

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Statistics



Bachelor Thesis

**Export of Czech commodities to Kazakhstan in
comparison to other export destinations**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

BACHELOR THESIS ASSIGNMENT

Vojtěch Joza

Economics and Management

Thesis title

Czech agricultural export to Kazakhstan

Objectives of thesis

The aim of the thesis is to assess the possibilities of the Czech agricultural export to Kazakhstan. In the theoretical part the terms corresponding with the topic of foreign trade, will be introduced. In addition, this thesis will explain the current status of various commodities.

Methodology

In the practical part the statistical analysis will be based on the data of Czech agricultural export to Kazakhstan compared to the development of export of those items to other relevant countries. The procedures applied will be regression analysis methods as well as time series and other relevant methods.

The proposed extent of the thesis

30 – 40 pages

Keywords

Statistics, agricultural export, foreign trade, Kazakhstan, Czech Republic

Recommended information sources

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-

Expected date of thesis defence

2021/22 SS – FEM

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Declaration

I declare that I have worked on my bachelor thesis titled " Export of Czech commodities to Kazakhstan in comparison to other export destinations " by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 13.3.2022

Vojtěch Joza

Acknowledgement

I would like to thank Ing. Tomáš Hlavsa Ph.D. for all their advice and support during my work on this thesis.

Czech Agricultural Export to Kazakhstan

Abstract

This thesis focuses on finding the potential of various commodities in export from Czech Republic to Kazakhstan. The theoretical part will identify the current situations regarding the different commodities and their possible restrictions. Furthermore, the knowledge researched in the theory will be used to possibly explain some of the rises or possible drops in the data of the commodities throughout time range. The time range used is from the year 2016 to the most recent year 2021. Using various sources, a list of commodities will be created which will be then further analysed in the practical part.

The practical part will analyse each commodity through statistical methods used with time series, correlation analysis or through regression. The regression analysis will vary between linear and polynomial depending on the type of data present. The data of the results for export to Kazakhstan will be compared to Russia, Serbia and Turkey where the data allows so. Correlations between Kazakhstan and the three picked non-EU countries will be calculated as well as calculated through residuals. These are found through regression of actual values to theoretical and later using that difference as residuals to calculate correlations without the effects of possible trend.

The results and discussion's part summarizes the results calculated and compares them to possible world situations found in the theoretical part. The results are compared to the findings and or predictions of an expert stationed in the embassy of Czech Republic of Kazakhstan for commodities that allow so. In the end, this thesis will list the commodities with potential out of the commodities analysed and state the decision whether the item views Kazakhstan as a potential destination or not.

Keywords: Kazakhstan, Export, Agriculture, Commodities, Correlation, Chain base Index, Fixed base Index, mean, Correlation of residuals, Serbia, Russia, Turkey

Český zemědělský vývoz do Kazachstánu

Abstrakt

Tato práce se zaměřuje na zjištění potenciálu různých komodit při vývozu z České republiky do Kazachstánu. V teoretické části bude zjištěna současná situace týkající se jednotlivých komodit a jejich případná omezení. Dále budou poznatky zkoumané v rámci teorie, využity k případnému vysvětlení některých nárůstů, či možných poklesů v údajích o komoditách v celém časovém rozsahu. Použitý časový rozsah je od roku 2016 do předposledního roku 2021. S využitím různých zdrojů bude vytvořen seznam komodit, který bude následně v praktické části dále analyzován.

V praktické části budou jednotlivé komodity analyzovány pomocí statistických metod využívajících časové řady, korelační analýzy nebo regrese. Regresní analýza se bude pohybovat mezi lineární a polynomickou v závislosti na typu přítomných dat. Údaje o výsledcích vývozu do Kazachstánu budou porovnány s Ruskem, Srbskem a Tureckem. Pokud to údaje umožňují, budou vypočteny korelace mezi Kazachstánem a třemi vybranými zeměmi, které nejsou členy EU, a rovněž budou vypočteny prostřednictvím reziduí. Ty se zjistí pomocí regrese skutečných hodnot vůči teoretickým a později se tento rozdíl použije jako rezidua pro výpočet korelací bez vlivu možného trendu.

Část výsledků a diskuse shrnuje vypočtené výsledky a porovnává je s možnými světovými situacemi zjištěnými v teoretické části. Výsledky jsou porovnány se zjištěními anebo předpověďmi experta umístěného na velvyslanectví České republiky v Kazachstánu pro komodity, které to umožňují. V závěru této práce jsou uvedeny komodity s potenciálem z analyzovaných komodit a uvedeno rozhodnutí, zda daná položka vnímá Kazachstán jako potenciální destinaci, či nikoliv.

Klíčová slova: Kazachstán, Export, Zemědělství, komodity, korelace, Chain base Index, Fixed base Index, Průměr, Korelace rezidua, Srbsko, Rusko, Turecko

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1 Introduction

Kazakhstan is economically and socially the most developed country in central Asia, with the territory above 2.7 mil square km, a population of nearly 19 million inhabitants and a pre COVID-19 annual increase in GDP of over 4%. It is an important partner for the Czech Republic regarding its foreign trade. At the same time, it is a specific market with a high involvement of the KZ government into the economy of the country. The number of different development programs financed from the KZ state budget are to be taken into account from the point of view of the Czech agricultural export. It is a highly interesting country for the Czech agricultural export, which is confirmed by the decision of the ministry of agriculture in the Czech Republic to establish a position of an agricultural expert within the frame of the embassy of the Czech Republic in Kazakhstan.

For the purpose of evaluating the Czech export to Kazakhstan, two issues must be addressed beforehand. The import potential into Kazakhstan, refers to the different individual commodities that the country of Kazakhstan is not able to produce in the amounts it requires. The second issue targets the evaluation of the comparative advantage of the Czech production of the commodities imported into KZ.

This paper will determine the possible commodities with a high demand on the KZ side, followed by the statistical evaluation of past export numbers (through different trends, world situations, regression analysis and other statistical tools) from the Czech Republic in general as well as the bilateral trade (trade between two countries) with Kazakhstan and two or three non-EU countries, most often compared to the trade with Turkey, Serbia and Russia on commodities that are present in the trade of those specific countries.

2 Objectives and Methodology

2.1 Objectives

The aim of this thesis is to identify agricultural commodities with the highest potential for Czech export to Kazakhstan. Such evaluation will be based on comparison of statistical data for Kazakhstan itself as well as the data for three major non-EU countries: Russia, Serbia, Turkey. This approach will allow focus only on commodities that have been already exported to these countries.

2.2 Methodology

The values for the import and export between Kazakhstan and Czech Republic with side comparisons of Turkey, Russia and Serbia and among other will be held in specific files for each commodity that will be compared and evaluated. The data will be evaluated through the use of Multiple linear Hypothesis testing including instances of hypothesis testing in simple regression. The chi-square test or the Fisher exact test will be used depending on the necessary conditions for the specific situations. Relative risk will be used to calculate chances of one country exporting or importing a specific commodity compared to another, determining if it is more likely to happen or not. Basic statistical tools such as the mean, mode, max and min will be used to describe the data sets. The correlation coefficient will be used to measure the linear relationship between two numerical variables, in order to remove trend the correlation will be used on the residuals of the actual and theoretical data calculated through regression. Predictions for the future year will be made through the use of confidence interval estimates and quadratic trend functions. Polynomial regression will be used to predict data that has more shifts from increases to falls, for more accurate data predictions, which would otherwise off put the estimate of a linear regression. Time series will be used to describe the average growth rate as well as the Fixed base index and Chain base index.

Hypothesis testing will use H_0 (H null) and H_1 ; H_0 representing no relationship between the variables and H_1 representing the fact that there is a relationship, to determine if there is or if there is no connection between the two commodities.

The formula for use is:

$$y' = a \times bx$$

where “a” is a constant “b” is the regression coefficient and “x” the targeted value of that commodity. The chi-square test will be used if n (the number of data available) is larger than 40, or if “n” is less than or equal to 40 and more than or equal to 20, and if all the expected values are greater than 5. If “n” is less than 20, or the previous requirements are not fulfilled use Fisher factorial test. During the chi-square test, the “DF” degree of freedom of distribution will be used for finding the results. Determining if there is a relationship and whether if the H₀ is rejected or if it stands depends on the final p-value that will be calculated. If the p-value is larger than alpha “α” (which for this work will always be stationed at 0.05) then the H₀ stands and there is no relationship between the variables, and in contrast if the p-value is lower than the alpha then there is a relationship and the H₀ is rejected and there is no relationship.

Relative risk will be used in instances of 2x2 tables with data. Firstly, the row values or as it will be referred to as “a + b”, “a” being the first value in the first row and “b” being the second value in the first row. “c” will be the first value in the second row and “d” the second value of the second row. This means that rows total will be values from “a + b” and “c + d”, while columns totals will be from “a + c” and “b + d”. The equation used to calculate the relative risk will be separated into compartments depending for which value a, b, c or d. So, calculating the relative risk or the RR for “a” will be RR1.

$$RR1 = \frac{\frac{a}{a+b}}{\frac{c}{c+d}} = a(c+d)/c(a+b)$$

If RR1 is equal to 1 then the probabilities are the same, if RR1 is less than 1 it means that the numerator is smaller than the denominator and the probability for “a” is smaller, if RR1 is larger than 1 then the probability for “a” is higher. To find the RR3 which is for “c” the numerator and denominator in RR1 will be switched.

Basic statistical tools such as the mean (the average), the maximum value and the minimum values will be used to show an overview of the data. These values will be compared with different countries of the same commodity.

To determine the quality of the regression model, two values will be presented. The coefficient of determination and the coefficient of correlation. The correlation coefficient or

in this study referred to as “r”, is a value that shows the level of dependency of the data inserted into the formula:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

This value will determine how strong the correlation is. “r” can be in the range -1 to 1. The correlation may be negative, positive or without any correlation. If the correlation coefficient is between -1 and lower than 0, then the correlation is negative. If the correlation coefficient is 0, then the correlation is without any dependency thus meaning the data is completely random. If the correlation coefficient is larger than 0 up to 1, then the correlation is positive. The closer the correlation is to 1 or -1 and thus further away from 0, the stronger the correlation of the data in question is. Correlations of 0.8 and higher is seen as a strong correlation, 0.3 and lower is weak and anything between those two is classified as of medium strength. The coefficient of determination, referred to as “r²”, shows the proportion of explained variation in the target variable.

The formula used is:

$$R^2 = 1 - \left(\frac{RSS}{TSS}\right)$$

The RSS refers to the residual sum of squares not explained by the regression model, this value helps determine if a statistical model is a good fit for the data in use.

The Formula for RSS is:

$$RSS = \sum_{i=1}^n (y_i - f(x_i))^2$$

Where the “y_i” is referring to the specific ordered variable that is to be predicted. The “f(x_i)” being the predicted value of “y_i”. The RSS is divided by the total sum of squares, referred to as TSS, which is calculated by

$$TSS = \sum_{i=1}^n (y_i - \bar{y})^2$$

“n” being the total number of data, “ y_i ” the predicted value and the “ \bar{y} ” being the mean value of the sample. Once the coefficient of determination is found for the specific data of the chosen countries to compare for the selected commodity, the value of r^2 will illustrate the percentage of data that is explained in the data set.

Simple linear regression will be used to identify how much does the dependent variable “y” change when the variable “x” changes by some amount or by the average change.

$$(Change\ in\ y') = b \times (change\ in\ x)$$

Multiple linear regression will be used in instances of comparing and hypothesis testing the data of multiple commodities, to find if there are relationships between the dependent variable and all the explained variables “x”. “a” being the constant and “b” the partial regression coefficient or the *ceteris paribus*.

With the applied equation:

$$y' = a + b_1x_1 + b_2x_2 + \dots + b_kx_k$$

If there will be three or more independent commodities that are unrelated, the ANOVA or the “one-way analysis of variance” will be used to compare the means of the data of those commodities.

To ensure the independent variables in the multiple regression model are truly independent, it will be tested for multicollinearity by comparing the correlation of various explanatory variables if any correlations compared between these variables are larger than 0.75, then there is multicollinearity and thus the independent variables are not independent of each other. If the correlation is lower than 0.75, then there is no multicollinearity.

Basic components of times series will be used to evaluate values on their change over a set amount of time and or predict the future values. Aspects taken into consideration are: the trend or also known as the long-term tendency where the trend either is increasing, decreasing or stationary meaning it is not changing, another one is periodicity which shows regular fluctuations which in this study may show periodic fluctuations of commodity export from Kazakhstan. Lastly there may be irregular occurrences which will not fit into the data

set, in this study it can be expected that a large amount of the random may be caused by the current world pandemic.

The basic description of time series and some of the basic equations and tools that will be used are: the fixed based index, chain base index, average growth rate. The fixed base index shows by how much the tested value has changed since the original value.

Fixed base Index:

$$K_{t0} = \frac{y_t}{y_0} = \frac{\text{present value}}{\text{original first value}}$$

Chain base Index:

$$K_t = \frac{y_t}{y_{t-1}} = \frac{\text{present value}}{\text{previous value}}$$

- If “Kt” is less than one, then the value is decreasing
- If “Kt” is larger than one, then the value is increasing

Average growth rate:

$$\bar{K} = \sqrt[n-1]{\frac{y_n}{y_1}}$$

The linear trend function will be used to predict future values in the future year (the further into the future the prediction is, the less accurate it is). This equation uses constant “a”, regression coefficient “b” and time or more importantly the order of the periods “t”. The “GOF” or the goodness of fit is determined by the R^2 . The chosen commodity of a country will be put into the equation of linear trend to predict possible future values that can be expected this process is also called pseudo forecast.

Linear trend function:

$$y' = a + b \times t$$

To test how reliable the predictions are, REF will be used to test the relative error of forecast. This is done by choosing a year that has actual data for it and calculating the pseudo

forecast for that specific year by using the previous year's data. After that, the predicted value is compared with the actual value to determine a percentage of accuracy or specifically in this case, the percentage of error of the prediction.

REF function where:

$$REF = \left| \frac{P - A}{A} \right| \times 100\%$$

- P ... predicted value
- A ... actual value

The lower the REF is the safer and the more accurate it is for prediction use, in this study if the REF is lower than 10% it will be accepted as safe for predications and use.

When predicating future values, the values will be listed with the confidence interval range. Both the lower and the upper confidence limits will be included in the range of the predicted value of the commodity for the future year at a 95% confidence rate.

3 Literature Review

3.1 Export potential of the Czech Republic

In accordance with journal article from M. Svatoš and L. Smutka, the paper's focus is on pinpointing different advantages in different commodities of the Czech agrarian sector. It compares these advantages to European countries as well as third world countries.

The paper evaluates the position of the Czech Republic and then targets some of the least important items in the Czech commodity trade to set the margin of what commodities will be shown. The text also describes some possible statistical reasoning for the unimportance of these commodities (follow this up by a table of data supporting these arguments. The work compares the respective differences between the different commodities and compares them to the EU countries. The commodity total is split into ten categories and later shown in a graph, this enables a more concrete approach to each commodity type. In such a way that helps illustrate the competitive ability of agrarian trade in Czech Republic (Svatoš & Smutka, 2012).

The paper uses statistical calculations such as the ballasa index, RCAI index, LFI index (or known as the Lafay index), geometric mean and some of the more basic statistical methods. The work uses the balsa index which provides a summary of the comparative advantage distribution. The RCA1 index which uses the formula,

$$RCA1 = \left(\frac{X_{ij}}{X_{nj}}\right) / \left(\frac{X_{it}}{X_{nt}}\right)$$

where “x” is the exports value, “i” showcases the country that was analysed, “j” stands for the analysed sector of the economy, “n” shows the group of countries, “t” represents the total of all the commodities, sectors or branches. If the resulting RCA1 value is larger than 1, the comparative advantage is proven. If the value is lower than 1, the conclusion would be that the country has a comparative disadvantage concerning the commodity in question (Svatoš & Smutka, 2012).

The LFI helps show the standing of all specific products in the foreign trade. One of the advantages of the LFI index is that it is able to showcase distortions formed by macroeconomic changes over time.

The LFI formula:

$$LFI_j^i = 100 \left(\frac{x_j^i - m_j^i}{x_j^i + m_j^i} - \frac{\sum_{j=1}^N (x_j^i - m_j^i)}{\sum_{j=1}^N (x_j^i + m_j^i)} \right) \frac{x_j^i + m_j^i}{\sum_{j=1}^N (x_j^i + m_j^i)};$$

“x’j” is the import and export of the commodity being analyzed which is the “j”. The country in question is labeled by “i” and “N” standing for number of items. Like in RCA1, if the index is higher than 1, it means there is a comparative advantage in the commodity being analyzed for the selected country. When the resulting index drops below 1, it means the country doesn’t have a comparative advantage in that specific commodity or item.

The results of these calculations stated that Czech Republic has a competitive advantage in commodity types: chemical products, manufactured goods, machinery and transport, miscellaneous manufacture articles. After this the work compares the competitive advantage of Czech Republic with the individual countries of the EU. It states that: “Slovak Republic, Germany, Poland, Hungary, Austria, Italy, Great Britain, France and the Netherlands”, are the most important trading partners (Svatoš & Smutka, 2012; Robinson, 2020).

The conclusion for this work states that CZ is more dependent on agrarian trading than in the past. It explains that Czech Republic has remained on the same position regarding agricultural and food products since the crisis in 2009, and thus the comparative advantages of the Czech Republic agrarian export were unchanged in comparison to the most important trading partners.

This source is highly useful for the purpose of this research from the point of methodology/the statistical methods of evaluating the export potential. Its findings will be used in a limited scope as the results tend to focus on non-agricultural export of the Czech Republic.

3.2 Import potential of Kazakhstan

This chapter is dedicated to research based on an interview with an expert on agricultural trade between Czech Republic and Kazakhstan, Lukashov Artyom, positioned in the Czech embassy in Nur-Sultan.

This work identifies different commodities that are exported or imported into Kazakhstan, and views them in regard to current trends and to the current global pandemic. It mentions that dairy product, meat, foreign canned fruits and vegetables, confectionery. A list of 19 products that come from Kazakhstan is given: beef, chicken, kefir, milk, cottage, cheese, butter, flour, horns, rice, buckwheat, sunflower, oil, sugar, salt, potatoes, carrots, onions, cabbage. It is also stated that Kazakhstan overall is able to provide for itself to a certain level. Furthermore, flour and rice are very popular items for export abroad.

Table 1. on the next page shows, the share of locally produced products in 2019, proving that Kazakhstan provides over 95% of its own flour, eggs and milk. The largest share of the food products comes from Belarus, Ukraine and Russia. Czech Republic exports eggs for hatching meat chicken, due to only 2 breeding poultry farms for the production of hatching eggs in Kazakhstan (Lukashov, 2021).

In Artom Lukasov's monthly reports the following commodities are evaluated: Live animals (breeding cattle), birds eggs in shells (hatching eggs), malt, hop cones and lupulin, sugar, lactose and glucose syrups, confectionery, pet food, edible products and preparations, beer, distillates, non-alcoholic beverages, food poppy, seeds (all types), fertilizers, dextrin and other modified starches, agricultural machinery and its spare parts, food processing machinery and its spare parts, veterinary vaccines.

Czech Republic specifically exports to Kazakhstan: food flavourings, food poppy, seeds, malt and different sauces. In conclusion the work states that Czech Republic has a substantial amount of potential in exporting equipment and technologies to Kazakhstan, instead of exporting everything in finished products.

Usage of the source for the final work:

This source is mainly useful for the purpose of defining the individual commodities with the highest import potential to Kazakhstan. This means that the bachelor's thesis of this work will focus exclusively on those commodities.

The potential of this country consists of 3 main reasons:

- The vast territory of Kazakhstan (9th largest country in the world) including the fact that the country is a neighbour of the most promising market in the world – China,

- The growing population and GDP resulting in an increase in demand for higher quality agricultural products,
- At this point in time the economy of Kazakhstan was driven mainly by the mining sector (mining and exports of oil and natural gas), resulting in the policy of Kazakhstani government to heavily subsidize (to input money) into agricultural and food sector with the help of funds that are generated in the state budget by the mining sector.

Table 1: Agricultural exports of January to April in the year 2021

general data			
for the period JAN-APR (export in thousands EUR)			
period	2020	2021	
SITC codes			▼ ▲
live animals (breeding cattle)	1159	283	▼76%
birds eggs in shells (hatching eggs)	1403	2141	▲53%
malt	13	19	▲600%
hop cones and lupulin	23	18	▼22%
sugar, lactose & glucose syrups, confectionery	9	39	▲333%
pet food	24	32	▲33%
edible products and preparations	229	1	▼100%
beer	45	58	▲29%
distillates	2	3	▲100%
non-alcoholic beverages	8	3	▼500%
food poppy	0	67	▲6700%
seeds (all types)	15	17	▲13%
fertilizers	10	113	▲1030%
dextrins and other modifies starches	2	113	▲5550%
agricultural machinery and its spare parts	211	427	▲102%
food processing machinery and its spare parts	115	930	▲709%
veterinary vaccines	123	13	▼89%
minors			
	3391	4277	▲26%

Source: Lukashov Artyom's own processing according to Kazakhstan's Statistical Office

In more detail, the information provided in table 1 showed that the volume of hatchling eggs exported to Kazakhstan has been declining during the first third of the year 2021. It is also important to mention that in the month of February of the year 2020, there was a restriction on livestock exported to Kazakhstan from the Czech Republic. In the beginning of the year 2021 some livestock was exported, but following February the amount of livestock exported to KZ has reached and remained at 0 until April (the ending of most recent available data).

The data provided in table 1 also shows that the export of cattle to Kazakhstan has changed dramatically through the year 2017 to 2020. In 2017 the number of cattle exported to KZ from the Czech Republic was at 7395, in 2018 this number grew to 21859 and later in peaked in 2019 at 52895. In 2020 the amount of cattle exported went down to 10 thousand. This large decrease was caused due to the introduction of new restrictions on the trade from the side of Kazakhstan as well as the beginning of the world pandemic COVID-19.

When comparing the export of cattle to Kazakhstan from the Czech Republic, CZ is placed fourth, where Russia is first by a large margin, US is second and Austria is located in third place. The different cattle breeds that are transported to Kazakhstan from the Czech Republic are in proportions as following: Angus- 28%, Hereford- 17%, Simmental- 16%, Holstein- 11% and other in the remaining 28%.

3.3 Regulation of prices of important commodities for Kazakhstan

On the fifth of January 2022, the president of Kazakhstan took the action for the creation of regulation of grocery goods including necessities such as bread, flour, salt, eggs, rice, sugar, butter, beef and chicken meat, milk and some vegetables such as carrots. This action is to last by instruction of the president for the next 180 days. Furthermore, on the sixth there was a restriction passed on for the export of agriculturally oriented animals in order to balance out and stabilize the situation of the prices in the home country markets. This specific restriction is to last 6 months (Lukashov, 2022).

These restrictions are expectedly going to heavily affect the export and international trade between Czech Republic and Kazakhstan. This may result in a potential plateau of inactive exchanges in the first quarter of the year 2022. The commodities that are not a part of the live animal regulation but have their prices regulated in Kazakhstan may not be affected as much, but are expected to definitely leave some noticeable mark in the data of imports and exports for the year 2022 (Lukashov, 2022).

3.4 Kazakhstan increases investment in sector of agriculture

Kazakhstan is steadily increasing the amount of investment into its agricultural sector. The share of investment funds being put into the agricultural sector in Kazakhstan is at 6.1%, leading to the understanding and the possible conclusion that there will be more of

an export of commodities from Kazakhstan into other countries such as Czech Republic. This is because of the ACC or the agricultural credit corporation which lends money to subjects in the agricultural field for low rates, making it more profitable for new entrants to enter the field of agriculture in Kazakhstan.

The minister of agriculture in Kazakhstan set a goal for the productivity of agriculture to 250% of what it is now, which would accordingly result in an increase of 70% to processed products being made and thus a potential increase to the exports to other countries as well (Lukashov, 2021).

3.5 Increase in fish exports in the agricultural sector of Kazakhstan

Kazakhstan showed an increase in fish exports to other countries in the year 2021, the estimated value of the amount of fish exported in this year is at 20.8 million dollars, which doubles the amount from the previous year of 2020. Almost 90% of this value comes from caviar.

It was reported that the prices of meat went up by over 10% in October of 2021, furthermore the production of meat products has gone up by over 6%. Reasonably this could mean that the exports of meat and poultry, and possibly their processed products will be on the rise in the export to foreign countries in the year 2022 (Lukashov, 2021).

3.6 Milk prices rising

Milk is a commodity that was fairly popularly bought in Kazakhstan, the average consumption of milk in 2019 was at 4,6 liters. Recently the commodity has been falling down in consumption and its average consumption dropped to 4 liters in 2020 and in 2021 it dropped to 3.7 which is almost a whole liter less than 2 years ago. In addition to this, even the outlands of city areas which usually have higher average milk consumption have seen a drop in their numbers. While the previous facts are in action, in the meantime the import of milk has increased by 5.7% and the export of milk has increased by 14.3% since the previous year as well. The sudden decline in Milk consumption, in addition to the growing import and export demands have increased the price of milk by 9.5%, making it a strongly noticeable rise in the last few years (Lukashov, 2021).

3.7 Apple exports

Kazakhstan exported apples in the estimated value of 1.6 million US dollars to mainly Russia, followed by Uzbekistan and Turkmenistan. The country has large lands dedicated to the harvesting of apples, resulting in a strong exporting potential for this commodity. This fact is proved by the import number of apples which is around 27 million US dollars in 2021. Neighbouring countries such as Uzbekistan, China and Kyrgyzstan as well as countries all the way in Europe such as Poland and Ukraine imported apples to Kazakhstan (Lukashov, 2021).

3.8 Food for livestock

The amount of food available for livestock in Kazakhstan has been unstable in the year of 2021. This is mainly due to an overall decrease of wheat production in the country leading to lower reserves. The largest importer of wheat for Kazakhstan which is currently Russia is not capable of sustaining the full country. Due to these situations, a restriction of exporting different kinds of feed such as hay, rye and oats has been passed and stands since September of 2021.

This restriction is very likely to be shown on the data which will be analyzed later on. It is to be expected that since September 2021, the export of hay, rye and oats commodities will be at a restricted amount, it will affect and decrease the correlation between these commodities and other variable commodities in the list of items being analysed as exports from Kazakhstan (Lukashov, 2021).

3.9 Export of flour in Kazakhstan

Most of the flour Kazakhstan exports is designated for Afghanistan which is currently facing a problematic state. Even though it is true that Kazakhstan is a dominant power in the market with flour in the country, it is closely rivalled by Uzbekistan which has recently began catching up as they use Kazakh resources for their own exporting.

In the scenario that Kazakhstan becomes less demanded in the market in Afghanistan, it will force Kazakhstan to pull some of its exports away leading to possible changes in export destinations for flour. One of the largest export partners for Kazakhstan is Russia which

might result in an increase of flour export to Russia, or possibly countries in Europe (Lukashov, 2021).

3.10 Disturbances in Kazakhstan

A factor that plays a role in exports and imports of Kazakhstan can also be attached to the unrest that took place in the first weeks in January 2022. The situation was discussed on the podcast “The Diplomat” between Ankit Panda and Catherine Putz. These protests took action all over the country with the largest one being in Almaty which is the biggest city in the country. These unrests were on the increase of gas prices. The protests were unexpectedly rough and ended up costing the lives of many people, with the largest and most brutal incident taking place in Almaty. The response of the country to this incident was shutting down the internet in the country for most of the day for a period of two weeks as a form of censorship (Panda & Putz, 2022).

The above-mentioned events also led to a noticeable shift of power inside the Kazakhstani administration. The closest allies of the first Kazakh president Nazarbayev lost their power (mainly the former prime minister Askar Mamin) and Nazarbayev himself has lost the presidency over the national security community. In the country with a substantial involvement of the government into the economy (mainly through state aid programs) such a change can lead to serious modifications of standing economic policies. It is yet too early to evaluate this impact. (Panda & Putz, 2022)

3.11 Organized presentation by the Czech Embassy in Kazakhstan

In 2021, the embassy of the Czech Republic organized a presentation in Nur-Sultan, which was used as a show case of 24 Czech firms in hopes of catching the attention of KazAgro and KazFarm organizations. The showcase ended up being successful, with the highest interest being placed on the Czech breeding cattle area. This demonstrates the interest of Kazakh firms on importing breeding cattle from the Czech Republic to Kazakhstan. This means that the exports of breeding cattle from the Czech Republic is likely to have a higher value in the future, similar to the value it had a few years prior when Czech breeding cattle was exported to Kazakhstan. Another area covered by the event are eggs, seeds for agricultural purposes, veterinary and phytosanitary products, animal feed or seeds,

beer, mineral water, ware and industrial potatoes. This event is another source of information regarding sectors/commodities where the Czech companies are ready to invest in the market of Kazakhstan. As long as the list of those commodities is in line with other sources of information, this should determine the scope of commodities that should be included in this survey. (Kalinová, Olga; Velvyslanectví ČR v Nur-Sultanu, 2021)

4 Practical Part

4.1 Commodity pool

This work is evaluating export potential, from Czech Republic to Kazakhstan on a statistical basis with comparisons to export data on export from Czech Republic to Russia, to Turkey and to Serbia. These three countries have been chosen as they are not member of the European Union and share other similarities with Kazakhstan. After researching potentially common commodity exports from Czech Republic to Kazakhstan and the base of recommendations by Mr. Lukashov, the following commodity list is what is to be used in statistical analysis:

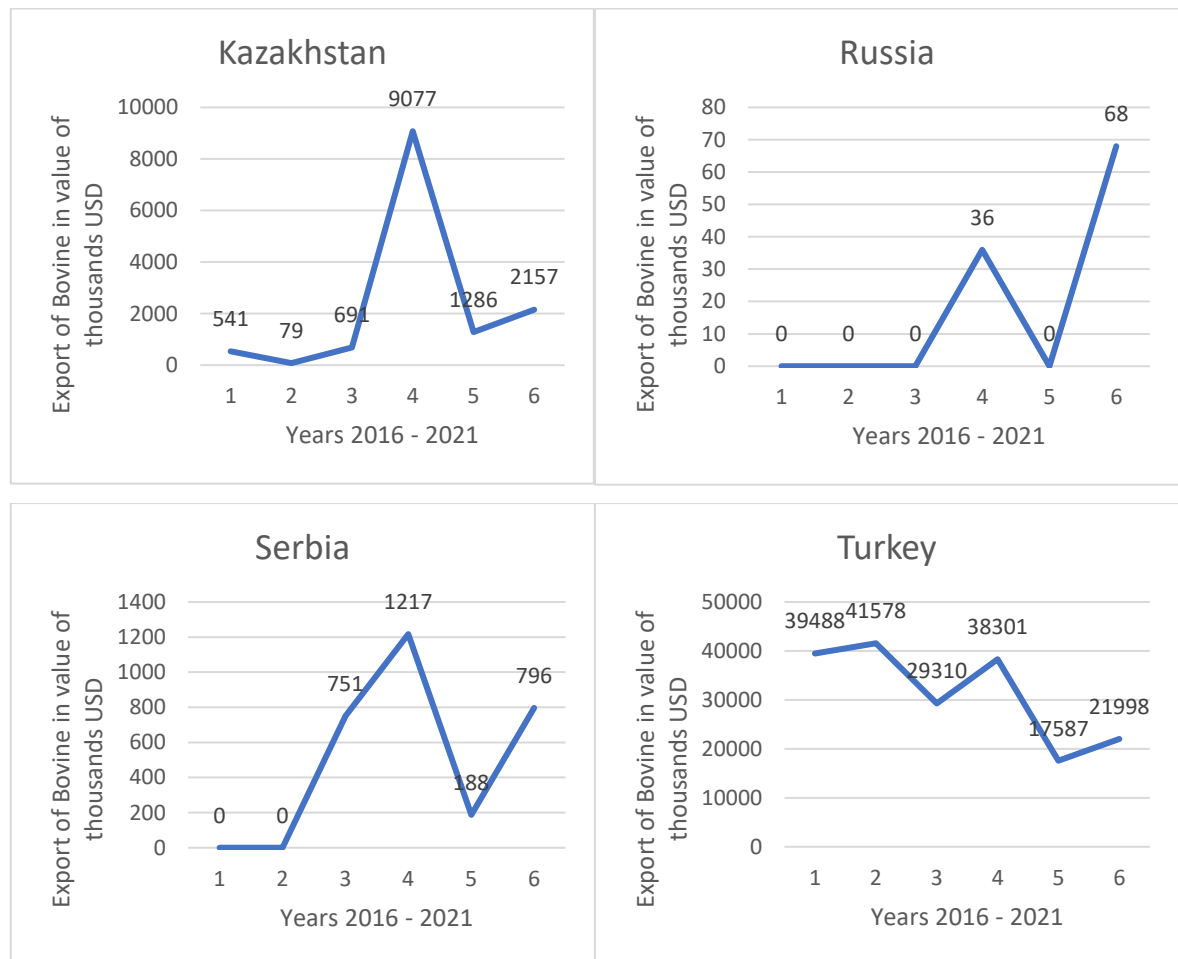
- Bovine animals (live)
- Sheep and goats (live)
- Birds' eggs (in shell)
- Malt, whether or not roasted (including malt flour)
- Vegetable products, roots and turbes
- Food wastes and prepared animal feeds
- Beer made from malt
- Oil seeds and oleaginous fruits

These commodities are to be used accordingly throughout the calculations for testing the potential of export the commodity in question to Kazakhstan and comparing it to the other destinations that are involved in this work. Data for the export of each commodity to each of the listed countries will be listed from the year 2016 up until 2021. In cases of a commodity having no record of being exported to one of the countries, that country will not be included in the comparison for that specific commodity as any statistical analysis being used with that country would not be possible. All the numbers for the export from Czech Republic to the listed countries is withdrawn from the "Czech Statistical Office" (Czech Statistical Office, 2021).

4.2 Bovine Animals (live)

Bovine animals are domestic animals categorized within the species cattle. According to available information, mainly the seamen tall breed is being exported to Kazakhstan. The data extracted from the Czech statistical office gives data for the export of Bovine animals from the Czech Republic to Kazakhstan, in addition to those values for the export of bovine animals from the Czech Republic to Russia, Turkey and Serbia are also included for further comparison of Kazakhstan export potential. The data being worked with below is from the years of 2016 to 2021.

Figure 1: Export of Bovine animals in thousands USD

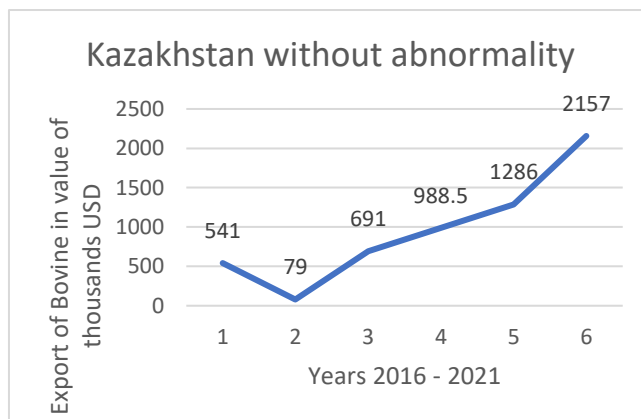


Source: CSZO.cz

As visible from the export of Kazakhstan graph, there is a strong spike in the year of 2019. This spike is causing a shift in the trend line and making the data less accurate. To

extract this abnormality, the point between the neighbouring data points will be smoothed out to help smoothen out the trend.

Figure 2: Export to Kazakhstan without abnormality



Source: CSZO.cz, own processing

The mean for export to Kazakhstan is 2305.17 thousand USD, the standard deviation is at 3393.88 and the lowest number of exported bovine animals to Kazakhstan in the last 6 years was worth 79 thousand USD while the highest was 9077 thousand USD.

To predict the value in 2022, a polynomial equation will be used to foretell a more accurate value which will adapt to the shifts of the data more reliably for this data set. The equation used is listed below:

$$y' = 96.554x^2 - 333.06x + 658.4$$

The predicted value expects the export to Kazakhstan to be at 3058.126 thousand USD, demonstrating a reliable increase with a prediction of a steep continuation of a sharp rise even without the previous abnormality which may have impacted a linear prediction.

Using correlation analysis to compare Kazakhstan to the other three countries helps view the data points and determine how strongly or weakly the correlation between each is. The correlation results are:

Table 2: Bovine correlation to Kazakhstan

	Correlation to Kazakhstan
Russia	0.47994
Serbia	0.78829
Turkey	0.1688

Source: Own processing

These results from table 2 may be impacted by the trend as well and so they do not give a reliable correlation result as the results may be influenced more by the change of data through the set amount of time and the trend. To eliminate the trend from the correlation it is necessary to create theoretical data values which will later be subtracted from the actual values to find residual values which will then be correlated among Kazakhstan, Serbia, Russia and Turkey to find the true correlation without the trend affecting it.

The linear regression equations used to find the theoretical correlations are:

$$\text{Kazakhstan: } y' = -1000000 + 573.91x$$

$$\text{Russia: } y' = -21667 + 10.743x$$

$$\text{Serbia: } y' = -288442 + 143.14x$$

$$\text{Turkey: } y' = 9000000 - 4298.1x$$

Through calculating the coefficient of determination, it can be seen that Kazakhstan has a very low percentage of explained data at 10.01%. Russia has $R^2 = 49.05\%$, Serbia has 28.42% and Turkey at 64.63%.

Table 3: Actual values for Bovine data

Year	Kazakhstan	Russia	Serbia	Turkey
2016	541	0	0	39488
2017	79	0	0	41578
2018	691	0	751	29310
2019	9077	36	1217	38301
2020	1286	0	188	17587
2021	2157	68	796	21998

Source: CSZO

Table 4: Theoretical values for Bovine data

Year	Kazakhstan	Russia	Serbia	Turkey
2016	-689515	-21667	-288442	-160723372.8
2017	-954661	-21667	-288442	-169706401.8
2018	-603428	-21667	-180944	-116977311
2019	4209381	-21280.3	-114241	-155621528.1
2020	-261952	-21667	-261532	-66590684.7
2021	237923.9	-20936.5	-174503	-85549603.8

Source: own processing

Table 5: Residuals for Bovine data

Year	Kazakhstan	Russia	Serbia	Turkey
2016	690055.7	21667	288442	160762860.8
2017	954740.1	21667	288442	169747979.8
2018	604119.2	21667	181694.9	117006621
2019	-4200304	21316.25	115457.6	155659829.1
2020	263237.7	21667	261719.7	66608271.7
2021	-235767	21004.48	175298.6	85571601.8

Source: own processing

Table 6: Bovine Correlation to Kazakhstan without trend

	Correlation to Kazakhstan without trend
Russia	0.47994
Serbia	0.78829
Turkey	-0.1688

Source: own processing

The correlation coefficient shows that the data was not impacted by trend in the previous correlation calculation, as the correlation strength has remained the same with the calculation of the correlation coefficient of the residuals extracted from the difference of the actual and theoretical values.

Using hypothesis testing to determine if there is a significant relationship among the variables of the other countries. Setting the hypothesis scale to:

H_0 : ... there is no significant relationship between the variables

H_1 : ... there is significant relationship between the variables

Using the formula $y' = a + b_1x_1 + b_2x_2 + \dots + b_kx_k$. The data give a constant “a” as -3411.607775, the coefficient of regression “b” for the three countries is 5.405365, 0.095048, 4.327531 making the equation for this data of linear regression:

$$y' = -3411.607775 + 5.405365x_1 + 0.095048x_2 + 4.327531x_3$$

Table 7: Bovine Hypothesis testing P-Values by t-test

	P-Values
Russia	0.2599
Serbia	0.5617
Turkey	0.9512

Source: own processing

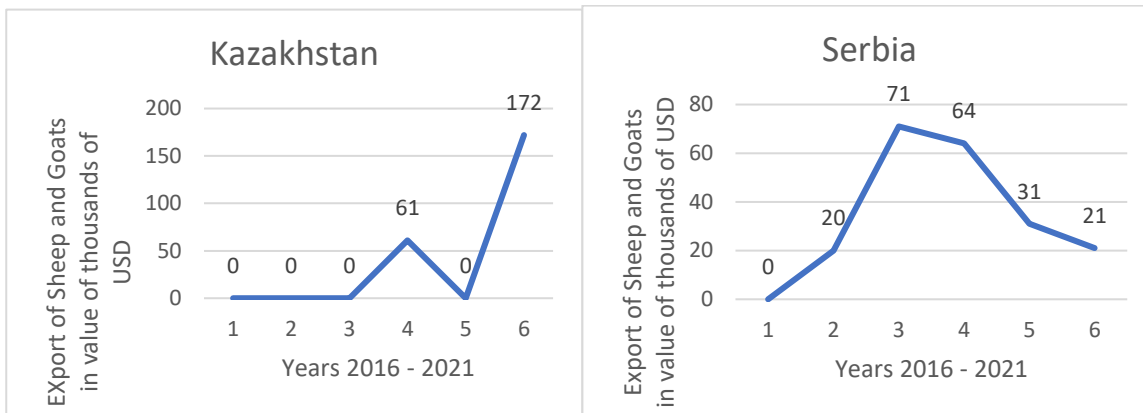
All the P-Values are larger than the alpha which is set at 0.05. The coefficient of determination also known as the R^2 is equal to 69.55%.

Taking into account the prediction as well as the stable correlation of varying from medium weak strength to highly strong, in addition to the exclusion of trend and the anomaly year, the values suggest that Kazakhstan has potential.

4.3 Sheep and Goats (live)

Finding the correlation and comparing the data for sheep and goats is done without the participation of Russia and Turkey as these two do not import this specific commodity from Czech Republic. None the less it is an important commodity of export to Kazakhstan, taking into account the importance of this sector for the agriculture of Kazakhstan, and so will be compared to that of export to Serbia.

Figure 3: Export of Sheep and Goats in value of thousands of USD



Source: CSZO.cz

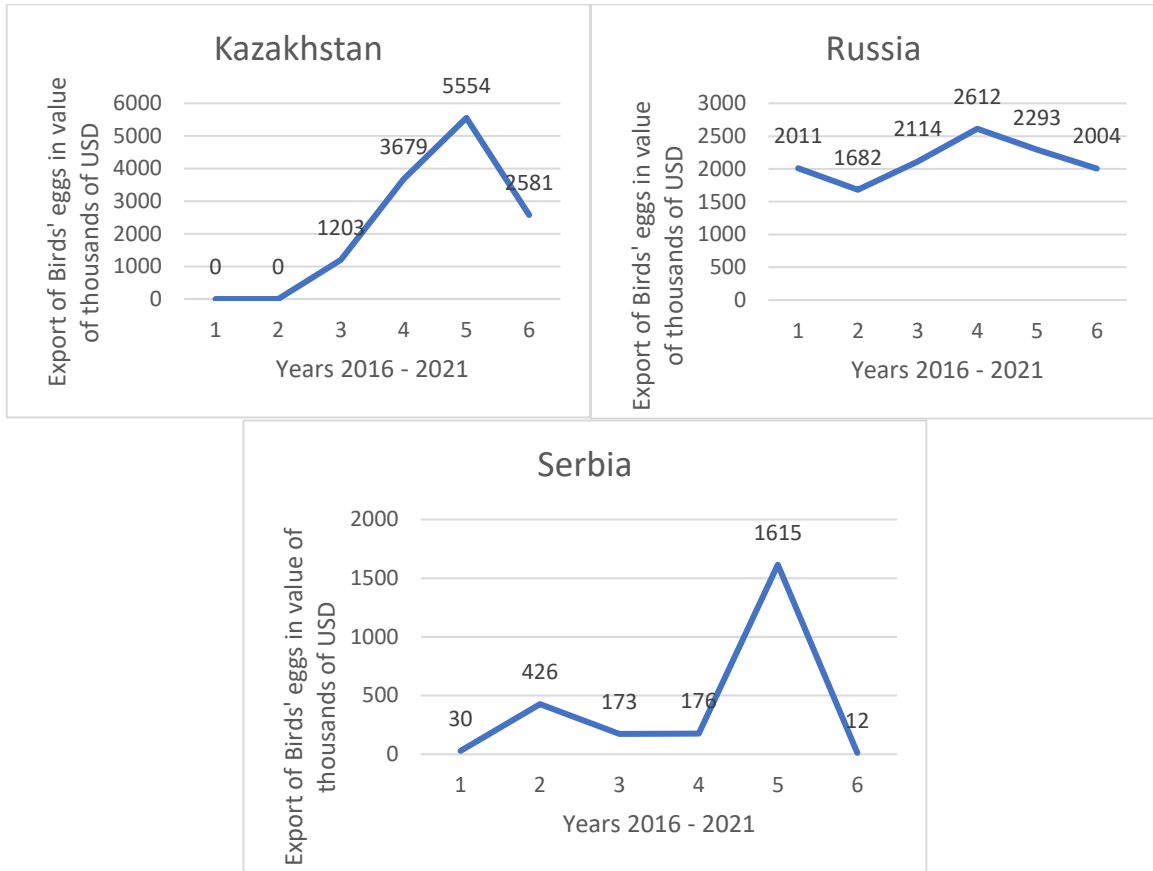
The mean number of sheep and goats exported to Kazakhstan in the years of 2016 to 2021 is 38.833 thousand USD, the standard deviation is 69.6517528. throughout the 6 years, 4 of those years Kazakhstan didnt import any sheep and goats from Czech Republic, and the highest amount was recorded in the year 2021 with worth of 172 thousand USD worth. In comparison serbia has a more consistant export rate with a mean of 34.5 thousand USD, standard deviation being 27.559 and the lowest amount exported being in 2016 while the highest amount in 2018 with 71 thousand USD worth.

The correlation coefficient between the export to Serbia and Kazakhstan is at -0.05444, showing an incredibly weak as well as negative correlation strength between the two. Furthermore the inconsistent history of the export to the country create doubts on its futre, while its recent year shows a possible spark of intrest in the upcoming years. Leading to a very unclear potential for the country of Kazakhstan at the moment.

4.4 Birds' eggs (in shell)

The commodity for bird's eggs will be tested among Kazakhstan, Serbia and Russia, as Turkey has no data on importing birds' eggs from Czech Republic in the specified time range.

Figure 4: Export of Birds' eggs (in shell) in value of thousands of USD



Source: CSZO.cz

The data shows that for Kazakhstan the mean number exported through out the time range is 2169.5, having no export value in 2016 and 2017 and reaching a peak in 2020 with a value of 5554 thousand USD. Russia has a mean of 2119.33, while having a much more consistent export curve throughout the 6 years. Having the lowest number at 1682 thousand USD in the year 2017 and having a maximum at 2612 thousand USD in 2019. Serbia has the lowest mean at 405.33, in addition to having the lowest export non-zero value at 12 thousand USD in 2021. The highest Serbia has imported from Czech Republic was just the year prior the minimum at 1615 thousand USD.

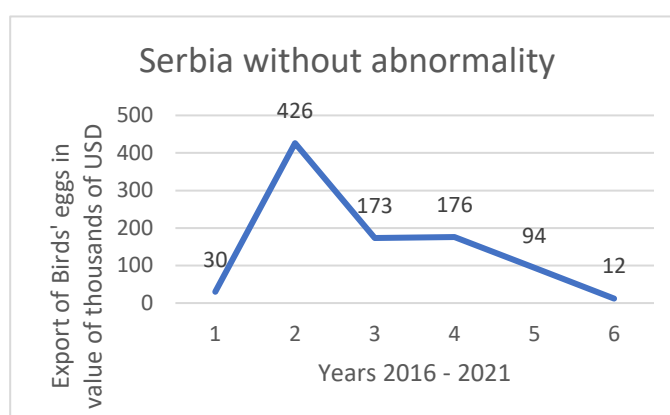
Using the equation listed below, the prediction for the year of 2022 for export to Kazakhstan in eggs' shells will be calculated.

$$y' = -217.45x^2 + 2437.6x - 3064.3$$

The prediction resulted in an estimate of 3343.85 thousand USD in the year 2022. Showing a possible rise since the year 2021, possibly indicating that the sudden break away and decrease in value exported to Kazakhstan may be an anomaly in the form of a sudden restriction.

The year of 2020 for Serbia is an anomaly having a much larger value than all the other years which is affecting the overall trend and mean.

Figure 5: Export of Birds' eggs (in shell) in thousands of USD for Serbia without abnormality



Source: own processing

The correlation coefficients of Russia and Serbia to Kazakhstan are both of medium strength with Russia having $r = 0.71798$, and Serbia having $r = 0.68088$. These correlation values may still be affected by the trend so the correlation must be tested with the residuals of the data to eliminate the possibility of results affected by trend. The linear regression equations used to calculate the theoretical values are:

$$\text{Kazakhstan: } y' = -2000000 + 915.51x$$

$$\text{Russia: } y' = -130294 + 65.6x$$

$$\text{Serbia: } y' = -200291 + 99.429x$$

The coefficient of determination also called as R^2 , shows that Kazakhstan data alone is explained at 60.49%, Russia's data has 15.39% and Serbia has a low percentage of explained data at 9.27%.

Table 8: Actual value for Birds' eggs

Year	Kazakhstan	Russia	Serbia
2016	0	2011	30
2017	0	1682	426
2018	1203	2114	173
2019	3679	2612	176
2020	5554	2293	1615
2021	2581	2004	12

Source: CSZO.cz

Table 9: Theoretical value for Birds' eggs

Year	Kazakhstan	Russia	Serbia
2016	-2000000	1627.6	-197308
2017	-2000000	-19954.8	-157934
2018	-898641	8384.4	-183090
2019	1368161	41053.2	-182791
2020	3084743	20126.8	-39713.2
2021	362931.3	1168.4	-199098

Source: own processing

Table 10: Residual value for Birds' eggs

Year	Kazakhstan	Russia	Serbia
2016	2000000	383.4	197338.1
2017	2000000	21636.8	158360.2
2018	899844.5	-6270.4	183262.8
2019	-1364482	-38441.2	182967.5
2020	-3079189	-17833.8	41328.17
2021	-360350	835.6	199109.9

Source: own processing

Table 11: Birds' eggs correlation to Kazakhstan without trend

	Birds' eggs correlation to Kazakhstan without trend
Russia	0.71798
Serbia	0.68088

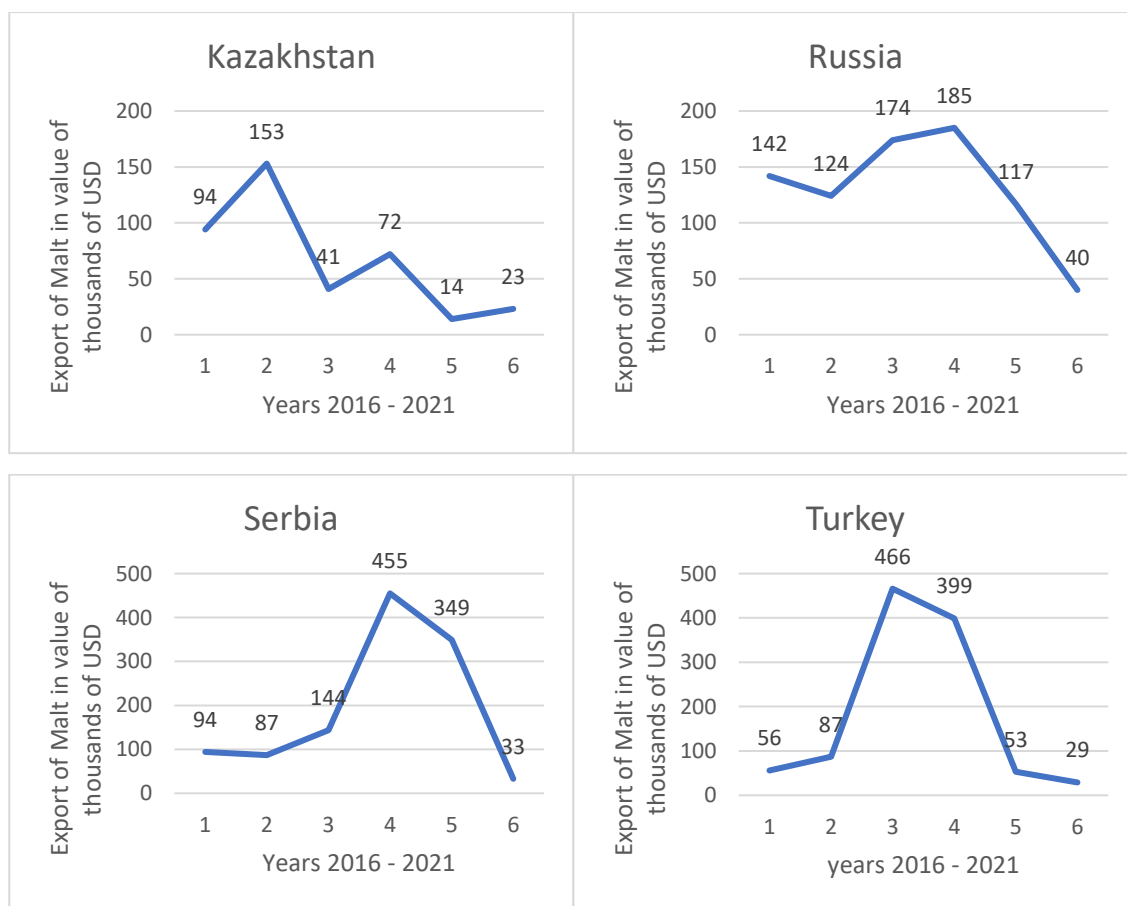
Source: own processing

This result shown in Table 11 state correlation coefficients for Kazakhstan correlated with Russia and Serbia, in both cases the result is without trend. The values are identical to those of the results before the extraction of the trend. The prediction as well as the correlation show that Kazakhstan could have potential depending on the actual value in 2022.

4.5 Malt whether roasted (including malt flour)

Malt belongs to one of the traditional export items of the Czech Republic also in relation to the developed beer production sector. Similarly, as in the exports of beer, one of the limiting factors is prevailing religious limitations such as ban on alcohol consumption for Muslims.

Figure 6: Malt whether roasted data



Source: CSZO.cz

The Malt commodity as illustrated in Figure 6, is seen to be decreasing among all countries listed. Russia and Serbia had their peaks in the year 2019, Turkey had it the year prior and Kazakhstan in 2017 and has been decreasing at a steady rate ever since. Russia, Serbia and Turkey are all reaching their lowest amount of Malt imported from Czech

Republic in the past year of 2021, while Kazakhstan is the only one which is slightly on the upwards way having the lowest in 2020 and jumping slightly back up to 23 thousand USD in 2021.

The fixed base index will be used to calculate the change of the data in the last year 2021 and comparing it to the first listed year 2016. The results for the fixed base Index calculation for the four countries is listed below in table 12.

Table 12: Malt Fixed base Index

Kazakhstan	Russia	Serbia	Turkey
0.244681	0.28169	0.351064	0.517857

Source: own processing

To further help show the potential of these countries for the export of this specific commodity, a comparison between the highest and lowest values can also show a spectrum of how much can the interest for this commodity shift in that specific country. Using the maximums and comparing them to the minimums for each country in the specified time range with the use of the equation below with the results in table 13.

$$y = \frac{\text{minimum in most of these cases the close present}}{\text{maximum}}$$

Table 13: Malt maximum and minimum comparison

Kazakhstan	Russia	Serbia	Turkey
0.091503	0.216216	0.072527	0.062232

Source: own processing

It is important to show the difference in Kazakhstan's last year shift change in direction compared to the other countries to find how much more potential Kazakhstan has for this commodity in terms of Export from Czech Republic. Using the chain base Index to compare the present year of 2021 to the previous one 2020 can be seen in table 14 below.

Table 14: Malt Chain base Index

Kazakhstan	Russia	Serbia	Turkey
1.642857	0.34188	0.094556	0.54717

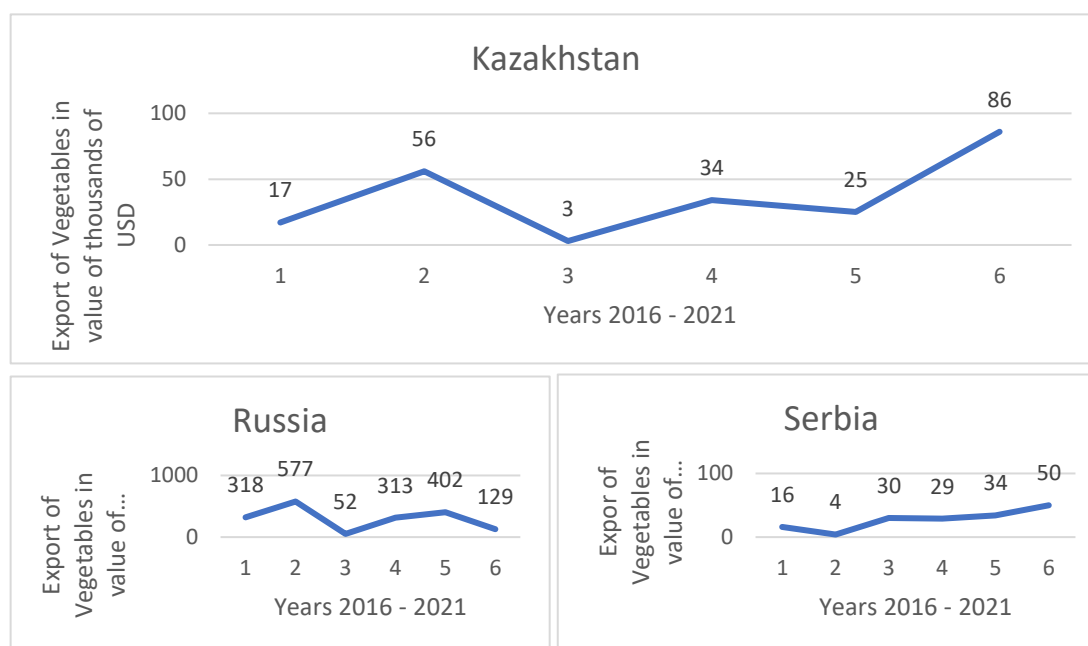
Source: own processing

The results in table 14 show that Kazakhstan exported from Czech Republic at a rate of 164.2857 %. Demonstrating a strong increase since 2020. None the less the potential for this commodity is not as strong as Kazakhstan is still only exporting only almost a quarter of what it did in 2016.

4.6 Vegetable's products, roots and turbes

The country of Kazakhstan has vast fields in its large area of land that it occupies. Large portions of these fields is dedicated to agriculture out of which, in the limited scope and mainly in the south of the country they are used for the production of the vegetables. Huge quantities of vegetables are being imported from other countries like Uzbekistan. Figure 7 below illustrates the data of vegetables exported from Czech Republic to Kazakhstan, Russia and Serbia. Turkey is not included in this testing for this specific commodity as it does not import this commodity from Czech Republic and in the 6 years range it only imported once in year 2017, furthermore the amount in that year was equal to a mere 3 thousand USD.

Figure 7: Vegetable's products, roots and turbes data



Source: CSZO.cz

Through the years 2016 to 2021 the mean number for vegetable products exported in value of thousands of USD is as follows: Kazakhstan at 36.833 thousand USD, Russia with 298.5 thousand USD and Serbia with 27.16 thousand USD. The highest amount reached out of all the listed countries is 577 thousand USD by Russia in 2017, it is also important to note that the following year of 2018 was also the lowest recorded year in the tested time range with a drop to 52 thousand USD. Kazakhstan is seen to be importing less than Serbia in the first 5 years up to 2020 even reaching a low of 3 thousand USD in 2018. In the year 2020 to 2021 both Serbia and Kazakhstan have a rapid increase in the amount of exports for this commodity from Czech Republic while Russia is on the decline. The chain base index will be used to test the change between the present year in this case 2021 to the year prior 2020. The results of the chain base calculations are shown in table 15.

Table 15: Vegetables products, roots and turbes chain base index

Kazakhstan	Russia	Serbia
3.44	0.320896	1.470588

Source: own processing

The chain base index shows that Kazakhstan is at 344% of export in value of thousand of USD in 2021 compared to 2020.

To find a reliable correlation coefficient for this commodity compared to Kazakhstan by Russia and Serbia, the correlation will be found through the residuals that are the difference between the actual and theoretically calculated values through linear regression equations listed below:

$$\text{Kazakhstan: } y' = 8.5333 + 8.0857x$$

$$\text{Russia: } y' = 419.4 - 34.543x$$

$$\text{Serbia: } y' = 1.2667 + 7.4x$$

Kazakhstan has a coefficient of determination equal to $R^2 = 25.59\%$, Russia with $R^2 = 11.71\%$ and Serbia with 77.23% . Showing a strong amount of explained data for Serbia and less reliably explained information for Kazakhstan and Russia. The coefficient of correlation results without trend from the linear regression equations are shown in table 16.

Table 16: Coefficient of correlation without trend

Coefficient of correlation without trend	
Russia	-0.13073
Serbia	0.30491

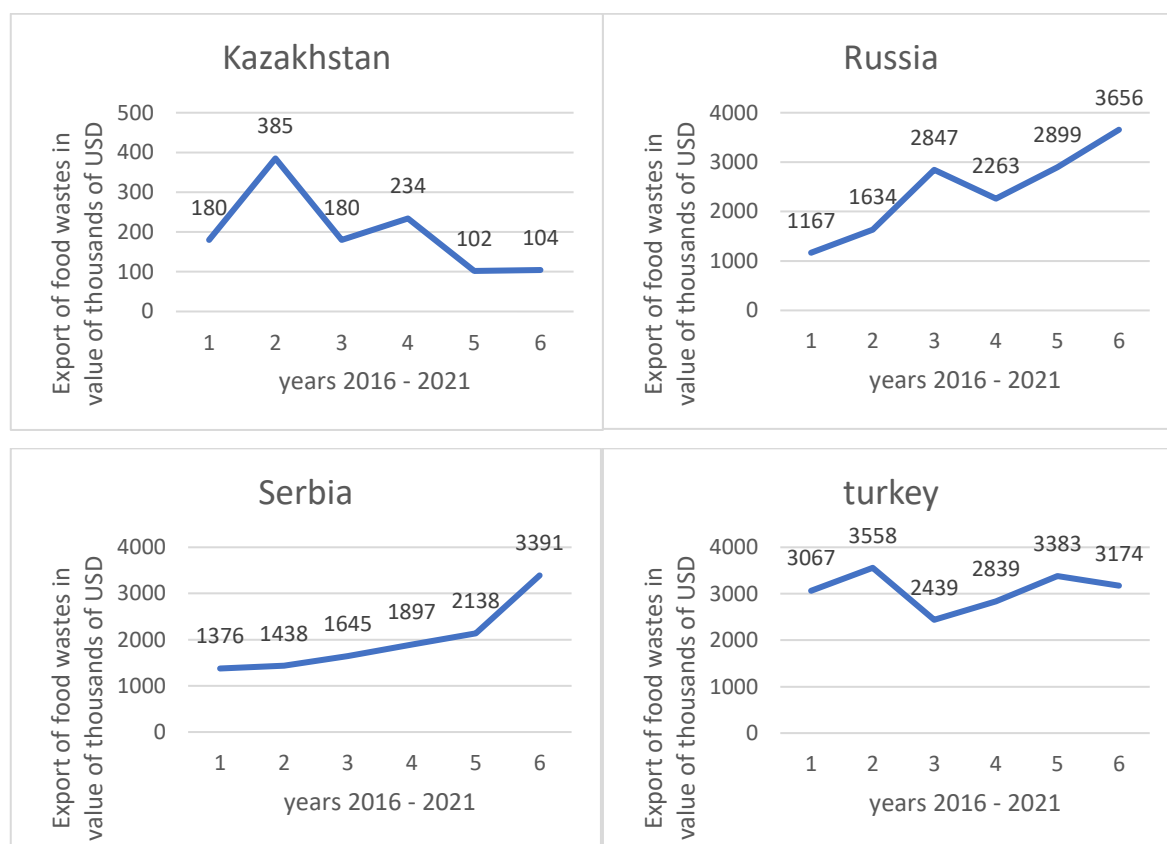
Source: own processing

Russia having a negative weak correlation of -0.1307 and Serbia a medium weak of 0.30491 shows that the data between Kazakhstan and these countries is not very similar. On the other hand, the steady increase of Kazakhstan through the years as well as the steady chain base results show potential for this commodity.

4.7 Food wastes and prepared animal feeds

With quickly increasing quantities of cattle Kazakhstan is facing a bottleneck in relations to the necessity to ensure sufficient feeding. The market of feeds for pets and special animals like horse is underdeveloped. Figure 8 below shows the data further analysed below.

Figure 8: Food wastes and prepared animal feeds data



Source: CSZO.cz

The mean number for the export of this commodity in the 6 years show a clear distinction between Kazakhstan and the other 3 countries. Kazakhstan has a mean of 197.5 thousand USD. Russia has 2411 thousand USD, Serbia with 1980.83 thousand USD and Turkey has 3076.67 thousand USD. The lowest number in the time range is recorded by Kazakhstan in the year 2020 with only 102 thousand USD. On the other hand, the other countries have all kept a consistent high level export rate, none falling below 1000 thousand USD in the last 6 years and all scoring as high as over 3000 thousand USD at some point. The chain and fixed base index are calculated to show the key changes in exports of this commodity with the present value for each country being compared to either the prior year or the original year which in this study is 2016. The results for these calculations are in table 17.

Table 17: Food wastes, chain base Index and fixed base Index

Fixed base index			
Kazakhstan	Russia	Serbia	Turkey
0.577778	3.132819	2.46439	1.034888
Chain base index			
Kazakhstan	Russia	Serbia	Turkey
1.019608	1.261125	1.586062	0.938221

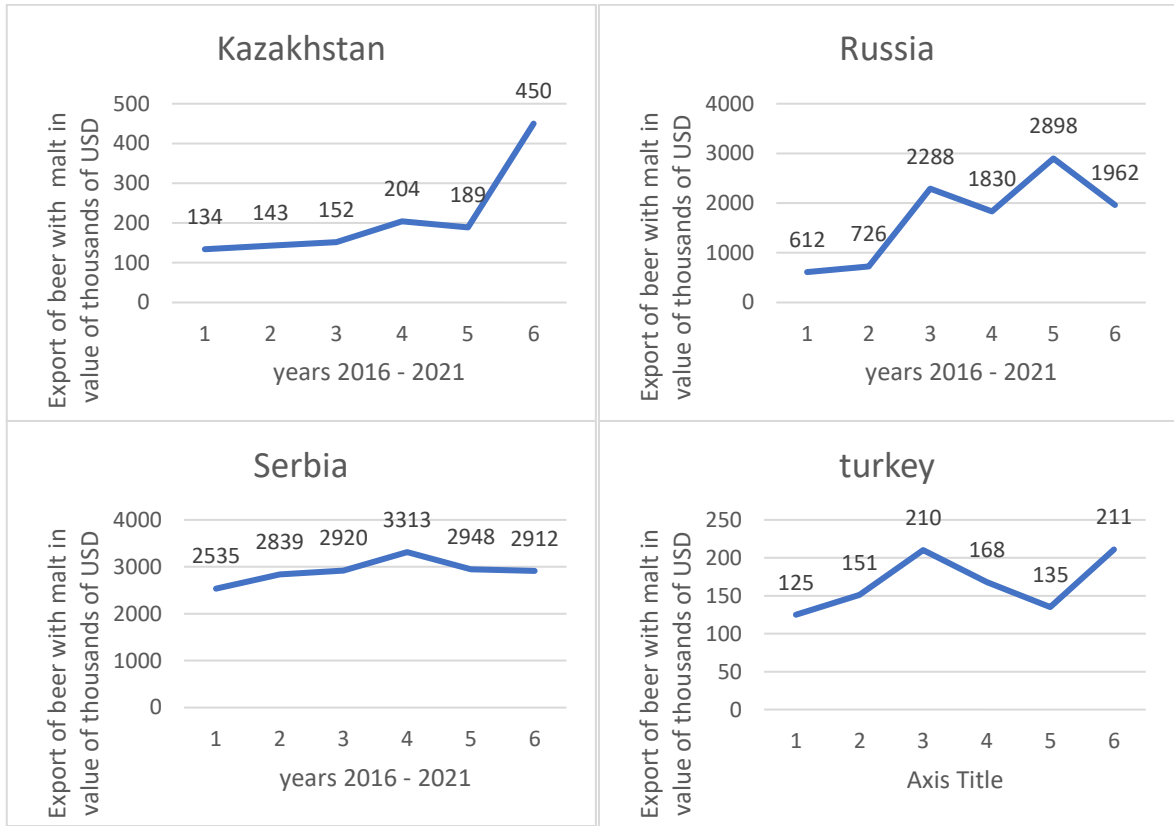
Source: own processing

Kazakhstan is the only country to be declining in the spectrum of the last 6 years in addition to it having small export values in scale comparison to the other three export destinations. In comparison to the year 2020, Kazakhstan has increased its import for this commodity from Czech Republic by a mere 1.96%.

4.8 Beer made from malt

Beer is the most successful agricultural final product in the export of the Czech Republic. Various brands of Czech beer are considered to be of premium quality worldwide. On the market of Kazakhstan Czech beer is competing with a low-quality local production as well as imports from Russia. Another limiting factor comes from the fact that approximately half of the population is actively following Islam.

Figure 9: Beer made from malt data



Source: CSZO.cz

The data in Figure 9 shows that there is a variation of types of two countries, Kazakhstan and turkey which have lower values, but are on the rise since 2020 and have a sharp growth rate in 2021. The other type is Russia and Serbia which both have higher values and are showing signs of plateauing and in Russia’s case even decreasing. The mean value for Kazakhstan is 212 thousand USD and 166.67 thousand USD for Serbia. Russia having 1719.33 thousand USD while Serbia having the highest mean of 2911.17 thousand USD.

Although Kazakhstan has a higher maximum than Turkey it is also less consistent which is mainly caused by the year 2021 which is inflating the value and is acting as a sort of abnormality. To check the possibility of Kazakhstan showing potential for future exports of this commodity on a larger scale a correlation analysis will be used to check possible similarities between the data of Serbia and Russia as well as Turkey to possibly identify a trend and or similar data shifts among the growths. The correlation coefficient of the residuals calculated through linear regression equations, listed below, to find the appropriate theoretical value which is to be subtracted from the actual to create the correct residual value,

all in order to withdraw any possible trend from the time series analysis is listed in table 18 below.

$$\text{Kazakhstan: } y' = 35 + 50.571x$$

$$\text{Russia: } y' = 438.53 + 365.94x$$

$$\text{Serbia: } y' = 2650.7 + 74.429x$$

$$\text{Turkey: } y' = 132.67 + 9.7143x$$

Table 18: Beer made from malt correlation coefficient without trend to Kazakhstan

Russia	0.28128
Serbia	0.20088
Turkey	0.58756

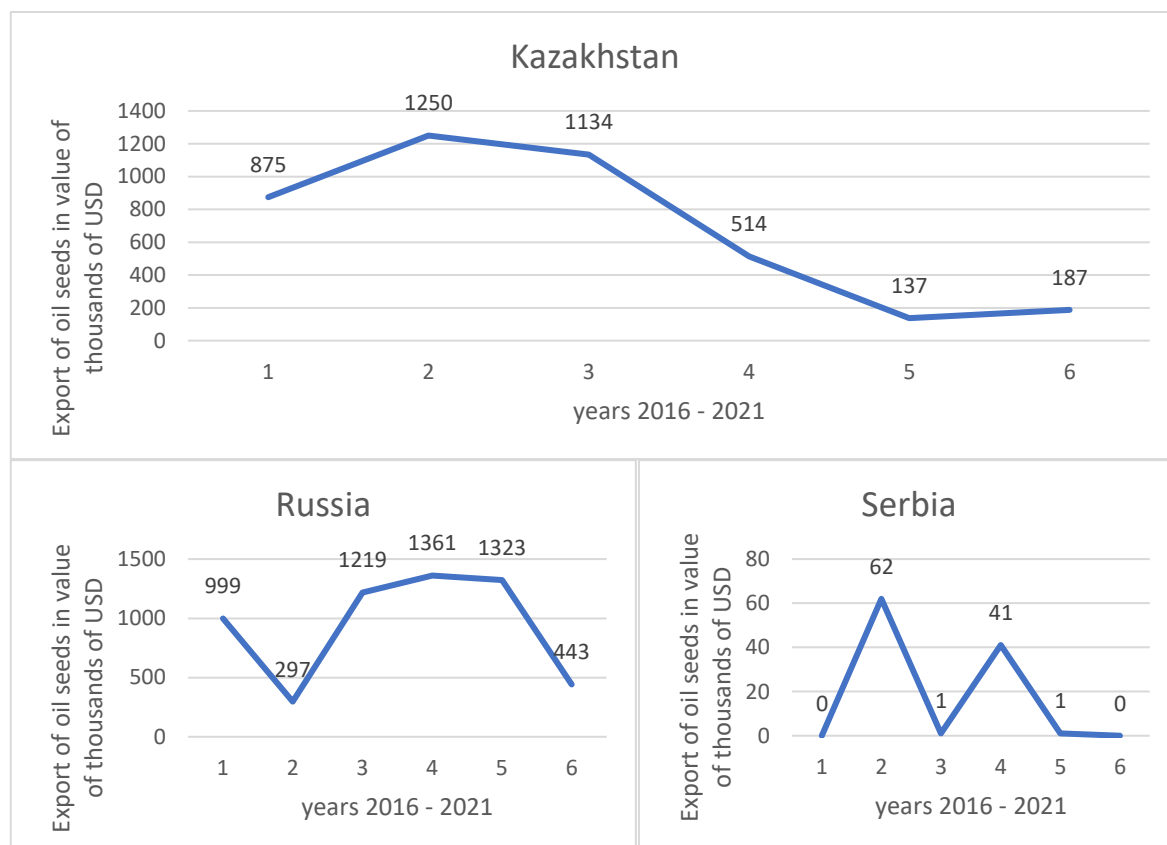
Source: own processing

The results show a correlation of medium strength between Turkey and Kazakhstan, while having a weak correlation with both Russia and Serbia. The data for Kazakhstan had a stable 62.44% of coefficient of determination, Russia's data was explained from 58.64%, Serbia had 31.31% and Turkey with a low 24.18%. The number show that even though the country imports less, there may be a trend in going upwards in the future, although as of now the value exported to Serbia and Russia are still much higher and thus have more potential.

4.9 Oil seeds and oleaginous fruits

Another sector where Kazakhstan searches for an improvement of cultivated species.

Figure 10: Oil seeds and oleaginous fruits



Source: CSZO.cz

The data in figure 10, shows a consistent curve for the export of oil seeds and oleaginous fruits to Kazakhstan from Czech Republic, with a mean of 682.83 thousand USD in the set time range of 6 years with the highest being 1250 thousand USD in 2017 and lowest being in 2020 at 137 thousand USD. Russia has a higher mean of 940.33 thousand USD with a larger maximum at 1361 in 2019, while the lowest being in 2017 at 297 thousand USD.

Serbia has a very inconsistent data set in the year between 2016 and 2021 in addition to having rather smaller value in the exports with a mean of 17.5 thousand USD, of which 4 years were at 1 thousand USD or 0. The fixed and chain-based index are used to compare the changes between the last two years and between the original year and latest for each country in table 19 below. Due to the fact that it is not possible to divide by a 0, Serbia is not included in the table.

The data for Kazakhstan in Oil seeds may be inaccurate to be measured by linear regression as the showcases a large curve which disorients the line of prediction. Using a polynomial parabola, a more reliable results can be found. The equation used for the predicting of the data for Kazakhstan in the year 2022 is listed below:

$$y' = -47.661x^2 + 122.22x + 977.9$$

Using the formula to find the results for the period 7 or in this case year 2022, the result estimates that the export will be -501.949 thousand USD which is impossible as the export can not be in the negatives. This shows plainly that the prediction sees the commodity to be decreasing in the following year.

Table 19: Oil seeds and oleaginous fruits, fixed base index and chain base index

Fixed chain index	
Kazakhstan	Russia
0.213714	0.443443

Chain base index	
Kazakhstan	Russia
1.364964	0.334845

Source: own processing

As of in 2021 both countries have gone down overall in their imports from Czech Republic regarding this commodity compared to 2016. Kazakhstan importing 21.37% of what it did 6 years ago while Russia being at 44.34%. On the other hand, comparing the changes in export of oil seeds and oleaginous fruits for the years 2021 and 2020, shows a difference percentage wise by 103%. Kazakhstan is making a slow rise with a 36.49% increase since 2020, while Russia decreases its value of imports for this commodity by 66.51%. The values calculated leading to the assumption that Kazakhstan does not have potential in terms of export of this commodity.

5 Results and Discussion

5.1 Bovine Animals (live) results

The cause for the abnormality in Kazakhstan in the year 2019, where the export in value of 9077 USD was clearly a spike compared to the other values, was a lift of restrictions from the side of Kazakhstan on import of Bovine animals from the Czech Republic. Regretfully in 2020 it was imposed again.

The correlation results concluded a variety of results for the strength of correlation to Kazakhstan between the listed countries. Russia has a medium correlation strength on the weaker side at 0.47994. Serbia has a relatively strong correlation at 0.78829 and Turkey has a very weak correlation strength at 0.1688. These results stayed the same even after testing the correlation with residuals in order to extract any possible present trend. This means that the number of bovine animals exported to these countries isn't affected as much by the past export but more by the specific situation of that current year and the need for the commodity in that time.

The results of the P-Values for the hypothesis testing are all larger than alpha thus for all the countries the H_1 hypothesis is rejected meaning that H_0 stands and there is no significant relationship between the variables in the data set.

In the end it is possible to conclude that even after the reduction of the anomaly for Kazakhstan in 2019, the potential is still higher than for the other destinations. This result is confirmed by an ongoing interest of Czech exporters in the market of Kazakhstan.

5.2 Sheep and Goats (live) Results

The similar means for the value of exported sheep and goats to Serbia and Kazakhstan show a similar potential for demand for this commodity in both if these countries over the span of those 6 years. While Serbia has a much more consistent curve indicating a possible trend of interest in the commodity, Kazakhstan demonstrates a much larger export potential with the amount imported into the country in 2021 at 172 thousand USD. This shows that when Kazakhstan has interest in this commodity it is more likely to import a much larger amount from Czech Republic. In addition to that the correlation between Serbia and Kazakhstan is extremely weak and thus no more comparing between these two countries

for this commodity is necessary. The potential in the end would be more likely towards Kazakhstan as it is on the rise, with the main issue being its inconsistency and the main question is whether the sharp increase in the last year is an anomaly or the beginning of a trend.

5.3 Birds' Eggs in shell Results

The results for Birds' eggs commodity shows that the item has little to no trend in the years of 2016 to 2021 in being exported to Kazakhstan, Russia and Serbia from Czech Republic. The R^2 or the coefficient of determination, showed that the data for each of the countries is highly unexplained with the highest percentage being for Kazakhstan at little over 60% and the smallest being for Serbia at little under 10%. In both cases these are not strong percentages, and it can be expected that these data values are highly impacted by situational decisions, global or country restrictions. Main factor would be development in investments into poultry breeding sector, mainly opening of new premises. The medium positive strong correlation results for Russia and Serbia in comparison to Kazakhstan show that even though when these values are presented without a trend, the calculations still show a reliable correlations strength. The polynomial regression prediction showed an expected increase in value exported to Kazakhstan in the following year. Due to the sudden decrease in export to Kazakhstan for birds' eggs in shell in 2021, it is necessary to be wary as this drop is mainly due to the cause of restrictions related to veterinary issues in the country and thus may be temporary.

5.4 Malt whether roasted (including malt flour)

As was seen in Figure 6, all the countries in question have decreased the number of Malt exported to them from Czech Republic. Nonetheless, Kazakhstan is showing a somewhat potential comeback with a slight increase in the past year. The results from the fixed base index calculations in table 12 show that the values for all countries have gone down considerably. In the last year Kazakhstan imported only 24.47% of what they imported in 2016, Russia having 28.16%, Turkey at 35.1% and Turkey having the least change compared to all at 51.78%.

After comparing the maximum and the minimum values of each country with the results in table 13, it can be seen that Turkey which was thought to have the least change in export from Czech Republic compared to the year 2016 is in fact the one that has the largest range of inconsistency as compared to its peak year it only exported 6.22%. Kazakhstan also has a large difference with comparison to its peak year with 9.15%, with some similarities to Serbia which has 7.25%. Russia has the lowest range of change out of all with 21.62%.

The results from the chain base index calculations in table 14 show that even though Kazakhstan has a large range between its peak year and its low year like the other countries, Kazakhstan is the only one that is on the rise with having 164.28% worth of export since 2020. The remaining countries being on the decline, being below 60%, Serbia even being below 10%, of what they exported in 2020. Showing that Kazakhstan has a high possible range of export interest and combining it with the fact that the country is on the rise with the export from Czech Republic regarding this commodity, Kazakhstan can be listed as having potential on importing it.

5.5 Vegetable's products, roots and turbes (results)

The data shows a similarity in cycled growth among Kazakhstan and Serbia and a slow decline for Russia. The listed means for the 3 countries show that Russia has a much higher mean than the other two countries, even if Kazakhstan and Serbia combined their means, Russia would still have well over 200 thousand USD average numbers more. On the other side, even though Russia has a larger potential on a high export amount, it is on a vast decline at the moment in the year 2021. The results from the chain base index in table 15, show that Russia exported 32.08% of what it exported in 2020. Kazakhstan and Serbia have a much higher potential in terms of the next future years as they are on a steady rise. Serbia has 147.05% in 2021 compared to the previous year which shows a good amount of potential. Furthermore, Kazakhstan exported 344% in 2021 then what it exported of this commodity the year before. Although this undoubtedly shows a potential for future export of Vegetable products such as roots and turbes from Czech Republic to this country, it is possible that this value is simply an anomaly of a lift of regulations for possibly a brief period of time. This can be disputed due to the steady increase through out the last 3 years which give reason to the fact that the interest for this commodity from Czech Republic is high and was on a rise even without the lift of the sanctions put in place in the past.

The coefficient correlation results from table 16 show weak correlations for both Russia and Serbia to Kazakhstan. Russia having a negative weak correlation and Serbia having a medium weak one. This shows that the two countries have data that have little similarity to the data of Kazakhstan in the tested time spectrum, leading to a conclusion that the shifts of export to each of these countries is affected by specific regulations, political relations and economic situations of each specific year, showing that Kazakhstan's rise in export is not as much a global or regional factor that is common among all or most countries, as Russia and Serbia in addition to Turkey are large export destinations of Czech Republic, but rather is specific to Kazakhstan itself. Thus, Kazakhstan has potential for the export of vegetable's products from Czech Republic.

5.6 Food wastes and prepared animal feeds Results

The large differences in the means and the overall minimal value for Kazakhstan show a rather small potential for the export of this commodity. The fixed base index shows a decreasing export to Kazakhstan as in 2021 the country imported 57.77% of what it did in 2016. When comparing this to other countries that import this commodity from Czech Republic, Russia is in the steepest growth at 313.28% followed by Serbia at 246.43% with Turkey at 103.48%. Furthermore, Kazakhstan is not showing much potential in growth for the future, as its chain index is showing little under 2% growth since the prior year. Comparing that to Serbia which has an increase of 58.6%, while already importing in the range of thousands, in that same year shows that it would most definitely be more beneficial to focus on importing to countries like Serbia with more export value history and higher growth rates, rather than to Kazakhstan with unsatisfactory values such as it has. The statistical time analysis using fixed and chain index in table 17 show additional proof that Kazakhstan has little potential for the import of food wastes and prepared animal feeds from the Czech Republic. A possible way to overcome the limitations is a joined production on the territory of Kazakhstan as illustrated by the activities of the Czech company Microp Čebín.

5.7 Beer made from malt Results

The results show that there is a slight correlation of medium strength equal to 0.58 between Kazakhstan and Turkey, showing a common similarity in potential growth in larger export potential from the point of view of Czech Republic. It is possible to conclude that Kazakhstan has a future potential for larger scale imports far greater than the other three countries. This is because Russia, while having a large mean number in the last 6 years, it is slowly falling down. Serbia on the other hand, although not falling, is on a consistent rate resulting in it being a reliable importer of this commodity possibly with more potential than Kazakhstan. In regards to this commodity it is rightfully possible to conclude that Serbia is as of the moment is a much better choice of priority for the export of beer made from malt and while Kazakhstan is showing larger growth potential for the future, its values are much lower than that of Serbia. In addition to that it is possible that the latest year for Kazakhstan is a simple abnormality due to the size of the increase, the main issue seems to be how Czech beer would succeed in establishing itself in the level of premium brands in Kazakhstan.

5.8 Oil seeds and oleaginous fruits Results

The data shows that among the 3 countries, Kazakhstan and Serbia have little potential at the moment for focus on investing or exporting to. Serbia has a clear inconsistent data set with very low values making it the least potential wise out of the 3. Although Kazakhstan has a slight growth in the last 2 years, the values are much lower than the values of Russia including the overall mean for the export in the set time range. It is reasonable to be wary of the steep fall in 2021's export to Russia as it does show Russia importing at 33.48% of what it did the year prior. The prediction created further showed a decrease in the following year. However, it is possible this value is an abnormality, and will aim to correct itself and rise back up in the next few years, unlike Kazakhstan that has been importing less for the last 3 years, thus decreasing the likelihood of a temporary abnormality in its situation.

6 Conclusion

Kazakhstan has vast potential for many commodities for export from the Czech Republic. After analysing the chosen commodities and further comparing the data with other non-EU countries through various statistical tools, the conclusions on whether each of the commodities sees Kazakhstan as a destination with potential for export from Czech Republic have been made.

The everlasting interest for the import of Bovine animals (Live), that has shown data with more potential for export from Czech Republic than Russia, Turkey and or Serbia. Thus, Bovine animals have potential.

The sheep and Goat (live) commodity favours Kazakhstan, while understandably this is mainly due to the final year and its sudden rise which may or may not be an anomaly. None the less it would be foolish to not investigate this commodity as it is a possible beginning of a future trend. Thus, Sheep and Goats have potential.

The Birds' eggs in shell commodity showed a strong incline earlier with a fall in the last year which is affected by heavy restrictions in the country of Kazakhstan. While the potential is definitely there, the question is if those restrictions will be lifted in the future. Thus, Birds' eggs in shell commodity still have potential.

The Malt whether roasted (including malt flour) commodity showed a good amount of value that the country of Kazakhstan is capable of being interested in, showing a healthy shift from the fall in previous year to a slow but steady growth. Thus, the Malt whether roasted commodity has potential.

Vegetable's products, roots and turbes are a commodity for Kazakhstan with a steady rise as was determined by time analysis such as the chain base index. While Russia being on a decline and Serbia not having a strong mean or as high a value in the recent year, Kazakhstan has potential for the export of vegetable's products, roots and turbes from the Czech Republic.

Food wastes and prepared animal feeds have been at a low in the recent years in Kazakhstan and even though the chain base index shows a slow rise, the fixed base index confirms that the values are much lower than what they were at the beginning of the 6 year period. In addition to that, the values are much smaller than that of the other three countries. Leading to the conclusion that the export of the commodity of food wastes and prepared animal feeds does not have potential to Kazakhstan.

The potential of beer made from malt as a commodity of export to Kazakhstan is of two possible viewpoints. First is that the recent year is showing an immense rise, one possibly being a less reliable anomaly or the beginning of a new high demand for this commodity from Czech Republic to Kazakhstan. The other side of this problem lies in the religious aspect of the country and its religious majority being Muslim, (a religion that forbids alcohol), therefore having a much lesser demand than in the countries that were compared. In conclusion the commodity of beer made from malt should be seen as having no potential at the moment, with a possibility of that potential developing in the future should the data from the recent year turn out to not be an anomaly.

The export to Kazakhstan in Oil seeds and oleaginous fruits has been shown to be at a steady decrease for a couple of years now. While the compared countries definitely don't have potential, Kazakhstan was shown to have fallen much lower than what it originally imported through the fixed base index. In the end the commodity of oil seeds and oleaginous fruits does not have potential in terms of export to Kazakhstan at the moment.

Taking into account the impact of the sanctions imposed by the EU towards Russia in the current moment (as well as possible future Russian contra sanctions), it is clear that Czech exporters will be forced to increase their efforts on other markets. Kazakhstan can be one of such potential markets, although with limitations given by its relatively small population of 19 million and average GDP per capita comparable to Bulgaria. This thesis shows some of the commodities with potential, but it can be expected that there are more gaps on the market that are not yet covered by the Czech export. Among the agricultural commodities, already exported from the Czech Republic to Kazakhstan, the highest export potential seems to be mainly in bovine animals (Live), sheep and goats (Live), Vegetable products, Malt and possibly Birds' eggs. These results are in line with the interest of Czech companies registered by the embassy of Czech Republic stationed in Nur-Sultan.

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