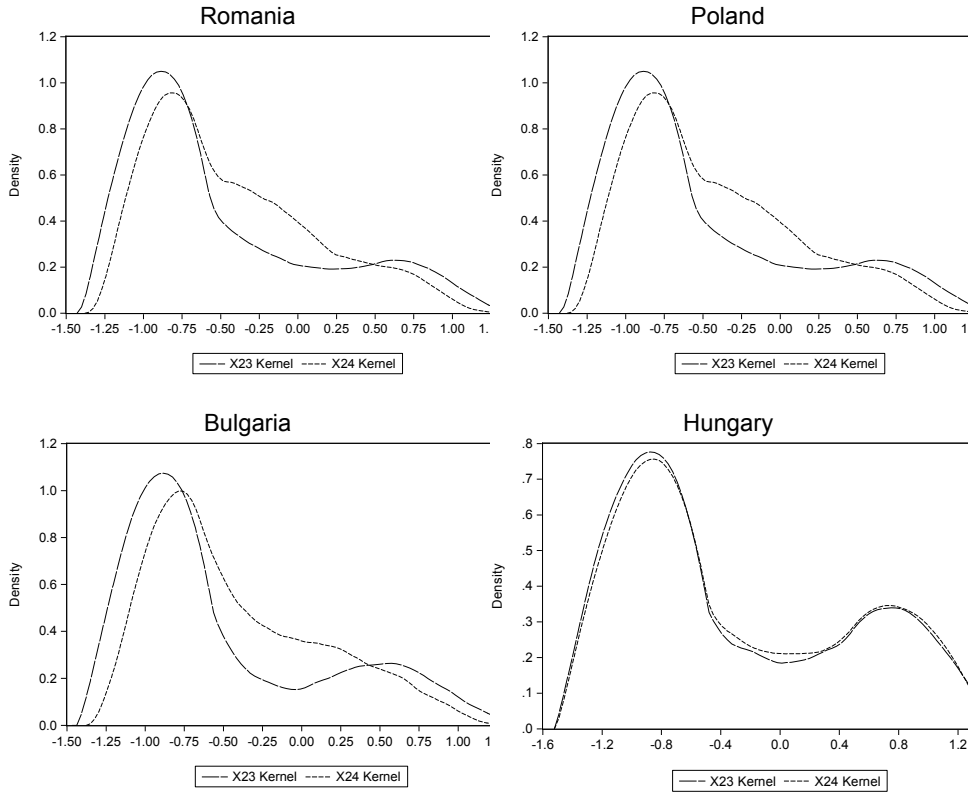
The calculation of the Pearson correlation coefficient between RSCA in the pre-accession and in the post-accession period shows a high dependence between the two data series in

the case of the four countries. The correlation is much stronger in the case of Hungary and Poland than in the case of Romania and Bulgaria. The values recorded for the four countries and the values of the t-Student statistics are: Romania 0.68 (13.0), Bulgaria 0.64 (11.7), Hungary 0.87 (24.9) and Poland 0.77 (17.01).

In the case of the four countries, a limited number of RSCA values are equal to 1 or -1. Moreover, in all cases the number of values equal to -1 is lower in the post-accession period than in the pre-accession period. To estimate the parameters of the regression models, those pairs of values for which at least one of the RCSA values is equal to -1 were eliminated.

Figure 2

Distribution of RSCA Values Calculated Based on Total Exports of Product Groups by SH4 Classification Before and After Accession to the EU



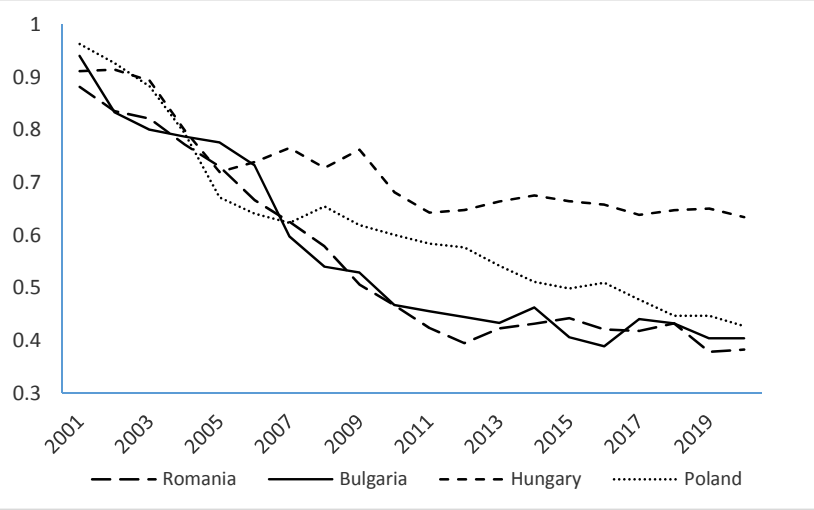
Source: Calculated by the authors

b. Characteristics of the Regression Model Parameters

The regression model (3) is estimated for each year from 2001 to 2020 for each of the four countries included in the study. The values of the regression coefficients for each country are presented in Figure 3.

Figure 3

The Values of the Regression Coefficients of Ecuation Regression (3) Estimates for Each Country



Source: Calculated by the authors.

One may notice a continuously decrease in these coefficients during the analyzed period, with Romania and Bulgaria showing the highest decrease. The values being sub-unitary, this means that the RSCA distribution changes significantly over time: categories of products that initially had low RSCA values increase over time, while product categories that initially had a high value for RSCA decreases over time for all for countries. We customized the econometric model (3) for the case the dependence of the RSCA values in the post-accession period is analyzed according to the values registered during the pre-accession period:

$$RSCA_{ij,II} = \alpha_t + \beta_t RSCA_{ij,I} + \varepsilon_{ij} \quad (5)$$

The values of the RSCA in model (5) are calculated for each country separately, for the product categories from the SH4 classification for the two subperiods or based on the relations (1) and (2) using the cumulated values at the level of each subperiod for each term. For the pre-accession and post-accession periods, the total values were calculated by summing up the annual export volume. For Romania and Bulgaria, the two subperiods were 2000 - 2006 for pre-accession and 2007 - 2020 for post-accession. In the case of Hungary and Poland, the two subperiods were 2000 - 2003, and 2004 – 2020, respectively. Using these data series obtained for each country and the EU, we computed the values of the RSCA indicator. The two RSCA data sets, for each country, were used to estimate the regression model parameters (5) using OLS and quantile regression techniques.

Since the distributions of the two data series used to estimate the parameters of the regression model considered are asymmetrical, especially in the case of Romania and Bulgaria, the quantile method was used to estimate the parameters, considering three important cases. The results allow us to establish whether the RSCA values from the pre-

accession period (the explanatory variable from the regression model) has only an impact on the average of the RSCA variable values from the post-accession period (the dependent variable) or it has the impact on the variance of RSCA values from the post-accession period, too. The results obtained from estimating the parameters of the regression model (5) are presented in Table 2. They show that in the case of Romania and Bulgaria, the RSCA pre-accession values have an important impact on both the average and the variability of the RSCA values, while in the case of Hungary and Poland, the impact is identified only at the level of variability of the RSCA values in the post-accession period.

Table 2

The Coefficients of the Regression Model (5)

		$\hat{\alpha}$	$\hat{\beta}$	R^2	$\hat{\beta}/\mathrm{R}$
Romania	OLS	-0.140 (0.0351)	0.580 (0.0446)	0.47	0.85
	Quantile (0.25)	-0.425 (0.0400)	0.540 (0.0682)	0.23	1.13
	Quantile (0.50)	-0.117 (0.0495)	0.739 (0.0541)	0.32	1.31
	Quantile (0.75)	-0.129 (0.0430)	0.681 (0.0573)	0.32	1.20
Bulgaria	OLS	-0.142 (0.0370)	0.539 (0.0461)	0.41	0.84
	Quantile (0.25)	-0.489 (0.1139)	0.447 (0.1315)	0.19	1.03
	Quantile (0.50)	-0.137 (0.0464)	0.708 (0.0532)	0.29	1.3
	Quantile (0.75)	0.117 (0.0527)	0.621 (0.0671)	0.28	1.2
Hungary	OLS	-0.016 (0.0283)	0.867 (0.0348)	0.76	0.99
	Quantile (0.25)	-0.228 (0.083)	0.772 (0.0897)	0.47	1.13
	Quantile (0.50)	-0.015 (0.0149)	0.982 (0.0133)	0.65	1.22
	Quantile (0.75)	0.098 (0.0398)	0.939 (0.0461)	0.60	1.21
Poland	OLS	-0.091 (0.0249)	0.702 (0.0413)	0.60	0.91
	Quantile (0.25)	-0.288 (0.0361)	0.707 (0.0434)	0.42	1.10
	Quantile (0.50)	-0.092 (0.0308)	0.817 (0.0399)	0.44	1.23
	Quantile (0.75)	0.099 (0.0303)	0.689 (0.0718)	0.36	1.15

Source: Calculated by the authors.

4. Conclusions

This paper analyzes the impact on foreign trade with agri-food products of the accession of the four East European countries (Romania, Bulgaria, Hungary and Poland) to the EU using RCA and RSCA indices. We estimated the parameters of a regression model established on the basis of the linear relationship between the RSCA values for each year from 2001 to 2020 in relation to the RSCA indicator values for the base year 2000. Firstly, starting from the results obtained from the estimates we find that, in the case of the four countries, for each of the twenty years, the linear relationship was validated, both the slope of the regression line and the free term. Secondly, there is a great similarity between the evolution of the estimators of the two parameters of the regression line in the case of Romania and Bulgaria. Thirdly, we find that for all four countries, for each year from 2001 to 2020, the estimated parameters are subunitary, which shows that the distribution of RSCA values has changed significantly over time. This shows that some of the product categories that initially had low RSCA indicator values increased significantly over time, but at the same time product categories that initially had a high RSCA value decreased over time. Therefore, the accession to the EU for each of the four countries has generated important changes in relation to the competitive advantage/disadvantage of the agri-food products.

Acknowledgment

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNDS-UEFISCDI, project number PN-III-P1-ID-TE-2019-1188.

References

Albu L.L., Lupu R., Călin A-C. and Popovici O-C., 2018. The impact of Romania's accession to the European Union on the economy Romanian. Sector analysis (industry, agriculture, services, etc. (in Romanian). *European Institute of Romania*, Available at: <http://ier.gov.ro/wp-content/uploads/2018/10/SPOS_2017_Studiul-1_FINAL.pdf> [Accessed 15.12.2021].

Balassa, B., 1965. Trade Liberalization and Revealed Comparative Advantage. *The Manchester School of Economic and Social Studies*, 33, pp.99-123. https://doi.org/10.1111/j.1467-9957.1965.tb00050.x.

Bojnec, Š. and Fertő I., 2009. Agro-food trade competitiveness of Central European and Balkan countries. *Food Policy*, 34(5), pp. 417-425. https://doi.org/10.1016/j.foodpol.2009.01.003.

National Institute of Statistics of Romania, 2017. Structural Survey in Agriculture – 2016 (in Romanian). Bucharest.

National Institute of Statistics of Romania, 2018. Typology and economic size of agricultural holdings: 2016 (in Romanian). Bucharest.

National Institute of Statistics of Romania, 2020. Statistical Yearbook. Bucharest.

Rusali, M., 2019. Assessments on Development Disparities in The Food Industry. *Agricultural Economics and Rural Development*, 16(2), pp.225-231.

Sanidas, E. and Shin, Y., 2011. Convergence towards the revealed comparative advantage neutral point for East Asia: similarities and differences between the three countries. *Seoul Journal of Economics*, 24(1), pp.21-50.

Smutka L., Spicka J., Ishchukova N. and Selby R., 2016. Agrarian import ban and its impact on the Russian and European Union agrarian trade performance. *Agricultural Economics*, 62(11), pp.493–506.doi: 10.17221/294/2015-AGRICECON.

Svobodová, H., 2014. Changes on Foreign Trade in Agricultural Commodities in the Czech Republic. *Journal of Central European Agriculture*, 15(2), pp.62-72.

Zaman, Gh., Simion, A-E., 2020. The impact of international trade on Romania's regional economic development (in Romanian). Bucharest: Romanian Academy Publishing House.

Xi, H., 2021. Political and economic determinants of export restrictions in the agricultural and food sector. *Agricultural Economics*, 53(3), pp. 439-453. https://doi.org/10.1111/agec.12684.

Appendix 1

Categories of Agri-food Products According to the Combined Nomenclature (CN)

CN code	Code name	No. subcategories (SH4)	CN code	Code name	No. subcategories (SH4)
I	**Live animals and animal products**		**III**	**Animal or vegetable fats and oils**	
1	Live animals	6			
2	Meat and edible offal	10			
3	Fish and crustaceans, molluscs and other aquatic invertebrates	8	15	Animal or vegetable fats and oils	22
4	Milk and dairy products; eggs; honey; edible products of animal origin	10			
5	Other products of animal origin	11			
II	**Vegetable products**		**IV**	**Food, beverages and tobacco**	
6	Live plants and floricultural products	4	16	Meat and fish dishes	5
7	Vegetables, plants, roots and tubers food	14	17	Sugars and sugar products	4
8	Edible fruit	14	18	Cocoa and cocoa preparations	6
9	Coffee, tea and spices	10			
10	Cereals	8	19	Cereal, flour, starch preparations; pastry	5
11	Products of the milling industry; malt; starch	9	20	Preparations of vegetables, fruits, seeds or other parts of plants	9
12	Oil seeds and oleaginous fruits; industrial and medicinal plants; straw and fodder	14	21	Various food preparations	6
13	Gums, resins and other vegetable saps and weaving	2	22	Alcoholic and non-alcoholic beverages; vinegars	9
14	Materials and other products of vegetable origin	4	23	Residues and waste from the food industries; animal feed	9
			24	Tobacco and processed tobacco substitutes	3