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## Competitive Efficiency of Foreign Cereal Trade Between Kazakhstan and China

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### Abstract

Cereal trade is an important means of managing global food demand and maintaining national food security. Trade-in cereal and other agricultural products are becoming an increasingly important way of managing resources between countries with rich resources and countries with limited resources. Grain production is the sector with the highest priority in the development of agriculture in Kazakhstan, while China is the world's leading cereal producer and consumer. Therefore, the aim of this study is to examine the development of foreign trade with cereal between Kazakhstan and China by using the empirical data given by UN COMTRADE to highlight its efficiency by type of cereal traded from 2009 to 2018. The study used Revealed Comparative Advantage and Import Coverage indexes to achieve its goal. The results revealed that Kazakhstan's most productive foreign trade has been achieved for wheat, barley, and rice, while the most productive cereals of China are rice, buckwheat, and sorghum. Moreover, there is no direct competition on cereal between Kazakhstan and China in international trade. This study has led to the conclusion that Kazakhstan intends to trade more cereals with high export value, low import value, high positive trade balance, high coverage index, and highly competitive advantages in foreign trade. Kazakhstan should make use of comparative advantages to optimize the structure of grain trade in bilateral trade. Consequently, China must increase its cereal production potential through improved yields, so that it can only enter foreign markets under exceptional circumstances.

*Keywords:* Cereals, Kazakhstan, China, International Trade, Development, Strategy.

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## Қазақстан мен Қытай арасындағы дәнді дақылдар сыртқы саудасының бәсекелестік тиімділігі

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### Түйін

Дәнді дақылдар саудасы азық-түлікке деген жаһандық сұранысты басқарудың және ұлттық азық-түлік қауіпсіздігін сақтаудың маңызды құралы болып табылады. Дәнді дақылдар және басқа да ауылшаруашылық өнімдер саудасы ресурстары бай елдері мен ресурстары шектеулі елдер арасындағы ресурстарды басқарудың маңызды әдісіне айналуға. Астық өндірісі Қазақстанның ауыл шаруашылығын дамытудың ең басым секторы болып табылады, ал Қытай әлемдегі жетекші астық өндіруші және тұтынушы болып табылады. Осылайша, осы зерттеудің мақсаты 2009 жылдан бастап 2018 жылға дейін саудаланатын дәнді дақылдар түрлері бойынша UN COMTRADE ұсынған эмпирикалық деректерді пайдалана отырып, Қазақстан мен Қытай арасындағы сыртқы астық саудасының дамуын зерттеу болып табылады. Зерттеу мақсатына жету үшін анықталған салыстырмалы артықшылықтың индекстері және импортты қамту қолданылды. Нәтижелер Қазақстанның бидай, арпа және күріш бойынша ең өнімді сыртқы саудасына қол жеткізілгенін көрсетті, ал Қытайдың ең өнімді дәнді дақылдары күріш, қарақұмық және құмай болып табылады. Сонымен қатар, Қазақстан мен Қытай арасында халықаралық саудада дәнді дақылдар бойынша тікелей бәсекелестік жоқ. Бұл зерттеу Қазақстан экспорттың жоғарғы құнымен, импорттың төмен құнымен, сауда балансының жоғарғы оң сальдосымен, қамтудың жоғарғы индексімен және сыртқы саудадағы жоғарғы бәсекелестік артықшылықтары бар дәнді дақылдардың көп мөлшерімен сауда жасауға ниетті деген қорытындыға әкелді. Қазақстан екіжақты саудадағы астық саудасының құрылымын оңтайландыру үшін салыстырмалы артықшылықтарды пайдалануы керек. Демек, Қытай ерекше жағдайларда ғана сыртқы нарықтарға шығуы үшін астық өндіру әлеуетін егін өнімділігін молайту арқылы арттыруы керек.

*Түйін сөздер:* жармалар, Қазақстан, Қытай, халықаралық сауда, дамуының, стратегиясы

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## Конкурентная эффективность внешней торговли зерновыми между Казахстаном и Китаем

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### Аннотация

Торговля зерновыми продуктами играет важную роль на мировом рынке, что повышает спрос на производство и поддержания национальной продовольственной безопасности. Кроме того, торговля зерновыми и другими сельскохозяйственными продуктами становится важным способом управления ресурсами между странами с богатыми ресурсами и странами с ограниченными ресурсами. Зерновое производство является важнейшей составной частью отраслей сельского хозяйства Казахстана, а Китай является ведущим производителем и потребителем зерна в мире. Таким образом, целью данного исследования является изучение уровня развития внешней торговли зерновыми продуктами между Казахстаном и Китаем для выявления эффективности экспорта и импорта зерна на основе анализа эмпирических данных за период 2009 по 2018 годы, предоставленных UN COMTRADE. Для проведения количественного исследования использовались индексы выявленного сравнительного преимущества и охвата импорта. Результаты показали, что наиболее продуктивная внешняя торговля Казахстана была достигнута по пшенице, ячменю и рису, в свою очередь наиболее продуктивными зерновыми культурами Китая являются рис, гречиха и сорго. В ходе исследования было выявлено, что между Казахстаном и Китаем в международной торговле нет прямой конкуренции по зерновым. На основании проведенного исследования был сделан вывод, согласно анализу внешнеторговой политики Казахстана, больше специализируется на продажах большого количества зерновых продуктов с высокой стоимостью экспортного потенциала, низкой стоимостью импорта, высоким положительным сальдо торгового баланса, высоким индексом охвата и высокими конкурентными преимуществами. Авторами были даны рекомендации, что Казахстану следует использовать сравнительные преимущества для оптимизации структуры торговли зерном в двусторонней торговле. Следовательно, Китай должен увеличить свой потенциал производства зерновых за счет повышения урожайности, чтобы выйти на внешние рынки с учетом исключительных обстоятельств.

*Ключевые слова:* крупы, Казахстан, Китай, международная торговля, развитие, стратегия

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### Introduction

Worldwide, almost one-third of the economically active population is engaged in agriculture [1]. However, in developing countries more than two-thirds of the population is employed in agriculture as the labor force [2]. Similarly, three-fourth of the agricultural labor force is involved in developed countries [3]. It is worth perceiving that agriculture in most of the developed countries fulfills the domestic needs having less or no contribution to the country's export. While, on the other hand in developed countries, this sector is supported by intensive exports. Recently, 1,500 species of cultivated plants are used in agriculture [4]. Among all these crops, the most significant branch of world agriculture is the cultivation of grain crops. Cereals occupy about half of all sown areas. In developed countries, most of the grain is fed to livestock (up to 75%), in developing countries, on the contrary, it is used for food (up to 90%) [5]. Three species of crops have almost the same percentage in the world gross grain harvest: wheat (28%), rice (26%), and maize (25%) [6]. By the area of crops and export, wheat is also the first among grain crops.

Globally, grain farming is one of the main components of the agro-industrial complex of the Republic of Kazakhstan; grain and its value-added products are strategically essential [7]. Cereals play an important role in the structure of Kazakhstan's exports followed by oil, oil products, metals, and ores. Like all other countries of the world, export is the leading direction of the Kazakhstan grain market and a key mechanism for its regulation. The state of the grain market characterizes both world and national security. The share of resources involved in the grain industry in Kazakhstan determines the general state of the economy of the republic. The grain is the essential object of foreign trade relations. Since Soviet times, Kazakhstan has traditionally produced a large number of grains, so it is not surprising that today grain makes up about 10% of the country's total exports [8]. Kazakhstan is among one of the leading producing countries of wheat, one of the top 10 leading countries-suppliers of wheat and flour to world markets [9]. Over 3/4 of the grain crops are wheat. Crops such as barley, oats, and corn are found everywhere, and millet occupies large areas in northwest Kazakhstan. In the south of the republic, with artificial irrigation, cotton yields high yields (about 15% of the country's total agricultural exports), sugar beets, tobacco, and rice [10].

Worldwide, China is one of the biggest producers and consumers of rice, with over 40% of global production and over 30% of global consumption. Chinese rice harvest area records for almost 25% of the harvested area of the country

[11]. In China, over 99% of the total rice cultivated area is occupied by irrigated rice. The major hurdles facing rice production in China include the limited genetic background, excessive use of pesticides and fertilizers, deterioration of irrigation networks, simplistic crop management, and poor extension program [11]. Over one-third of China's grain production is maize, which is 23% of global maize production [12]. China has become one of the world's leading wheat producers since 1991. Due to the fast urbanization, an increase in people's income, and lifestyle changes, the consumers' behaviors of the Chinese are shifting from high-carbohydrate foods to high protein and high-energy foods, leading to increased demand for meat and dairy resulted in higher crop production [13, 14]. In turn, this condition puts more stress on agriculture. Therefore, it has become a national priority to further increase and maintain food production. Nevertheless, it needs more crops to feed its population because of the growing population pressure and demand for animal products.

The above studies analyzed cereal production and trade in Kazakhstan and China from different points of view and showed that two countries have great potential for bilateral trade growth. However, the current trade in cereals between China and Kazakhstan is small and the trade is driven by factors such as the instability of agricultural production, insufficient storage, logistical capacity, trade inconvenience, and large distance between countries.

Based on the above mentioned research, this article contributes to the field in two ways. First, the research helps to understand the current export situation and the international competitiveness of the cereal products of Kazakhstan and China, as well as the recommend opportunities for cooperation in the field of cereal trade between Kazakhstan and China. Second, the research calculates the potential and changing trend of cereal trade between Kazakhstan and China, and finds out the main reasons that affect the export potential and provides corresponding recommendations.

### Materials and Methods

The empirical basis of the research work was based on the statistical data of the agricultural sector in the Republic of Kazakhstan and the People's Republic of China from the UN COMTRADE database and FAO Statistical Database for the period 2009 to 2018. The aim of this study is to analyze group level of Kazakhstan's and Chinese foreign trade with cereals, but also by each category of cereal using different indicators such as export, import, trade balance, import coverage by export. The main objective is to create the hierarchy of the marketed cereals based on their effectiveness in the

country's foreign trade.

This study uses the following indicators to describe Kazakhstan's and Chinese foreign trade of cereals:

the amount of export, import, and trade balance of cereal is calculated by sector and category;

the volume and concentration of foreign trade of cereals;

the import by export coverage index (ICD), calculated by cereal sector and category;

the geographical orientation of the export and import of cereals was examined depending on the share of each cereal exporting country and share of every supplier country;

the Revealed Comparative Advantage Index was put forward by Balassa in 1965 [15].

RCA Index is used to analyze the comparative advantage of one industry export based on comparing a country trade structure and world trade structure, and its calculation formula is as follows:

$$RCA_{aj} = \frac{X_{aj} / X_{at}}{X_{wj} / X_{wt}}$$

where / refers to the share of product j in total export of country a, / is the share of product j in the total export of the world. If the RCA index is more than 2.5, this shows that product j in the country i has an extreme trading advantage; while the RCA index is between 1.25 - 2.5, this means that product j has a definite comparative advantage; if the RCA is between 0.8 - 1.25, this indicates that product j has an average comparative advantage; the RCA index of fewer than 0.8 means that product j has no comparative advantage in the market. If both countries have a comparative advantage of product j, this shows that the states are competing with product j, in the international market. If one of the countries has the advantage of product j and the other does not, this shows the complementarity between these countries concerning product j, and potential benefits are obtained with the cooperation of each other in trade.

Point-based foreign trade efficiency has been used to assess every cereal's efficacy in international trade [16].

### Results

Cereal production has fluctuated between 12-26 million tons over the past ten years. Instability in grain production in Kazakhstan is well supported by statistics of high yields in 2009, 2011, and the period 2013-2017 and weak yields in 2010 and 2012 due to low harvest and drought. In recent years, about 60% of the produced volume for domestic consumption is used. In general, domestic production fully meets the

needs of the domestic market. The level of grain supply in the republic in recent years is about 170%. The export potential of Kazakhstan for grain at the current level of production is about 5-6 million tons per year (Table1). As can be seen, the trade balance is always positive and its trend is fluctuating. Lack of stability in the grain trade balance in Kazakhstan is well supported by statistics of yields and self-consumption. In recent years, despite high yield, there has been a tendency to increase domestic grain consumption. This is due to an increase in the volume of grain consumption for seeds and fodder due to an increase in livestock numbers, as well as an increase in grain consumption due to the development of the grain processing industry of the republic.

Chinese grain production has increased and the self-sufficiency rate decent to 95%, when net imports grow since 2014 (Table 1).

Moreover, the export and import of cereals both increased. Nevertheless, the export value of cereals has shown a higher growth rate compared to the value of imports. China imports more cereals than export; as a result, the trade balance is negative and is characterized by a continuous declining trend due to its growing population. Even though agricultural production in China is sufficient to feed the country, it must import grain, due to the lack of available farmland and the abundance of labor. China preserves arable land for valuable export products such as fruits, nuts, or vegetables and imports crops, such as wheat and rice.

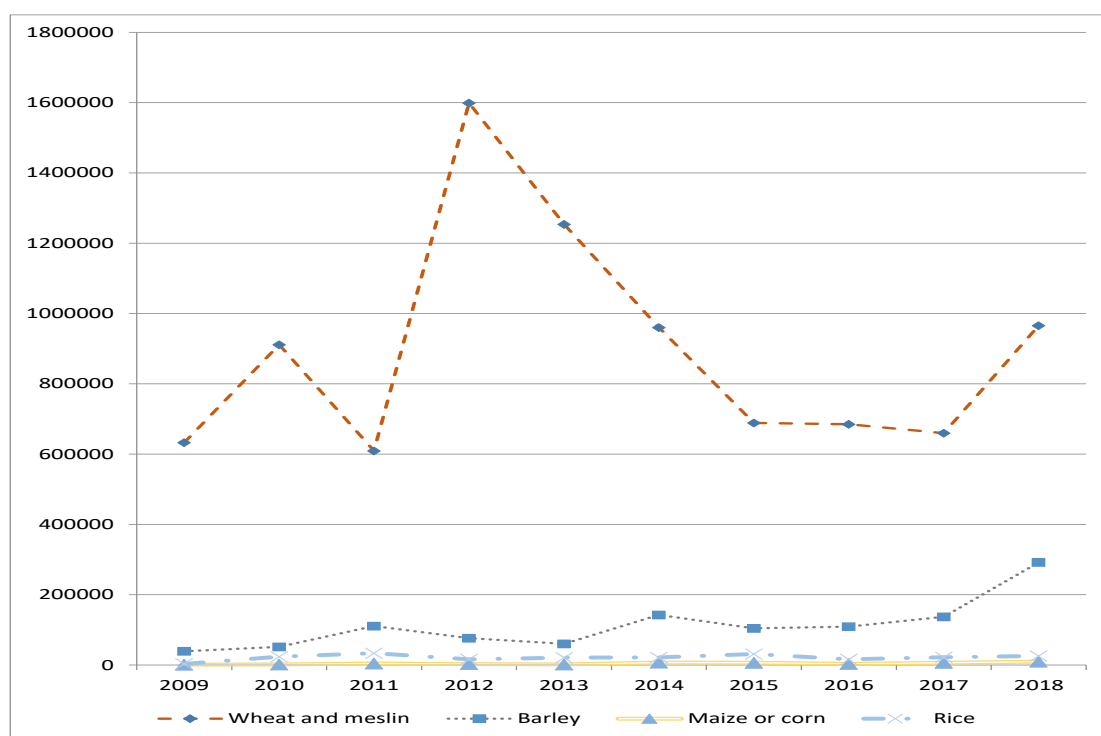
The export value of dynamics by cereal type indicates that all cereals exported by Kazakhstan: wheat, maize, barley, oat, rye, sorghum, and rice reported an upward trend and their export value. Wheat was in the leading position with the largest export value of 965.45 million USD in 2018, which was 1.5 times greater than in 2009 (632.85 million USD). Barley comes in the 2nd position with 291.93 million USD export value in 2018, being 7.5 times greater than in 2009 (39 million USD). Rice was in the 3rd position with an export value of 25.96 million USD in 2018, which was 8.2 times higher than in 2009 (3.15 million USD). Maize came in the 4th position with 9.45 million USD export value in 2018, which is 9.3 times higher than in 2009 (1.02 million USD) (Figure 1).



**Table 1** - Production, consumption, and trade of cereal by Kazakhstan and China, thousand tons.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Kazakhstan</b>									
Production	20764	12116	26826	12789	18157	17111	18586	20411	20129
Import	172	36	96	89	46	61	133	49	63
Consumption	10935	9474	12167	9055	10166	8500	12715	10760	13022
Export	3577	5492	3491	7861	5413	5015	4373	5334	5309
Share of import in market (%)	1.57	0.38	0.79	0.98	0.46	0.72	1.04	0.46	0.48
Share of export in production (%)	17.23	45.33	13.01	61.47	29.81	29.31	23.53	26.13	26.37
Share of production in consumption (%)	189.88	127.89	220.48	141.23	178.61	201.31	146.17	189.69	154.58
Share of consumption in production (%)	52.66	78.19	45.36	70.81	55.99	49.68	68.41	52.72	64.69
<b>China</b>									
Production	481563	496343	519374	539347	552692	557417	621439	616251	617930
Import	3120	5672	5417	13938	14524	19454	32640	21922	25432
Consumption	409415	429014	460367	477332	491318	579091	616156	646751	641420
Export	1083	918	875	674	670	520	360	567	1365
Share of import in market (%)	0.76	1.32	1.18	2.92	2.96	3.36	5.30	3.39	3.96
Share of export in production (%)	0.22	0.18	0.17	0.12	0.12	0.09	0.06	0.09	0.22
Share of production in consumption (%)	117.62	115.69	112.82	112.99	112.49	96.26	100.86	95.28	96.34
Share of consumption in production (%)	85.02	86.43	88.64	88.50	88.90	103.89	99.15	104.95	103.80

Source: calculated and compiled by authors according to the data provided by FAO STAT



**Figure 1** - The evolution of the export value for wheat, barley, maize and rice, Kazakhstan, 2009-2018 (Million USD)

Source: designed by authors according to the data provided by the UN Comtrade

Buckwheat export value was 1.95 million USD in 2018, which is 10.8 times higher than in 2009. Oats came in the 6th position with 1.45 million USD export value in 2018, which is 3 times higher than in 2010 (0.5 million USD). In 2009, this type of cereal was not exported by Kazakhstan. Rye comes in the 7th position with the smallest export value. Kazakhstan did not export sorghum during the analyzed period. The most competitive

cereals exported by Kazakhstan were the following: wheat, barley, and rice, which contributed to 1283.34 million USD in 2018, accounting for 99% of the total volume of cereal export.

Table 2 shows the dynamics of cereal export value structure by category of cereal in Kazakhstan, and also presents that wheat, barley, and rice are the major cereal crop in the export value of cereals, with a total contribution of 99%.

**Table 2** - The dynamics of the share of each cereal in Kazakhstan's cereals export value in percentage, 2009-2018

Product label	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Wheat	93.58	92.21	80.24	94.35	93.71	84.59	82.73	83.85	79.68	74.48
Rye	0.00	0.00	0.01	0.00	0.00	0.00	0.04	0.01	0.01	0.00
Barley	5.78	5.20	14.62	4.50	4.51	12.58	12.54	13.35	16.57	22.52
Oats	0.00	0.05	0.12	0.04	0.09	0.07	0.02	0.13	0.16	0.11
Maize or corn	0.15	0.14	0.57	0.15	0.10	0.61	0.75	0.41	0.78	0.73
Rice	0.47	2.39	4.42	0.95	1.56	1.88	3.73	1.95	2.66	2.00
Buckwheat	0.03	0.00	0.01	0.01	0.03	0.28	0.21	0.29	0.15	0.15

Source: Calculated and compiled by authors according to the data provided by UN COMTRADE

The weight of wheat declined from 93.58% in 2009 to 74.48% in 2018 in the cereals export value. The share of barley in the export value of cereals recorded remarkably steady growth from 5.75% in 2009 to 22.52% in 2018. Rice accounted for 2% of the value of the cereal export in 2018, and its proportion varied over the years with the lowest point of 0.47% in 2009, and a maximum of 4.42% in 2011. All other cereals such as oat, maize, and buckwheat accounted for a limited and growing proportion in the study period.

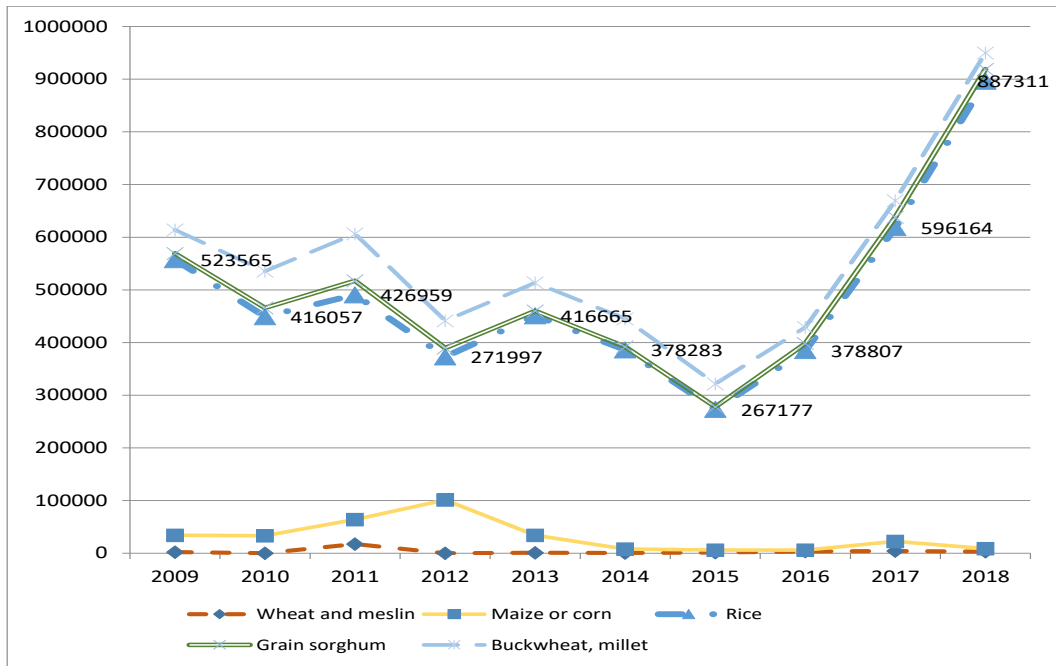
The export value dynamics by cereal category represent that all cereals exported by China: wheat, maize, barley, rye, sorghum, and rice reported an upward trend. Rice was in a leading position with the greatest export value in 2018, which amounted to 887.31 million USD, being 1.7 times higher than in 2009 (523.57 million USD). Buckwheat came in the 2nd position with 31 million USD export value in 2018, being 0.7 times smaller than in 2009 (45 million USD). 3<sup>rd</sup> position was occupied by sorghum with an export value of 22.54 million USD in 2018, which was 2 times higher than in 2009 (11.47 million USD). Maize came in the 4th position with 5.84 million USD export value in 2018, which is 81% smaller than in 2009 (31.69 million USD). Wheat was in the 5th position with an export value of 3.15 million USD in 2018, being 39% higher than in 2009 (Figure 2).

Barley came in the 6th position with 0.09 million USD export value in 2018, which is 43 times smaller than in 2009 (4 million USD). Oats came in the 7th position with the lowest export value. China did not export rye during the analyzed period. Consequently, the most valuable cereals exported by China, in decreasing order are the following: rice, buckwheat, and sorghum, which amounted to 940.86 million USD in 2018, presenting 99% of the total export value of cereals.

Table 3 describes the dynamics of the cereals export value structure by the cereal category.

This table indicates that rice, buckwheat, and sorghum which contribute 99% of total cereal export, are the major cereal crops. The share of rice in cereal export value recorded growth from 84.7% in 2009 to 93.4% in 2018, and its proportion varied over the year with a decrease reaching 61.38% in 2012. Buckwheat represented 7.29% in the cereals export value in 2009, and its proportion changed over the years with a maximum of 14.63% in the year 2011 and followed by a decrease reaching 3.26% in 2018. The weight of sorghum grows from 1.86% in 2009 to 2.37% in 2018 in the cereals export value. Therefore, all other cereals such as wheat, barley, oats, maize, noted a small and declining proportion in the study period.

The dynamics of Kazakhstan's import value by category of cereal are illustrated in Figure 3.



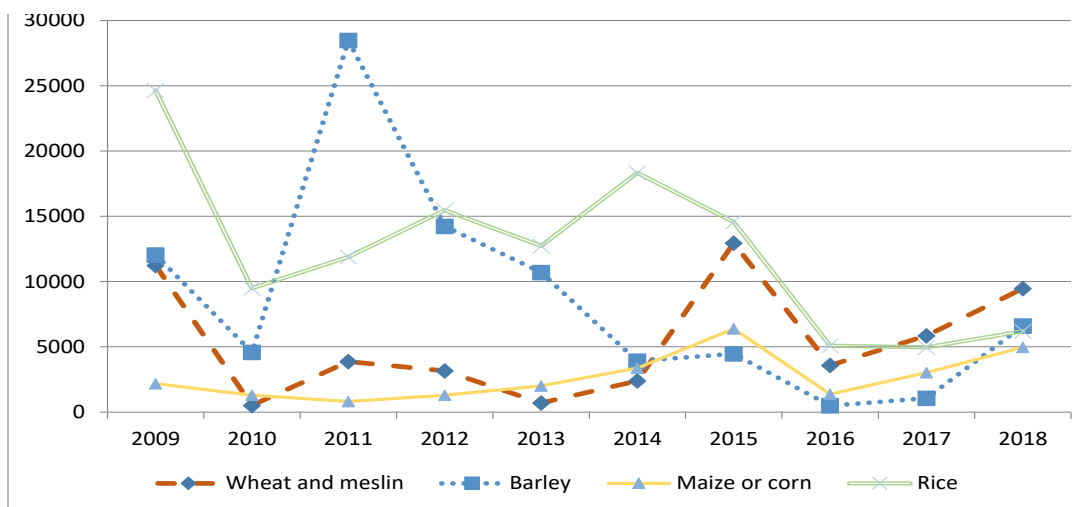
**Figure 2** - The evolution of the export value for wheat, maize, rice, sorghum, and buckwheat, China, 2009-2018 (Million USD)

Source: designed by authors according to the data provided by the UN Comtrade

**Table 3**-The dynamics of the share of each cereal in the Chinese cereals export value in percentage, 2009-2018

Product label	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Wheat and meslin	0.37	0.00	2.86	0.00	0.20	0.07	0.38	0.78	0.61	0.33
Barley	0.65	0.75	0.38	0.43	0.09	0.02	0.03	0.02	0.01	0.01
Oats	0.02	0.01	0.01	0.00	0.02	0.08	0.03	0.00	0.00	0.01
Maize or corn	5.13	6.18	7.65	22.82	6.45	1.72	1.51	0.64	2.74	0.61
Rice	84.70	77.13	70.15	61.38	81.07	84.93	83.02	88.26	89.01	93.40
Grain sorghum	1.86	3.05	4.34	3.72	1.79	1.31	1.41	3.06	2.85	2.37
Buckwheat	7.29	12.88	14.63	11.64	10.38	11.87	13.64	7.23	4.76	3.26

Source: calculated and compiled by authors according to the data provided by UN COMTRADE



**Figure 3** - The evolution of the import value for wheat, barley, rice and maize, Kazakhstan, 2009-2018 (Million USD)

Source: designed by authors according to the data provided by the UN Comtrade



In 2018, the wheat import value was 9.47 million USD, which is 15.7% smaller than in 2009 (11. 23 million USD). The barley import value reached 6.61 million USD in 2018, which is 1.8 times lower than in 2009 (12 million USD). The import value of rice accounted for 6.19 million USD in 2018 is 3.98 times lower than in 2009 (24.63 million). The import value of maize increased 2.3 times, in 2018, amounting to 4.96

million USD, compared to 2.18 million in 2018. These four kinds of cereal: wheat, barley, rice, and maize totalized 27.23 million USD import value in 2018, weighting 97.2 % of the cereals import value of Kazakhstan. Other cereals have less impact on import value.

Table 4 illustrates the complexities of the cereal import value structure.

**Table 4** - The dynamics of the share of each cereal in Kazakhstan’s cereals import value in percentage, 2009-2018

Product label	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Wheat	22.14	3.24	8.25	9.03	2.67	8.34	33.29	32.27	35.18	33.81
Rye	0.40	0.19	0.19	0.16	0.91	1.22	0.07	0.13	0.26	0.46
Barley	23.74	28.62	60.59	40.66	40.13	13.63	11.52	4.40	6.40	23.57
Oats	0.04	0.01	0.13	0.29	0.17	0.12	0.05	0.18	0.37	0.35
Maize or corn	4.30	8.13	1.73	3.71	7.56	11.79	16.43	12.30	18.14	17.71
Rice	48.54	59.23	25.28	44.16	47.81	64.01	37.46	45.67	29.85	22.10
Sorghum	0.00	0.00	0.00	0.04	0.05	0.29	0.08	0.03	0.65	0.28
Buckwheat	0.85	0.58	3.82	1.94	0.71	0.60	1.10	5.03	9.15	1.72

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

It indicates that the largest share of imported cereals in Kazakhstan in 2018 was 33.81% of wheat, 23.57% of barley, 22.1% of rice, and 17.71% maize, totaling 97.2%. In the study period, the portion of the wheat import value of cereals reported an increase from 22.14% in 2009 to 33.81% in 2018, and its portion varied over the years with a fall reaching 2.67% in 2013. The weight of barley decreased from 23.74% in 2009 to 23.57% in 2018 in the import value of cereal, and its proportion changed over the years with a decline reaching 4.4% in 2016 and a peak of 60.59% in 2011. Rice represented 48.54% in the cereals import in 2009, and its proportion changed in the analyzed period with a maximum of 64% in the year 2014 and recorded a decline amounted to 22.1% in 2018. Maize increased from 4.3% in 2009 to 17.71% in 2018, and its proportion changed over the last 10 years with a decrease reaching 1.73% in 2011. Oat, maize, and buckwheat showed a limited and increasing trend in the study period.

Figure 4 shows that, in the period 2009-2018, Chinese cereal reported a growing trend of their import value.

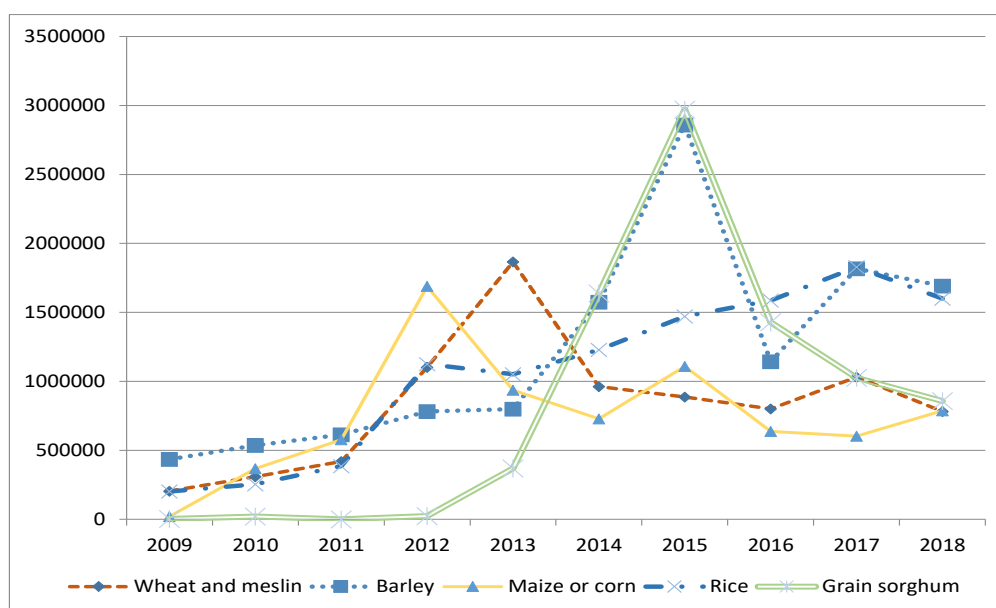
In 2018, the import value of barley was 1.69 billion USD, 3.9 times higher than in 2009 (434.61 million USD), with a peak of 2.86 billion USD in the year 2015. The rice import value reached 1.6 billion USD in 2018, which is 7.9 times higher than in 2009 (201.4 million USD). The import value of sorghum accounted for 857.7 million USD in 2018, which is 372 times higher than in 2009 (2.3 million USD), with a peak of 2.97 billion

USD in the year 2015. The import value of maize was 787.2 million USD, which is 38 times higher than in 2009 (20.5 million USD). The import value of wheat grew 3.8 times, in 2018, accounting for 780.9 million USD, compared to 204.6 million in 2009. These five kinds of cereal: barley, rice, sorghum, maize, and wheat weighed 98.7% of the cereals import value of China with a total of 5.7 billion USD.

Table 5 shows that the barley weight in import value of cereals decreased from 49.6% in 2009 to 29.18% in 2018, and its proportion changed over the years with a decline reaching 15.8% in 2013.

The percentage of rice in the cereals import value registered growth from 22.99% in the year 2009 to 27.61% in 2018, and its proportion varied along the years with a decline reaching 15.74% in 2015 and a peak of 28.56% in 2017. Sorghum represented 0.26% in the cereals import value in 2009, and its share changed over the years with a maximum of 31.78% in the year 2015 and then registered a decline amounted to 14.81% in 2018. Maize increased from 2.34% in 2009 to 13.59% in 2018. The share of wheat declined from 23.35% in the year 2009 to 13.48 in 2018. Oat and buckwheat noted a small and declining percentage in the study period. China did not import rye during the analyzed period.

The trade balance is presented in table 6, considering the development of export and import value per cereal category.



**Figure 4 - The evolution of the import value for barley, rice, sorghum, maize, and wheat, China, 2009-2018 (Million USD)**

Source: designed by authors according to the data provided by the UN Comtrade

**Table 5 - The dynamics of the share of each cereal in the Chinese cereals import value in percentage, 2009-2018**

Product label	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Wheat and meslin	23.35	20.59	20.73	23.19	36.92	15.59	9.48	14.15	16.11	13.48
Barley	49.60	35.71	30.38	16.44	15.80	25.49	30.59	20.17	28.38	29.18
Oats	1.26	0.91	0.97	0.60	0.61	0.61	0.54	1.15	1.48	1.17
Maize or corn	2.34	24.46	28.65	35.55	18.53	11.81	11.85	11.27	9.41	13.59
Rice	22.99	16.87	19.18	23.69	20.82	19.90	15.74	28.02	28.56	27.61
Sorghum	0.26	1.32	0.00	0.49	7.30	26.52	31.78	25.23	16.03	14.81
Buckwheat	0.20	0.13	0.09	0.04	0.02	0.08	0.03	0.02	0.03	0.17

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

**Table 6 - The dynamics of the trade balance sheet by each category of cereal, Kazakhstan and China, 2009-2018 (Million USD)**

Product label	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Kazakhstan</b>										
Wheat	621.6	911.0	605.5	1596.0	1253.2	957.7	675.8	681.5	653.7	956.0
Rye	-0.2	-0.01	0.02	-0.06	-0.2	-0.4	0.3	0.1	0.04	-0.1
Barley	27.0	46.9	82.5	62.1	49.6	138.9	99.9	108.6	136.1	285.3
Oats	-0.02	0.5	0.8	0.7	1.2	0.8	0.1	1.1	1.3	1.4
Maize or corn	-1.2	0.1	3.6	1.2	-0.6	3.5	-0.2	2.0	3.4	4.5
Rice	-21.5	14.1	21.7	0.6	8.1	3.0	16.5	10.8	17.1	19.8
Sorghum	0	0	0	-0.02	-0.01	-0.08	-0.03	-0.003	-0.1	-0.08
Buckwheat	-0.3	-0.07	-1.7	-0.6	0.3	3.0	1.3	1.8	-0.3	1.5
<b>China</b>										
Wheat	-202.3	-309.1	-400.6	-1101.5	-1864.9	-962.2	-885.1	-797.7	-1027.3	-777.8
Rye	0	0	0	0	-0.001	0	-0.002	-0.007	-0.001	-0.014
Barley	-430.6	-532.1	-610.1	-779.3	-798.1	-573.7	-859.3	-1141.9	-1816.2	-690.3
Oats	-10.9	-13.7	-19.5	-28.4	-30.5	-37.5	-50.1	-64.9	-94.6	-67.5
Maize or corn	11.2	-333.4	-531.1	-1587.6	-903.4	-721.4	-102.8	-6345.0	-583.9	-781.4
Rice	322.2	162.8	40.2	-853.6	-635.3	-850.7	-120.4	-120.7	-123.2	-712.4
Sorghum	9.2	-3.4	26.4	-6.8	-359.9	-631.9	-966.4	-1415.0	-1007.1	-835.2
Buckwheat	43.3	67.5	87.3	49.6	52.3	47.9	41.3	29.9	29.8	21.3

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

This table indicates that excluding buckwheat, the amount of trade balance generally reported an increasing trend from 2009 to 2018. In the case of wheat, the trade balance is always positive, registering a peak of 1.6 billion in 2012. Every year of the study period, barley registered a positive trade balance, with a maximum of 285 million USD in 2018 which is 10.7 times more in 2009. In the situation of rice, the trade balance was negative in 2009, although it becomes positive in all other years, recording a maximum of 19.8 million USD in 2018. Maize reported a negative trade balance in 2009, 2013, and also in 2015, all other years were a positive one with a peak of 4.5 million USD in 2018. Buckwheat had a negative trade balance in the period 2009-2012, and in 2017, but other years reported by positive with a maximum of 1.8 million USD in 2016. Oats trade was negative in 2009, but reported positive in the following years, with a peak of 1.4 million USD in 2018, which is 72 times higher than in 2009. Rye registered a negative trade balance in the period of 2009-2010 and 2012-2014 and also in 2018, but a positive one in all the other years. The trade balance of sorghum was zero in the period between 2009 and 2011, which means the value of export was equivalent to the value of an import. In all other analyzed years, it reported a negative trade balance.

The Chinese trade balance for every cereal category described in Table 6, shows that the trade balance in 2009-2018 has a descending trend. In each year of the study, the period buckwheat registered a positive trade balance with a maximum of 87.3 million USD in 2011. In 2018, it was noted 21 million USD, 2 times smaller than in 2009. The trade balance of rye was zero from 2009 to 2012 and 2014, and in other analyzed years, the trade balance was negative. The trade balance was also negative in all study periods. Rice recorded a positive trade balance in the period 2009-2011, all other years were negative one with a peak of deficit in 2012 accountant 853.6 million USD. Regarding wheat, the trade balance is always a negative one, the gap in 2018 accounted for 777.8 million USD, which is 3.8 times higher compared to 2009. In 2009, maize reported a positive trade balance but in other years it was negative. In the period 2009-2011 sorghum trade balance was positive, but in other years was negative, with a deficit of 3.0 billion USD in 2015. In the study period, barley registered only a negative trade balance, and the maximum of the deficit was 2.9 billion USD in 2015.

Table 7 describes the dynamics of the degree of cereal import coverage by export in Kazakhstan by the cereal category.

**Table 7** - The dynamics of the coverage degree of import value by export value by type of cereal, Kazakhstan and China, 2009-2018

Product label	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Kazakhstan</b>										
Wheat	56.34	1756.24	157.03	505.73	1763.62	401.87	53.21	190.61	112.62	101.92
Rye	0.00	0.60	1.26	0.00	0.00	0.00	12.15	7.87	1.93	0.00
Barley	3.24	11.22	3.90	5.36	5.64	36.57	23.30	222.56	128.78	44.20
Oats	0.00	249.00	14.37	7.40	27.18	23.23	7.86	53.95	21.50	14.97
Maize or corn	0.47	1.10	5.34	1.95	0.69	2.04	0.97	2.45	2.13	1.90
Rice	0.13	2.49	2.83	1.04	1.63	1.16	2.13	3.13	4.43	4.19
Sorghum	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Buckwheat	0.42	0.24	0.05	0.19	2.34	18.20	4.06	4.25	0.79	4.05
<b>China</b>										
Wheat	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rye					0.00		0.00	0.00	0.00	0.00
Barley	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oats	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Maize or corn	1.55	0.09	0.08	0.06	0.04	0.01	0.00	0.00	0.03	0.01
Rice	2.60	1.64	1.10	0.24	0.40	0.31	0.18	0.24	0.33	0.55
Sorghum	4.98	0.83	2400.00	0.71	0.02	0.00	0.00	0.01	0.02	0.03
Buckwheat	25.60	34.96	51.43	25.69	50.96	10.45	16.90	26.29	15.38	3.20

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

For wheat, the ICD value in period of 2009-2018 were > 100, except for the year 2009 (ICD=56.34) and 2015 (ICD=53.21). The ICD value in 2018 was 1.8 times greater than in 2009. Regarding barley, the value of ICD for 2018 amounted to 44.2 which was 13.6 times greater than the value reported in 2009. The ICD for oats was 14.97 in the year 2018, with the peak of ICD = 249 in the year 2010. Rice recorded ICD = 4.19 in 2018, which is 32 times greater than in 2009 and a maximum of the index, ICD = 4.43, in 2017. During the study period, buckwheat raised its ICD 9.6 times, acceding 4.0 in 2018. The maize ICD in 2018 amounted to 1.9 which is 4 times bigger than in 2009, with a maximum value of 2.45 in 2016. The rye ICD was zero in the analyzed period, with the peak of ICD=12.15 in the year 2015. Kazakhstan did not export sorghum at the analyzed period; as a result, ICD = 0.

The dynamics of the degree of Chinese cereal import coverage by the export of the cereal category

are also described in Table 7. For all cereals, except buckwheat, the ICD values were less than 1. During the analyzed period, buckwheat decreased ICD 8 times, reaching 3.2 in 2018. In the case of rice, the ICD value was 4.7 times smaller than in 2009. The ICD for sorghum was 0.03 in the year 2018, which is 166 times lower than in 2009, with the peak of ICD = 2400 in the year 2011. Maize recorded ICD = 0.01 in 2018, which is 155 times higher than in 2009. The ICD for wheat accounted for 0 in the analyzed period, except in 2009 (ICD=0.01) and 2011 (ICD=0.04). The ICD of oat was zero in the analyzed period, with the peak of ICD=0.01 in the years 2009 and 2014. In the case of barley, the ICD value amounted to 0.01 during the period from 2009 to 2010; all other years ICD value was equal to 0. China did not export rye during the analyzed period; as a result, ICD = 0.

The geographical orientation of Kazakhstan's cereals export and import is presented in Table 8.

**Table 8** - List of importing and supplying markets for cereals by Kazakhstan

No.	Export						Import					
	2009			2018			2009			2018		
	Country	Value (thsd \$)	%	Country	Value (thsd \$)	%	Country	Value (thsd \$)	%	Country	Value (thsd \$)	%
1	Iran	173961	25.72	Uzbekistan	309914	23.91	Russia	35883	70.72	Russia	22134	78.99
2	Turkey	82737	12.23	Iran	281846	21.74	Ukraine	9510	18.74	Hungary	1230	4.39
3	Afghanistan	70816	10.47	Tajikistan	167034	12.89	China	2778	5.48	India	927	3.31
4	Tajikistan	62848	9.29	China	98970	7.64	Viet Nam	1076	2.12	France	898	3.20
5	Kyrgyzstan	57935	8.57	Afghanistan	68667	5.30	Thailand	391	0.77	USA	827	2.95
6	Turkmenistan	40741	6.02	Italy	66753	5.15	Pakistan	270	0.53	Turkey	449	1.60
7	Azerbaijan	39485	5.84	Turkey	59564	4.60	USA	269	0.53	Italy	398	1.42
8	Russia	32071	4.74	Azerbaijan	54361	4.19	Canada	138	0.27	Austria	347	1.24
9	Uzbekistan	28187	4.17	Russia	54088	4.17	Turkey	93	0.18	Ukraine	195	0.70
10	United Kingdom	23355	3.45	Turkmenistan	42334	3.27	Hungary	61	0.12	Romania	150	0.54

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

Kazakhstan was exporting cereals to 23 countries in 2009 with a total value of 676 million USD in the year 2018 to 32 countries with a total amount of 1.3 billion USD. The leading importers of cereals are Uzbekistan, Iran, Tajikistan, China, and Afghanistan. The export value of these countries was 71.48%. Kazakhstan was buying cereals from 24 countries in 2009, the total amount of imports was 51 million USD. In the year 2018, exporter countries' amount grows to 27, but the import value decreases to 28 mln. USD. The leading exporters in 2018 were Russia, Hungary, India, France, and the USA, which totalized 92.84%.

The geographical orientation of Chinese cereals export and imports is presented in Table 9.

China, in the year 2018, was exporting cereals to 113 countries and the total value was 950

million USD. The main importers of cereals are Cote d'Ivoire, Korea, Japan, Guinea, and Turkey. The export value of these countries was 48.87%. In the year 2009, China was exporting cereals to 94 countries with a total value of 618 mln. USD. China was importing cereals from 24 countries with a total amount of 876 million USD in 2009. In 2018 exporter countries become 30 and imported value grows to 5.8 billion USD. The leading exporters in 2018 are Australia, the USA, Canada, Viet Nam, and Ukraine, which totalized 69.11%.

To calculate the competitiveness of cereals of Kazakhstan, it is necessary to determine the competitive advantage of cereals. RCA indices of Kazakhstan and China's cereals are given in Table 10.

**Table 9** - List of importing and supplying markets for cereals by China

No.	Export						Import					
	2009			2018			2009			2018		
	Country	Value (thsd \$)	%	Country	Value (thsd \$)	%	Country	Value (thsd \$)	%	Country	Value (thsd \$)	%
1	Korea	154451	24.99	Côte d'Ivoire	142316	14.98	Australia	287003	32.76	Australia	1348707	23.28
2	Japan	105654	17.09	Korea	130318	13.72	Thailand	196896	22.47	USA	908672	15.69
3	DPRK	55461	8.97	Japan	76850	8.09	Canada	152682	17.43	Canada	862899	14.90
4	South Africa	39267	6.35	Guinea	58137	6.12	France	109983	12.55	Viet Nam	739175	12.76
5	Nigeria	36994	5.98	Turkey	56621	5.96	USA	95131	10.86	Ukraine	731964	12.64
6	Hong Kong	25283	4.09	Egypt	51161	5.39	Lao	14932	1.70	Thailand	508371	8.78
7	Viet Nam	18507	2.99	Philippines	43142	4.54	United Kingdom	8667	0.99	Pakistan	145363	2.51
8	Liberia	18213	2.95	Pakistan	30861	3.25	Myanmar	5668	0.65	France	139100	2.40
9	Samoa	14320	2.32	DPRK	25771	2.71	Germany	1178	0.13	Cambodia	122879	2.12
10	Russia	13751	2.22	USA	24440	2.57	Viet Nam	1038	0.12	Kazakhstan	99813	1.72

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

**Table 13.** The RCA of Kazakhstan and China cereals

Product label	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Kazakhstan</b>											
Wheat	7.31	5.64	7.31	2.64	6.52	5.69	4.77	6.35	8.12	6.15	6.77
Rye	0.42	0.00	0.02	0.08	0.00	0.00	0.00	0.43	0.27	0.15	0.00
Barley	4.55	2.43	2.73	3.06	1.93	1.55	4.32	4.75	7.64	7.17	10.95
Oats	0.48	0.00	0.23	0.22	0.19	0.36	0.23	0.08	0.73	0.76	0.58
Maize or corn	0.01	0.01	0.02	0.03	0.01	0.01	0.05	0.08	0.05	0.08	0.08
Rice	0.13	0.05	0.31	0.28	0.13	0.18	0.19	0.48	0.33	0.33	0.30
Grain sorghum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Buckwheat	0.99	0.09	0.01	0.02	0.03	0.09	0.60	0.57	1.18	0.49	0.62
<b>China</b>											
Wheat	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rye	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barley	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oats	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maize or corn	0.03	0.02	0.01	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.00
Rice	0.25	0.28	0.20	0.17	0.10	0.14	0.12	0.08	0.14	0.19	0.25
Grain sorghum	0.20	0.13	0.14	0.16	0.11	0.05	0.02	0.01	0.06	0.10	0.13
Buckwheat	0.92	0.83	1.01	1.08	0.59	0.44	0.34	0.29	0.27	0.28	0.24

Source: calculated and compiled by authors according to the data provided by UN COMTRADE

As can be seen from Table 10, Kazakhstan has an apparent comparative advantage in wheat and meslin, barley, maize, and corn. Among them, RCA indexes of wheat and barley are far greater than 2.5, with an extreme comparative advantage. Other cereals have no comparative advantage in international trade. Table 10 also indicates that China has no comparative advantage of cereals in international trade. Based on the calculations above, it was concluded that Kazakhstan has a comparative advantage in wheat and maize, while

China has no strength of cereals in international trade. As a result, there is no direct competition on cereals between Kazakhstan and China in the global market, so they are more complementary to each other.

To estimate the efficiency of Kazakhstan's and Chinese cereals' foreign trade based on numerical points obtained for export and import value, trade balance, and coverage degree index, the total sum of points earned by each cereal was calculated and presented in Table 11.



**Table 11** - The comparative position of each cereal reflects the efficiency of foreign trade based on the Point Method

Product label	Position for Export value	Position for Import value	Position for Trade Balance	Position for Coverage Degree Index	RCA	Total points	The final position in the hierarchy
<b>Kazakhstan</b>							
Wheat	1	1	1	1	2	6	1
Rye	7	6	7	7	7	34	7
Barley	2	2	2	2	1	9	2
Oats	6	7	6	3	4	26	6
Maize or corn	4	4	4	6	6	24	5
Rice	3	3	3	4	5	18	3
Sorghum	8	8	8	8	8	40	8
Buckwheat	5	5	5	5	3	23	4
<b>China</b>							
Wheat	5	5	5	5	6	26	5
Rye	8	8	2	8	8	34	8
Barley	6	1	8	7	5	27	6
Oats	7	6	3	6	7	29	7
Maize or corn	4	4	6	4	4	22	4
Rice	1	2	4	2	1	10	1
Sorghum	3	3	7	3	3	19	3
Buckwheat	2	7	1	1	2	13	2

Source: calculated and compiled by authors according to the data provided by UN COMTRADE [17]

Table 11 shows that wheat is the most competitive in foreign trade, accompanied by barley, rice, buckwheat, maize, oat, and rye in the declining order. Chinese most competitive cereals in the foreign trade in the declining order are rice, buckwheat, sorghum, maize, wheat, barley, and oats.

However, the major cereals which qualified for trading on the international market by Kazakhstan and China are different, except rice, in which China has more competitiveness. Based on the comparative position of cereals, there is no direct competition on cereals between Kazakhstan and China in international trade.

#### 4. Conclusions

This study leads to the conclusion that Kazakhstan must trade more cereals with high export value, low import value, high positive trade balance, high coverage index, and high competitive advantages. Kazakhstan can produce more cereals than its consumption and that is the justification for exporting more cereals to the international market where the price is more rational and reducing imports from Russia where the price is high. To summarize, Kazakhstan's international cereal trade has a positive balance with a significant effect on the balance of payments and the economy as a whole. Grain quality is the main deterrent to the development of export products. The republic has excellent opportunities but does not produce enough wheat grain with the required milling and

baking qualities. In the Republic of Kazakhstan, only 70% of the gross harvest is wheat of 1-3 classes. This product is widely used by many countries to improve the baking properties of flour produced. Considering the situation in Kazakhstan as a whole, it should be noted that the country has an extremely high potential for raising its position in the world market. Since Kazakhstan is growing large volumes of grain, the cost of it is kept at a low level. This fact allows exporting grain to the world market, thereby increasing the country's competitiveness. Another positive point is the availability of sufficient land resources. However, there are negative factors that impede grain production: one of the main difficulties is the incomplete transition to a modern farm form, which makes it difficult to control the payment of taxes; also worth noting is the lack of investment in the industry, which leads to insufficient implementation of innovative technologies, inadequate technical equipment of agricultural producers; another key problem that needs to be addressed immediately is the lack of storage space for harvested crops.

The grain self-sufficiency rate was more than 100%, but it has decreased to 95% in the last 5 years. The ratio of imported cereals grew to 3-5% of the total consumed agricultural products in China, and it is expected to import more cereals in the future. Food security in China also became an international problem because if China increases cereal import for a small percentage of the

domestic market, it could increase global demand and prices significantly. This would also raise the living expense in many food-importing developing countries. Hence, China needs to raise its cereal production potential by improved yields, that it can import cereal only in exceptional circumstances.

Strategies to solve these problems would include policy improvement for cereal production, such as growing grain yield through improved crop varieties and crop management, food waste reduction, and control of the population. This means that China must expand investments in research and development of agriculture, develop its irrigation and drainage systems, maximize the farm income from cereal production whether directly or by subsidies, and reform the price-setting process for cereals [18]. Therefore, China must collaborate with international partners, such as foreign agricultural research centers, specialized institutes, and private enterprises, to increase cereal production.

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