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**CHANGES IN THE COMPETITIVE POSITION OF CHINA  
AND THE EUROPEAN UNION IN INTERNATIONAL  
AGRICULTURAL AND FOOD TRADE CONSIDERING  
AGRICULTURAL WORKFORCE PRODUCTIVITY**

Key words: China, EU, balance of trade, trade coverage ratio, import penetration ratio, relative export orientation index

**ABSTRACT.** This paper aims to evaluate the competitive position of China and the European Union in international agricultural and food trade using properly selected measurement indicators and comparing the resulting values with changes in workforce productivity in agriculture. On foreign markets, an improvement in the competitive position of a country/regional group is equivalent to an increase in the share of a specific entity in export markets. One of the basic determinants of the scale of regional and global competitiveness is workforce productivity. The period of analysis ranges from 2001 to 2017. Data was retrieved from statistics database FAOSTAT and the World Bank. The analysis used indicator-based methods. The studies carried out endorse the statement that a larger improvement in workforce productivity in agriculture in China compared to EU countries had little influence on the international competitive position of that country compared to EU countries. In the analyzed period, the value of the trade coverage ratio (TCR) is decreasing for China and increasing for the EU, as is the value of the relative export orientation index (REO). In the case of China, the negative balance of trade is deepening, while the EU achieves a positive balance in agricultural and food trade in 2010. The results of analyses point to an improvement in the competitive position of the European Union and a deterioration in the position of China in international agricultural and food trade.

INTRODUCTION

China holds nine per cent of the total area of arable land in the World and accounts for twenty per cent of the World's population. The economic growth of China can, to a large extent, be attributed to the mass movement of workers migrating from rural to urban areas. Migration increased productivity, both in and outside agriculture, through a more

effective allocation of the workforce [OECD 2018]. China has been unusually successful in developing its agricultural sector since its opening and reforms in 1978 [Cieślak 2013, Kubicka 2010, Xiaobo 2010, Zhenglai (ed.) 2009]. The percentage of people in China living on agriculture decreased from 70% in 1978 to 49.1% in 1997, 40.1 % in 2010 and 26.5% in 2017 [FAOSTAT 2020], which correlates with a significant improvement in total productivity of agriculture. In the 1980s, agricultural production and productivity grew rapidly [Tong et al. 2012]. In the 1990s, growth slowed down; industrial expenditure was a critical factor limiting the level of agricultural production [Xu 1999]. When China joined the WTO in 2001, it was a country with a large population but an insufficient amount of arable land. The main problem was the small scale of agricultural activity, low land and workforce productivity [OECD 2001]. At present, despite 40 years of reforms, Chinese agriculture is still facing the problem of fragmentation and low productivity compared to global leaders [Wieliczko 2015].

Two decades ago, the Chinese middle class only constituted 2.5 million people. Today, it is more than one hundred times that. According to forecasts by USDA [GAP 2018], the middle class in China will continue growing and will reach 950 million by 2030, which corresponds to nearly three times the present population of the United States. Therefore, satisfying the dynamically growing demand for food in China will be a huge challenge. Countries of the European Union make up a self-sufficient area with a considerable surplus in food production, meaning that, as a whole, it is the largest exporter and importer of agricultural and food products in the World. The competitive position of the European Union on the international agricultural and food market has been high for years. EU countries have a large share of trade turnover compared to agricultural and food production. In addition, they are still looking for new markets to sell their products. It is worth noting that the competitive advantage of the European Union in trade in agri-food products grew with the reform of the common agricultural policy (CAP). The Agenda 2000 and the new CAP project adopted by the Council of Ministers on June 26, 2003 in Luxembourg were of crucial importance. It was based on: an increase in agricultural productivity, competitiveness of agricultural products, and the main condition for achieving these goals was the elimination of subsidies. Changes in the agricultural policy of the EU were forced by the multilateral liberalization of international trade [Mucha-Leszko 2004].

International competitiveness is defined as a capacity to catch up with international competitors and maintain a high rate of internal demand without compromising the current turnover balance. Reference literature makes a distinction between international competitive capacity and international competitive position [Bossak, Bienkowski 2004, Misala 2011]. One of the authors carrying out multi-faceted analyses of international competitive capacity and the competitive position of the Polish agri-food sector compared with EU countries is Karolina Pawlak [2013]. In this paper the author juxtaposes the

international competitive position of EU countries in agri-food products trading with that of third countries such as China. Agricultural competitiveness factors include production technology, innovation, and expenditure on research and development [Nowak 2017]. However, not many analyses are dedicated to studies of international competitiveness of agriculture taking workforce productivity into account. Workforce productivity is a very important factor of economic growth and competitiveness and affects fundamental macroeconomic parameters such as: consumption, employment, investment and production volume [Mucha-Leszko 2007]. The main aim of this paper is to evaluate the competitive position of China and the European Union in international agricultural and food trade using properly selected measurement indicators and comparing the resulting values with changes in workforce productivity in agriculture.

## STUDY MATERIAL AND METHODS

The competitive position of the European Union and China in the international sales of agricultural and food products was evaluated using quantitative indicators of competitiveness ex post. The share of China and the European Union in production and global agricultural and food trade, trade balance, trade coverage ratio (TCR), import penetration ratio (IPR) and relative export orientation index (REO) was calculated. The indicators were calculated using the following formulas [Jagięło 2003, Pawlak 2013, Pilarska 2017]:

$$TCR_{ij} = \frac{X_{ij}}{M_{ij}} \times 100 \quad (1)$$

$$IPR_{ij} = \frac{M_{ij}}{Q_{ij} - X_{ij} + M_{ij}} \times 100 \quad (2)$$

$$REO = \left( \frac{X_{ij}}{Q_{ij}} : \frac{X_{iw}}{Q_{iw}} \right) \times 100 \quad (3)$$

$i$  – analysed commodity or group of commodities,  $j$  – analysed country or group of countries,  $w$  – world,  $M$  – value of import,  $X$  – value of export,  $Q$  – value of production sold.

The above-mentioned indicators are interpreted as follows:

1. If the value of TCR is higher than 100 ( $TCR > 100$ ), the country specialises in the production of a commodity or a group of commodities, because the export of such a commodity (group of commodities) exceeds its import. Thus, supposedly the country has a relative comparative advantage over its business partner.

2. High IPR testifies to the fact that a large portion of domestic consumption is satisfied by import. If, in addition, the economy is characterised by a growing share of the analysed country's import in global import, it is believed that the international competitive position of the analysed country becomes worse.
3. REO index higher than 100 ( $REO > 100$ ) means that production is export-oriented and is competitive on an international scale. On the other hand, if it is less than 100 ( $REO < 100$ ), production on an international scale is deemed non-competitive [Jagiello 2003, Pawlak 2013, Pilarska 2017].

Data used in calculating the above-mentioned indicators was retrieved from FAOSTAT – a statistics database of the Food and Agriculture Organization. Next, the trade results of China and the European Union were compared with changes in added value generated by agriculture per capita according to the World Bank statistics [World Bank 2020]. Analysis covered the period from 2001 – when China joined the World Trade Organization – to 2017.

## RESULTS

An analysis of the competitiveness of the European Union and China in international agricultural and food trade should start with a comparison of their production potential. In the analysed period, between 2001 and 2017, agricultural and food production in China increased more than four times, while in EU countries 1.6 times and in the World 2.8 times [FAOSTAT 2020]. The average annual total growth rate of workforce productivity in China in the analysed period amounted to 7.8%, while in EU countries it was 4.2% and 3.9% globally [World Bank 2020]. Workforce productivity in China increased two times faster than the average EU and global workforce productivity in 2001-2017. It will be difficult to maintain such a growth rate in the long run. Despite having successfully improved the overall productivity of its agricultural sector, it is likely that, by 2030, China will only be able to satisfy 74% of its demand. Most of the remaining demand for food will be satisfied by trade [GAP 2018].

The European Union is a leading exporter of agricultural and food products in the World. The EU's export of agricultural and food products increased between 2001 and 2017 three times from USD 180 billion to USD 544 billion, but its share in global exports decreased by 5 percentage points (p.p.), which was due to the growth rate of EU export being slower than the global growth rate of agricultural and food export. In the analysed period, Chinese agricultural and food export increased four times from USD 16.8 billion to USD 67.5 billion, exceeding the growth rate of global export, thanks to which the share of China in global agricultural and food export grew insignificantly by 0.7 p.p. Despite Chinese export growing very dynamically, the negative balance of trade for agricultural and food products increased from USD 8 billion in 2001 to USD 88 billion in 2017. At

the same time, in the European Union, the negative balance of agricultural and food trade amounting to USD 7 billion changed into a positive balance amounting to USD 24.7 billion in 2017 (Table 1). The surplus of agricultural and food products trade balance achieved by the European Union can be interpreted as an improvement in the competitive position of the EU, while the growing surplus of Chinese agricultural and food import over export testifies to a deteriorating competitive position of that country in international trade.

Comparing the share of the European Union and China in global agricultural and food import, it can be noted that the share of the European Union decreased between 2001 and 2017 by 6.6 p.p., and that of China increased by 5.1 p.p. An increased share of China in global import points to a deterioration in the competitive position of China in international agricultural and food trade. The growth rate of Chinese agricultural and food import considerably exceeded the growth rate of the EU and global imports. Chinese agricultural

Table 1. Share of the European Union and China in international agricultural and food production and turnover in 2001-2017

Years	Share [%] in the global							
	general production		food and agricultural production		food and agriculture exports		food and agriculture imports	
	EU	China	EU	China	EU	China	EU	China
2001	22.10	4.01	16.9	20.0	43.6	4.1	42.5	5.7
2002	23.19	4.24	16.7	20.5	45.3	4.1	44.2	5.2
2003	25.45	4.26	17.3	21.3	47.1	3.9	46.0	5.8
2004	25.98	4.46	17.1	22.8	47.7	3.4	46.2	6.5
2005	25.05	4.81	15.5	23.3	47.1	3.6	45.4	6.2
2006	24.66	5.34	14.9	23.8	46.3	3.6	44.5	6.3
2007	25.35	6.12	14.9	23.2	45.3	3.7	44.6	6.5
2008	25.49	7.21	14.3	24.8	43.7	3.4	43.1	7.2
2009	24.35	8.45	12.7	27.0	43.7	3.7	42.9	7.4
2010	21.99	9.21	11.4	26.3	40.9	4.0	39.9	8.9
2011	21.43	10.28	10.9	28.7	39.5	4.0	38.6	9.5
2012	19.47	11.35	10.1	29.6	38.8	4.0	36.9	10.5
2013	19.78	12.38	10.6	30.3	39.6	4.1	37.0	10.6
2014	19.68	13.18	10.5	28.5	38.9	4.3	36.3	10.6
2015	18.01	14.71	9.6	31.6	37.9	4.8	34.9	11.0
2016	18.18	14.71	9.4	32.0	38.4	5.0	35.5	10.6
2017	18.15	15.14	9.9	30.0	38.6	4.8	35.9	10.8

Source: own elaboration based on FAOSTAT

and food import increased from USD 24.9 billion in 2001 to USD 156 billion in 2017 (more than six times), and, respectively, the EU's import went up from USD 187 billion to USD 519 billion (more than three times) and global import from USD 441 billion to USD 1,447 billion (more than three times). Factors determining such a high increase in food imports in China include an increase in the population and income and an increase in Chinese consumers' demand for food [Jarosz-Angowska 2019]. The consumption of products such as poultry, pork and dairy products increased exponentially [GAP 2018].

Analysis of TCR, IPR and REO (Table 2) makes it possible to evaluate more specifically and compare the competitive position of the European Union and China in international agricultural and food trade. The trade coverage ratio (TCR) for the EU increased throughout the analysed period, exceeding 100 in 2010, which points to the specialisation of the EU in agricultural and food trade. For China this ratio decreased and did not approach 100

Table 2. Evaluation of the competitive position of the European Union and China in international agricultural and food turnover in 2001-2017 using selected indicators.

Years	Agricultural and food balance of trade [thousands USD]		Trade Coverage Ratio (TCR)		Import Penetration Ratio (IPR)		Relative Export Orientation Index (REO)	
	EU	China	EU	China	EU	China	EU	China
2001	-7,223	-8,167	96.2	67.3	77.49	8.74	257.50	20.30
2002	-5,519	-6,351	97.3	74.0	84.71	8.20	270.61	19.88
2003	-6,346	-11,423	97.5	64.2	87.09	8.81	271.70	18.28
2004	-5,255	-20,857	98.2	50.0	89.22	9.16	278.99	15.03
2005	-0,813	-18,588	99.7	56.2	98.07	8.64	303.90	15.64
2006	-1,420	-21,368	99.6	55.1	101.16	8.66	310.80	15.24
2007	-11,745	-26,896	97.1	54.4	99.35	9.11	304.27	15.85
2008	-15,271	-45,008	96.8	44.4	103.44	9.81	305.21	13.57
2009	-7,855	-37,395	98.1	48.7	112.93	8.89	345.00	13.82
2010	1,550	-55,430	100.4	44.0	115.01	10.43	359.17	15.23
2011	-1,609	-75,930	99.7	40.8	117.41	10.24	364.47	13.80
2012	13,379	-90,311	102.6	37.3	123.86	10.92	382.30	13.58
2013	24,654	-93,816	104.7	38.0	125.07	10.98	375.39	13.60
2014	20,232	-94,731	103.8	38.9	126.92	12.14	368.77	14.97
2015	17,773	-84,999	103.8	41.7	134.03	11.35	395.80	15.15
2016	20,714	-76,112	104.4	45.8	141.10	10.98	406.35	15.66
2017	24,693	-88,658	104.8	43.3	144.57	12.47	389.84	15.97

Source: own elaboration based on FAOSTAT

between 2001 and 2017, which suggests that China had no comparative advantage in agricultural and food trade.

The import penetration ratio (IPR) provides important information on the share of import in the supply of goods on the internal market. A high value of this ratio for the European Union testifies that a large portion of internal consumption is satisfied by import. On the other hand, China mostly satisfies its internal demand through its own production and, to a considerably smaller extent, through import, which is corroborated by low IPR. China is a giant selling market so trade exchange plays a considerably smaller role here than in European Union countries that are mostly self-sufficient and produce a considerable surplus of food sold on World markets. The import penetration ratio cannot be considered separately from other competitive position indicators. The analysis is supplemented by the relative export orientation index (REO) expressing the degree of opening of the economy of a specific country/group of countries compared to the average degree of opening of all economies in the World. The value of this index for the European Union is very high, which means that production in EU countries is export-oriented and is competitive on an international scale, in contrast to China, where this index is very low, which is connected with the fact that China mainly sells its agricultural produce on the internal market.

One of the ways of meeting challenges, and increasing the competitiveness of Chinese agriculture and the participation of China in international trade is to improve workforce productivity that is currently very low but has huge potential for growth. In 2001-2017,

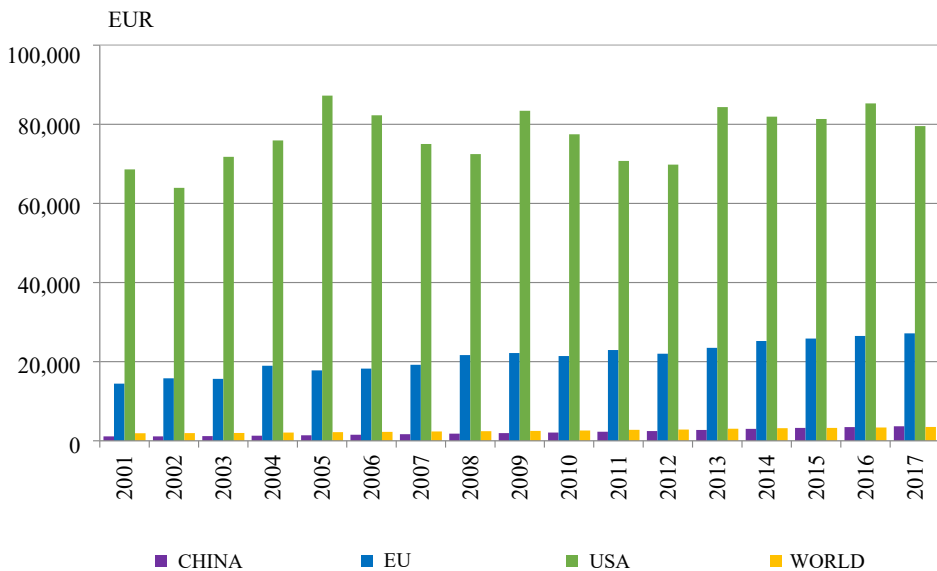


Figure 1. Value added in agriculture per capita in the EU and China compared to the USA and the World in 2001-2017 (in USD, prices from 2010)

Source: own calculations based on the World Bank Database

Table 3. The dynamics of value-added agriculture (VAA) per capita in respective EU countries and changes in the relation of VAA of EU countries compared to the mean value for the EU, USA and China in 2001-2017

Country (X)	(VAA 2017/ VAA 2001) x 100%	VAA in X/ VAA in China		VAA in X/ VAA in the EU		VAA in X/ VAA in the USA	
		2001	2017	2001	2017	2001	2017
Austria	153.9	20.0	9.2	1.52	1.25	0.32	0.43
Belgium	126.9	47.4	18.0	3.61	2.44	0.76	0.83
Bulgaria	104.3	9.0	2.8	0.68	0.38	0.14	0.13
Cyprus	104.9	32.3	10.2	2.46	1.38	0.52	0.47
Czech Republic	172.6	13.3	6.9	1.01	0.93	0.21	0.32
Germany	191.4	22.2	12.7	1.69	1.73	0.36	0.59
Denmark	143.7	37.5	16.1	2.86	2.19	0.60	0.75
Spain	149.1	28.8	12.8	2.19	1.74	0.46	0.59
Estonia	238.8	9.5	6.8	0.72	0.92	0.15	0.31
Finland	195.9	33.9	19.9	2.59	2.70	0.54	0.92
France	157.7	34.5	16.3	2.63	2.21	0.55	0.75
United Kingdom	126.7	34.8	13.2	2.65	1.79	0.56	0.61
Greece	145.7	13.3	5.8	1.01	0.78	0.21	0.27
Croatia	180.0	7.5	4.1	0.58	0.55	0.12	0.19
Hungary	130.5	15.4	6.0	1.17	0.81	0.25	0.28
Ireland	174.1	15.5	8.1	1.18	1.10	0.25	0.37
Italy	124.4	31.6	11.8	2.41	1.60	0.51	0.54
Lithuania	293.0	4.0	3.5	0.30	0.47	0.06	0.16
Luxembourg	28.7	85.1	7.3	6.49	0.99	1.37	0.34
Latvia	314.4	4.9	4.6	0.37	0.63	0.08	0.21
Netherlands	168.8	44.8	22.7	3.42	3.07	0.72	1.05
Poland	169.2	3.6	1.8	0.28	0.25	0.06	0.08
Portugal	245.9	6.1	4.5	0.46	0.61	0.10	0.21
Romania	252.4	2.1	1.6	0.16	0.21	0.03	0.07
Slovak Republic	593.1	5.9	10.5	0.45	1.42	0.10	0.49
Slovenia	189.9	8.9	5.1	0.68	0.69	0.14	0.23
Sweden	180.5	53.0	28.7	4.04	3.89	0.85	1.33
United States	115.9	62.3	21.6	4.75	2.93	1.00	1.00
China	333.8	1.0	1.0	0.08	0.14	0.02	0.05
EU	187.8	13.1	7.4	1.00	1.00	0.21	0.34

Source: own calculations based on the World Bank Database



the value of agricultural production per agricultural worker in China increased more than three times from USD 1,101.8 to USD 3,678.3, and in the European Union nearly two times from USD 14,450.2 to USD 27,141.7. Workforce productivity in China, despite a considerable growth (in 1991 it was only USD 713), is still very low compared to world leaders. In the analysed period, it only slightly exceeded the world average, increasing from USD 1,910 in 2001 to USD 3,497.3 in 2017 [World Bank 2020]. It is more than seven times lower compared to the average workforce productivity in the European Union.

The calculations shown in Table 3 lead to a conclusion that Slovakia was the only EU country in which the rate of increase in workforce productivity in agriculture was higher than in China. No other EU country reached a rate of increase in workforce productivity in agriculture matching that in China in 2001-2017. Some of the newly admitted member states of the EU showed high dynamics – these include Estonia, Lithuania, Latvia, and Romania, and among the so-called old EU-15 countries – Portugal. Poland is a country noting a significantly lower rate of increase in workforce productivity in agriculture than China. It is even below the EU average, which is not a good sign for the future. A significantly smaller increase in workforce productivity in agriculture in the so-called old EU-15 is due to the fact that these countries already have high levels of productivity and the technological options to further increase it are limited. In the so-called catching-up countries, the growth rate should be much higher in comparison to the leading countries in order to reduce the differences inside the EU.

Comparing workforce productivity in the agriculture of China to that of workforce productivity leaders among EU countries (Table 3), the difference can be thirty-fold to the disadvantage of China in 2017. This is the case in Sweden where the value of workforce productivity in agriculture is the third largest value of workforce productivity in the World and in 2017 amounted to USD 105,469.8 (Norway ranked first with productivity amounting to USD 127,326.3, followed by Iceland – USD 122,854.8). On the other hand, considering rapid changes in workforce productivity in China, it can be anticipated that, in the near future, China will overtake countries with the lowest workforce productivity in the European Union, such as Romania and Poland, where the value of production generated by a farmer in 2017 was USD 5,765.59 and USD 6,729.2, respectively.

## SUMMARY AND CONCLUSIONS

The study analyzes changes in workforce productivity in China and the European Union compared to global workforce productivity in 2001-2017 with reference to the evaluation of the competitive position of China and the EU in international agricultural and food trade. The results in international trade vary considerably over time due to the fact that the volume of export and import remains under the influence of a large variety of

economic and political factors. The fact that China became a member of the WTO in 2001, boosted competition on the Chinese market and necessitated continuous improvement in the quality and productivity of agriculture. A high rate of workforce productivity in Chinese agriculture (exceeding the growth rate of workforce productivity in developed EU countries, such as the Netherlands, Belgium and Denmark, and comparable with the growth rate of workforce productivity in some new member states of the European Union, such as Romania, Lithuania, Latvia and Estonia) contributed to a significant increase in agricultural production. The share of China in global agricultural and food production increased to nearly one third, from 20% in 2001 to 30% in 2017 and, at the same time, the share of the European Union decreased by nearly half, from 16.9% to 9.9%. Simultaneously, along with a significant increase in agricultural and food production in China, the relative export orientation index decreased and the import penetration ratio increased, which was connected with the rapidly growing income and demand for food in Chinese society. Increased production was mainly oriented at the internal market, which was accompanied by a growth in Chinese imports. Countries of the European Union, in contrast to China, are characterised by a significant degree of openness to international agricultural and food turnover and, at the same time, are the largest exporters and importers of agricultural and food products in the World. On the one hand, the EU has a high import penetration ratio, but on the other hand, its balance of trade is positive and the trade coverage ratio is above 100, which testifies to a strong competitive position of the EU in international agricultural and food trade. The results of studies on the international competitive position in agricultural and food trade of China and the European Union in 2001-2017 lead to the conclusion that the position of China deteriorated and that of the European Union improved in the analysed period. The negative balance of trade increased in China, which is a potential selling market for products from the EU, where the positive agricultural and food trade balance is still growing. Benefits from growing internal demand for agricultural and food products in China and the participation of China in the multilateral liberalization of trade can be significant for the whole European Union, especially for leading producers and exporters of food, including Poland.

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## ZMIANY POZYCJI KONKURENCYJNEJ CHIN I UNII EUROPEJSKIEJ W MIĘDZYNARODOWYM HANDLU ROLNO-SPOŻYWCZYM A WYDAJNOŚĆ PRACY W ROLNICTWIE

Słowa kluczowe: Chiny, UE, saldo bilansu handlowego, wskaźnik pokrycia importu eksportem, wskaźnik penetracji importowej, wskaźnik relatywnej orientacji eksportowej

### ABSTRAKT

Celem badań jest ocena pozycji konkurencyjnej Chin i Unii Europejskiej w między-narodowym handlu rolno-spożywczym przy wykorzystaniu odpowiednio dobranych wskaźników pomiaru i odniesienie uzyskanych wartości do zmian wydajności pracy w rolnictwie. Konkurencyjność międzynarodowa jest definiowana w literaturze przedmiotu jako zdolność do sprostania konkurencji międzynarodowej oraz utrzymania wysokiego tempa popytu wewnętrznego bez pogarszania bilansu obrotów bieżących. Na rynkach zagranicznych poprawa pozycji konkurencyjnej kraju lub ugrupowania regionalnego jest jednoznaczna z powiększaniem udziału danego podmiotu w eksportowych rynkach. Jednym z podstawowych czynników determinujących konkurencyjność w skali regionalnej i globalnej jest wydajność pracy. Okres analizy obejmował lata 2001-2017 roku. Dane zaczerpnięto z bazy statystycznej FAOSTAT oraz Banku Światowego. Do analizy wykorzystano metody wskaźnikowe. Przeprowadzone studia upoważniają do stwierdzenia, że większa poprawa wydajności pracy w rolnictwie Chin w porównaniu z krajami UE miała niewielki wpływ na międzynarodową pozycję konkurencyjną tego kraju w porównaniu z krajami UE. W analizowanym okresie wartość wskaźnika pokrycia importu eksportem (TCR) obniżyła się dla Chin, a wzrosła dla UE, podobnie jak wartość wskaźnika relatywnej orientacji eksportowej (REO). W przypadku Chin pogłębiało się ujemne saldo bilansu handlowego, podczas gdy w UE osiągnięto dodatni bilans w handlu rolno-spożywczym w 2010 roku. Wyniki przeprowadzonych analiz wskazują na poprawę pozycji konkurencyjnej UE oraz pogorszenie pozycji Chin w międzynarodowym handlu rolno-spożywczym.

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