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Analysis of Wheat Production in Turkey

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Thesis title

Analysis of Wheat Production in Turkey

Objectives of thesis

The ultimate goal of the author is to characterize the wheat production in Turkey, find the main trends and the patterns of production. In addition to this, the author answers the question if the country is self-sufficient in wheat, finds the most important factors influencing the production and describes the situation that farmers face – if they are actively subsidized by the government or they are independent.

Methodology

In order to reach the goals described above, the author works with numeric data provided from the Turkish statistical office and FAO. The author primarily relies on empirical methods, among which there are: self-sufficiency, logarithmic dissolution of factors and break-even point.

The proposed extent of the thesis

60 – 80 Pages

Keywords

self-sufficiency, Turkey, wheat Production, Foreign Trade, Food Security.

Recommended information sources

Imran, M., & Ozcatalbas, O. (2021). Optimization of energy consumption and its effect on the energy use efficiency and greenhouse gas emissions of wheat production in Turkey. Discover Sustainability, 2(1), 1-13.

Tipi, T., Cetin, B., & Vardar, A. (2009). An analysis of energy use and input costs for wheat production in Turkey. Journal of Food, Agriculture & Environment, 7(2), 352-356.

Unakıtan, G., & Aydın, B. (2018). A comparison of energy use efficiency and economic analysis of wheat and sunflower production in Turkey: A case study in Thrace Region. Energy, 149, 279-285.

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Declaration

I declare that I have worked on my master's thesis titled "Analysis of Wheat Production in Turkey" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2023   _____

Analysis of Wheat Production in Turkey

Abstract

The ultimate objective of the author's is to describe the wheat production in Turkey as well as to identify the primary trends and patterns of production in the country. In addition to this, the author provides an answer to the question of whether or not the nation is self-sufficient in wheat, identifies the most important factors that influence production, and describes the situation that the country faces in terms of this important commodity.

Additionally, the author does an estimation of a linear regression, which will assist the author in determining the elements that have the greatest impact on the wheat output in Turkey, and then the author proceeds to quantify the effect of each significant economic and social aspect. The author uses the data on numbers that were supplied by the Turkish statistics office and the FAO in order to work toward the objectives that were outlined before. The author focuses heavily on empirical methodologies, the most important of which are the self-sufficiency analysis, the logarithmic dissolution of factors analysis, and the terms of trade analysis.

Consequently, the author comes to the conclusion that Turkey is not a self-sufficient country in wheat and the quantity of this commodity in the country is not satisfying. In addition to this, two most important factors that influence the development of the indicator are yield and area; macroeconomic variables do not have any statistically significant effect on the wheat production in the country. The country gains from the terms of trade.

Keywords: self-sufficiency, wheat, domestic production, export, import, foreign trade, terms of trade.

Analýza produkce pšenice v Turecku

Abstrakt

Konečným cílem autora je popsat produkci pšenice v Turecku a identifikovat primární trendy a vzorce produkce v zemi. Kromě toho autor poskytuje odpověď na otázku, zda je národ soběstačný v pšenici, identifikuje nejdůležitější faktory, které ovlivňují produkci, a popisuje situaci, které země čelí z hlediska této důležité komodity.

Kromě toho autor provede odhad lineární regrese, která pomůže autorovi při určování prvků, které mají největší dopad na produkci pšenice v Turecku, a poté autor pokračuje v kvantifikaci účinku každého významného ekonomického a sociálního aspektu. Autor používá údaje o číslech, které poskytl turecký statistický úřad a FAO, aby pracoval na dosažení cílů, které byly nastíněny dříve. Autor se silně zaměřuje na empirické metodiky, z nichž nejdůležitější jsou analýza soběstačnosti, analýza logaritmického rozpuštění faktorů, a podmínky obchodní analýzy

V důsledku toho autor dospěl k závěru, že Turecko není soběstačnou zemí v pšenici a množství této komodity v zemi není uspokojivé. Kromě toho jsou dva nejdůležitější faktory, které ovlivňují vývoj ukazatele, výnos a plocha; makroekonomické proměnné nemají statisticky významný vliv na produkci pšenice v zemi. Země získává z obchodních podmínek.

Klíčová slova: soběstačnost, pšenice, domácí produkce, export, import, faktory

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LDC	Least Developed Countries
OLS	Ordinary Least Squares Method
GDP	Gross Domestic Product
UK	United Kingdom
USD	United States Dollar
USDA	United States Department of Agriculture
G20	Group of Twenty
BLUE	Best Linear Unbiased Estimator

1 Introduction

In spite of the fact that Turkey's economy went into a recession not too long ago, the country has been exhibiting some very intriguing economic progress, which has been followed by the country's rising relevance in the international political and economic arena. Nevertheless, the recession that is putting a brake on the economy at the moment seems to be having a very devasting impact on the people as a whole as well as on a variety of sectors. Undoubtedly, Turkey is a country that is active in virtually every industry; consequently, the author of the following thesis was interested in gaining an understanding of a specific industry with the intention of analyzing the primary factors and tendencies that are present in that industry; for this purpose, he decided to analyze the wheat production.

Wheat is an obvious commodity whose significance in no way can be minimized, and this fact cannot be stressed enough. Wheat is used to produce a wide variety of staple foods that are an essential part of almost everyone's diet, including bread, pasta, and other similar items. As a result, it is of the utmost importance to get an understanding of the overall circumstances surrounding the wheat production in Turkey. Further on, the author's reflections can be used to determine whether or not there might be a complication caused by the growing rate of economic instability and uncertainty that is underpinned by the contentious decisions of the ruling party and the figure of the Turkish president. This can be done by using the author's reflections to figure out whether or not there might be a complication caused by the growing rate of economic instability and uncertainty.

The significance that Turkey has for Palestine, the author's home country, lends credence to the choice of that nation as the location for the book's action. A significant number of countries in the Middle East identify Turkey as one of their most important trade partners. Given the extent to which globalization is spreading, whenever even a single member of the community suffers, it is almost inevitable that other countries that are actively engaged in trading and cooperation will suffer accordingly, with the only difference being the degree to which they will suffer.

All of the conclusions that will be discussed in this section have been validated using applicable calculations and statistical procedures. These approaches guarantee that the results

are as accurate as can be given the amount of information that is currently available from publicly accessible sources.

2 Objectives and Methodology

2.1 Objectives

The ultimate objective of the author is to describe the wheat production in Turkey as well as to identify the primary trends and patterns of production in the country. In addition to this, the author provides an answer to the question of whether or not the nation is self-sufficient in wheat, identifies the most important factors that influence production, and describes the situation that the country faces in terms of this important commodity.

Additionally, the author does an estimation of a linear regression, which will assist the author in determining the elements that have the greatest impact on the wheat output in Turkey, and then the author proceeds to quantify the effect of each significant economic and social aspect.

2.2 Methodology

The author uses the data on numbers that were supplied by the Turkish statistics office and the FAO based on the time interval from 2007 to 2020 in order to work toward the objectives that were outlined before. The author focuses heavily on empirical methodologies, the most important of which are the self-sufficiency calculation technique and the logarithmic dissolution of factors technique.

Apart from self-sufficiency and factor analysis, the author also calculates terms of trade for the main commodity of the analysis – wheat in Turkey. In addition, the author estimates a linear regression model using the OLS technique. This model assists the author in quantifying the influence of each economic element. For the purpose of estimating the linear regression model, the author makes use of the time series data. The author does also create a trend reflecting the development of wheat production in Turkey over years. When it comes to linear models, those models are estimated with the help of the ordinary least squares formula.

In the section of his book devoted to theoretical considerations, the author examines the relevant scientific framework and references academics who have made contributions to the same subject matter. This study makes extensive use of secondary data as its major source of information.

The econometric model is verified according to the basic rules of econometric modelling, which entail computation of various test criteria, such as F and t ratios.

Lastly, the creation of correlation matrix, the author uses Pearson correlation coefficients, which are generated with the help of a correlation matrix.

3 Literature Review

3.1 Foreign trade

Foreign trade, also referred to as international trade, describes the method of the exchange of products, services, and capital between nations. It includes the import and export of products and services, also as international investment streams. Foreign trade may be a essential element of the worldwide economy, with an anticipated $19.5 trillion worth of international trade 2019 (WTO, 2021)

The notion of foreign trade has existed for thousands of years, with early civilizations exchanging goods like spices, textiles, and precious metals (Bairoch, 1993). Today, foreign trade plays an important role within the global economy and is important for economic process and development. Foreign trade is governed by a group of rules and regulations, including international trade agreements, tariffs, and trade policies. the planet Trade Organization (WTO) may be a prominent organization that regulates and promotes international trade, with 164 member countries as of 2021 (WTO, 2021). Foreign trade is that the exchange of products, services, and capital between countries and may be a critical component of the worldwide economy. it's essential for economic process and development and is governed by a group of rules and regulations.

3.1.1 Types of foreign trade:

There are several types of foreign trade arrangements that exist between nations, each with its own unique benefits and challenges.

First Bilateral trade is one of the most straightforward types of foreign trade and involves the exchange of goods and services between two countries based on mutual agreements (Amadeo, 2021)

second, Multilateral trade, on the other hand, involves the exchange of goods and services among multiple countries, often through organizations such as the World Trade Organization (WTO). The WTO is an international organization that oversees global trade and helps to negotiate trade agreements between member countries. Multilateral trade agreements promote free trade and reduce trade barriers between countries, contributing to global economic growth (Wolrd Trade Organization, 2021)

third, Regional trade is another type of foreign trade that involves the exchange of goods and services between countries within a particular region. Neighboring countries often have complementary economies and can benefit from increased trade. The European Union (EU) is a regional trade agreement between 27 European countries that facilitates the free movement of goods, services, and people within the EU (European Union, 2021)

fourth, Free trade agreements (FTAs) are agreements between two or more countries that eliminate or reduce trade barriers between the participating countries. The United States has several FTAs with countries such as Canada, Mexico, and Australia, among others (Office of the United States Trade Representative, 2021). FTAs can promote trade and investment between participating countries by eliminating tariffs, quotas, and other trade barriers

fifth, Preferential trade agreements (PTAs) are agreements between two or more countries that offer preferential treatment to certain goods or services. PTAs can include reduced tariffs or quotas for specific goods or services, which can benefit the participating countries. An example of a PTA is the ASEAN Free Trade Area, which is an agreement between Southeast Asian countries (Wolrd Trade Organization, 2021)

Last, Customs unions are agreements between two or more countries that eliminate internal trade barriers and establish common external trade barriers. Customs unions promote trade between participating countries by creating a unified external trade policy. The European Union is an example of a customs union (Wolrd Trade Organization, 2021)

3.1.2 Advantages of foreign trade

foreign trade is considered as having solely good aspects , despite the accuracy of this statement,. One benefit is that it gives inhabitants of an economy a method to raise their living standards and economic well-being while also increasing the effectiveness of their use of natural resources. Also, international trade encourages and promotes the exchange of cultural and educational values across nations. Additionally, it strengthens and advances international ties based on shared interests and cohabitation. For instance, major corporations like Coca-Cola have supported numerous initiatives that promote social responsibility. (SUSTAINABILITY, 2023)

The employment opportunities supplied by foreign producers in the host country are another beneficial aspect of international trade. The reduction in unemployment will assist the dealers on "foreign export" and "foreign import." The exporter will have the opportunity to bring foreign currency into the nation through "foreign export," leading to economic growth.

Additionally, proponents of foreign trade assert that it guarantees the formation of new sectors as well as the specialization of existing industries. These days, this is considered to be a trend. We occasionally encounter goods created abroad that are successful locally.

3.1.3   Disadvantages of foreign trade:

While there are advantages to international trade that help different countries, there are also drawbacks that can, in certain cases, be detrimental to society, people, and the environment. In order to compete with other producers abroad, producers engage in international trade and work to maintain production costs as low as feasible. This could lead to the closure or collapse of numerous small local firms due to the intense competition. This drop in new startups and small business openings raises the unemployment rate. Small-scale production companies are clearly exhibiting the negative effects of such trade (International Trade Policy Assignment, 2021). Sometimes, as in Saudi Arabia, exporting natural resources to foreign nations is the only way to preserve an economy. Crude oil exports are the main source of revenue for the Saudi economy. Saudi Arabia has become wealthy because to the production of crude oil, but due to exhaustion, the oil is predicted to run out in less than two decades. leaving Saudi Arabia vulnerable to an economic depression. (Dudley, 2020)

Economic and political dependence on the states controlling the national economy through their firms, investments, and companies is another negative impact of international commerce. In this situation, the economies of the Golf nations are mostly dependent on foreign trade, investments, and agreements, which prepares the way for U.S. political hegemony. Callers opposed to international trade also claim that such commerce introduces undesirable commodities into the nation. Dealing in illegal narcotics internationally is, in some ways, a type of foreign trade.

3.1.4   Terms of trade

The spread of industry specialization followed the emergence of international trade. The majority of nations began producing goods and services with the greatest possible comparative advantage as a result. In his theory of comparative advantage, David Ricardo demonstrates how trade can benefit nations, but it also depends on the Terms of Trade (TOT), which is the relationship between the monetary value of what is imported and the monetary value of what is exported. When the prices of exported commodities are higher than the prices of imported ones, the term of trade grows. The TOT also falls when import prices are higher than export

prices. The following equation can be used to express terms of trade, often known as the "Ratio Index": (Terms of trade, 2022)

Terms of Trade (TOT) = Index of Export Prices / Index of Import Prices X 100

Assuming that the Czech Republic imports 20 cars and exports 1 truck in a given year, the TOT in the Czech Republic is said to be improving if the Czech Republic increases the number of cars it exchanges for 1 truck in the following year. Conversely, if the Czech Republic imports fewer cars for the same number of trucks, which is 1 truck, or increases the quantity of trucks exported for the same number of cars, the terms of trade in the Czech Republic are deteriorating. (Reinsdorf, 2010)

The base year is always equal to 100 when calculating an index, as long as the term of trade is an index. The index is used to demonstrate how a nation's exports and imports have changed over time. This enables the economists to determine if imports and exports both generate increasing amounts of revenue over time. This enables us to determine if import prices are rising or falling over time. Although both will constantly change in real life, utilizing indexes gives us a broad representation. If, for example, that in 2020 the Czech Republic had an index of export prices of 130 and an index of import prices of 120, the country would have a term of commerce of 109, which would indicate an improvement in the term of trade. Observe that as the term of trade rises above 100, things go better, but when it falls below 100, things become worse. (Reinsdorf, 2010)

The elasticity of supply, elasticity of demand, and exchange rate are only a few of the variables that might affect a nation's terms of trade.

Secondly, when a country's export demand is less elastic than its import demand, the terms of trade between the two countries benefit each other. Second, the terms of trade are favorable if a country's export supply is more elastic than its import supply. The terms of trade of a given country would benefit if its currency appreciated, which therefore caused the prices of imported goods to decrease and the prices of exported goods to climb. Lastly, changes in the exchange rate between countries might affect term of trade.

3.2   Wheat Production

3.2.1   Utilization

Wheat is a crop that belongs to the family of cereals, the grains which are extremely popular for populations around the world and especially to people living in developing and least developed countries.

Winter wheat, which is traditionally regarded as the main kind of wheat is planted 6-8 weeks before the first frosts in Autumn and harvested starting from late May and throughout the entire Summer.

Figure 1, wheat field

Source: The World Economic Forums, 2022

it is important to understand why wheat production in general is considered to be quite crucial for any country, and why it is common practice to judge the entire agricultural situation in a given country based primarily on the trends of development of wheat production. This is

because wheat production tends to be a good indicator of how a country's agricultural situation is changing over time (Gooding, 1997).

Wheat is a commodity that is utilized nearly in all activities that are linked to the production of food and nutrition, and there are a lot of different reasons why this is the case. It is clear that practically all academics, scientists, and even historians agree on one specific premise. When discussing matters that are connected to economics, it is important to keep in mind that virtually everything in this field is carried out with the goal of maximizing the logic and effectiveness of any decision. This is due to the fact that economics, at its core, is the study of how resources should be distributed in order to fulfill the unending requirements of human beings. What is the one need that is always there, despite the fact that everyone possesses it? It should come as no surprise that in order for humans to fulfill their daily responsibilities, they are required to take in food and allow their bodies to produce energy (Aykroyd, 1970).

Wheat is an ideal commodity in terms of the cost of production, efficiency, and the nutritional value that it has for people, thus the fact that it is thought to be one of the most important commodities, if not the most important commodity, is not at all a major surprise at all. The following table, provided by the European Commission, provides a comprehensive analysis of the amount of nutrients and other components that may be found in 100 grams of raw wheat.

Table 1, nutritional value of wheat per 100 grams

Nutritional Value	Content
Energy	340 kcal
Protein	13.2 grams
Total fat	2.5 grams
Carbohydrates	61.3 grams
Fibre	10.7 grams
Calcium	34 mg
Iron	3.6 mg
Magnesium	137 mg

Source: European Commission, 2021

In other words, the first row contains the most crucial piece of information about the nutritional value of wheat, which is that an individual may satiate 340 kcal with every 100 grams of row wheat powder. Wheat's significance becomes readily apparent when one considers the recommended calorie intake for women, which is 2000 per day, and the recommended calorie intake for males, which is 2500 per day (Villalobos, 2012).

Aside from the obvious utilization of wheat for nutrition, there is also another significant application that is becoming more and more common, particularly as more and more nations try to follow the path of sustainable development and sustainable economic growth. This application is the use of wheat in the production of biofuels. Wheat is processed into something that is either termed biofuels or bioethanol, both of which are quite popular in the market in North America (Imran, 2021). It is clear that this is the use that the author is referring to when they speak ambiguously about it. The presence of a high starch content, which often amounts to around 55 or even 70 percent of total starch in certain instances, is precisely the factor that makes the generation of ethanol feasible (Qureshi, 2013).

It is obvious that it is far too soon to suggest that the production of biofuels is the savior for humankind, which is currently using the ecological resources of the planet two or even three times more than it should. However, it is unquestionably something that can contribute to a better ecology and also help communities reach a sustainable growth, the main pillars of which are ecological, social, and economic ones. Therefore, the conclusion that can be drawn from the preceding two lines is that wheat is also used on a regular basis for industrial purposes (Dutia, 2014).

In conclusion, one more use of wheat that ought to be mentioned is one that is closely related with the large amount of starch that is present in this kind of grain. As a result, utilizing wheat for the purpose of feeding livestock, such as cattle, fowl, and other types of animals, is a method that is used rather often. In addition to the obviously beneficial effects that this commodity has on people, it is also extremely advantageous for livestock, the health of which is of the utmost importance and has an effect on the quality of the secondary products that are produced by them (milk, eggs, etc.) as well as the quality of the meat that is produced.

3.2.2 Tendencies

Now that the primary use of wheat was explained, it is necessary to investigate the trends that are associated with the production of wheat. These trends should include the trends of consumption and the behavior of consumers in connection to the sort of commodity that is being discussed.

According to the economic theory, bread is the most prominent example of a segment of the commodities that may be generated from this crop. These commodities largely belong to the category of basic goods, and wheat is one of their representatives. Bread is a basic commodity, which basically implies that people will eat it regardless of the price since it will still stay more inexpensive than other commodities given its price in relation to its nutritious content per gram.

The growing economic, political, and military instability in the region that strongly contributes to the world supply of wheat to the international market, drives the price of this commodity up. This results in the fact that people living in the world's poorest regions are getting more and more limited in the quantity of the wheat and bread that they consume, which in turn has an inevitable effect on their health and wellbeing. However, the problem with wheat in modern times is that due to the growing economic, political, and military instability in the region that strongly contributes to the wheat production in the world, the future of entire communities seems rather ambivalent and pessimistic (The World Economic Forum, 2022).

In addition to this, the present trend with prices skyrocketing up and reaching around 400 USD per ton, compared to the pre-pandemic level of 300-310 USD per ton, is something that puts the world's purest places on the border of literally surviving as a whole. It is unfortunate that the world's least developed countries, also known as LCDs, are located in the region of Sub-Saharan Africa, which provides practically no means for those countries to establish their own production of wheat. Because of this, it should not come as any kind of surprise that all of these poor countries, where the number of people living in absolute poverty (below 1.9 USD per day), are highly dependent on the wheat imported from other countries. Unfortunately for them, the ongoing military conflict in Ukraine and the rise in prices are likely to increase the number of people living in absolute hunger from approximately 700 million people to numbers that are well beyond 1.1 billion people. This will put them in a position where they will be unable to survive. After the breakout of the coronavirus, experts have developed a prediction

that is much more pessimistic than their previous projections (The World Economic Forum, 2022).

Figure 2, classification of countries according to their development
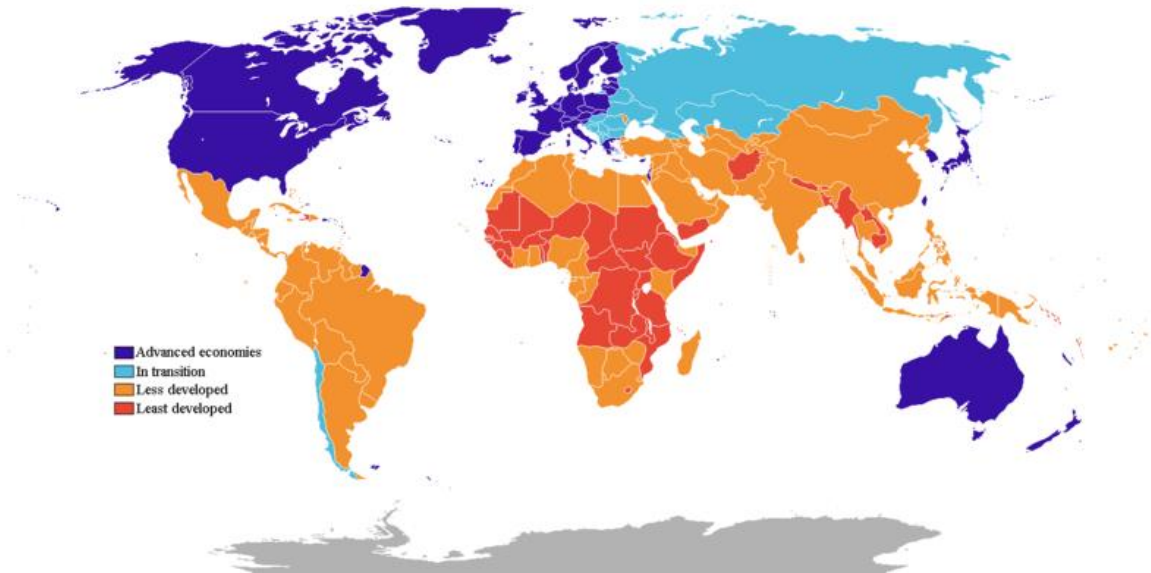
Source: The United Nations, 2014

In addition to this, even nations that cannot in any way be considered to be LCDs are likely to experience shortages and challenges due to the current situation. For example, Middle Eastern countries and other Arabic countries that are highly dependent on the wheat imported from the region surrounding the Black Sea will face a shortage of wheat that cannot be replaced by their own domestic production because they barely have any, and finding an alternative trading partner in the near future will be nearly impossible. This is because the region surrounding the Black Sea is currently experiencing a shortage of wheat.

The next question that arises is whether or not other nations that have their own wheat production, such as Turkey, are able to raise the volume of their own domestic production and provide assistance to other nations that are currently dealing with a number of significant challenges with the assistance of their wheat industry. After carrying out the assortment of relevant assessments, the solution to this issue will be provided in the section devoted to practical considerations.

Figure 3, Black Sea wheat market
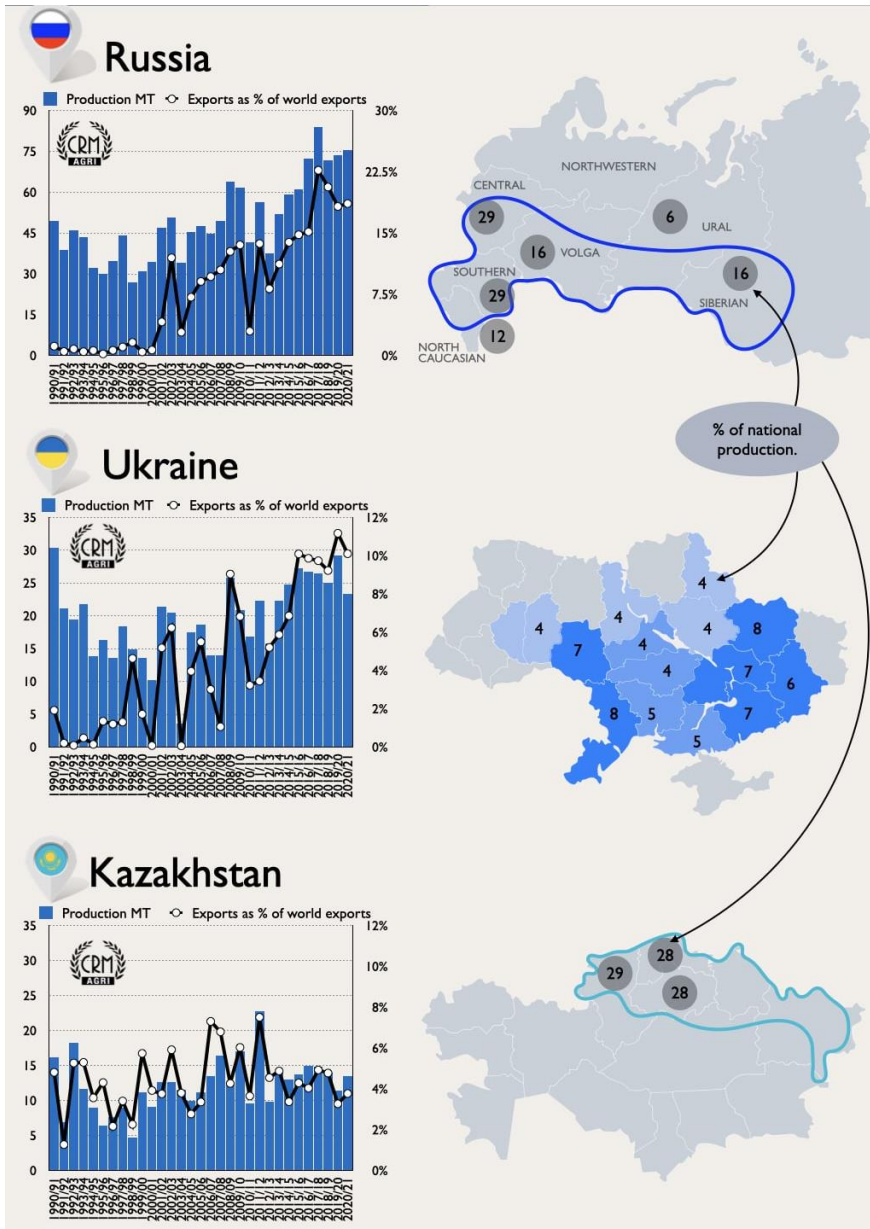
Source: CRM AgriCommodities, 2020

3.2.3 Factors of Production

Wheat, like almost every other agricultural variable, has its own unique determinants of production, all of which always have an effect on the overall amount of the crop that is produced within the borders of a specific nation. It should come as no surprise that the elements that go into the production of wheat in one nation might vary quite a bit from those that go into the economy in another. It is feasible to differentiate the set of smaller or micro-elements from the multitude of factors that, to some degree, impact the production of this crop. These micro-

factors include the mean values of fertilizer, seed, and pesticide as well as fuel consumption, equipment, and human labor.

However, yield and area are the two primary elements that have the most important impact on wheat production. These two basic aspects are greatly supported by the collection of more minor factors that were discussed before. Therefore, countries that produce wheat in various regions of the globe could have completely different values for yield and acreage, but those two parameters are often quite consistent throughout a number of nations and are considered traditional. In other words, when comparing the wheat production in Russia and the United Kingdom, for example, it becomes clear that the yield in the United States is traditionally high reaching around 8-8.4 tons per hectare, which is the result of highly productive labor, good fertilizers, and technology. On the other hand, the yield in the country that had been the world's leading exporter of Wheat – Russia – is approximately 2 times lower than in the UK and remains at the level of 3-4 tons per hectare. However, compared to the same measure in the UK, the quantity of harvested land that is utilized in Russia is far higher. Some nations who do not own enormous amounts of land like Russia attempt to depend on technology and other techniques to enhance their production and somewhat compensate for their relatively small size (Ramadas, 2019).

To put it another way, the phenomenon in which nations that own a great deal of land but not really have a high figure for yield is extremely prevalent, and the fact that these nations are area intensive ones provides a justification for it. The author does the necessary study in order to determine whether or not Turkey, the nation where the author conducted the most of his main research, is depending more on its yield per area.

The final output value may be determined using the formulas below:

$$Production = Yield * Area \qquad\qquad (8)$$

3.3 Turkey

3.3.1 Sectors of Economy

Figure 4, map of Turkey

Source: Nations Online, 2022

Turkey is a growing nation that is strategically located at the boundary between Europe and Asia, serving as a link between these two regions of the globe. Izmir, Bursa, Trabzon, Adana, and finally, Istanbul, which is the country's financial and economic center, offering a place to its population of nearly 5 million people in the metro-area, are among the many regional and economic centers that can be found in Turkey. The nation's capital, Ankara, is located in the western part of the country.

Turkey is one of the wealthiest nations in the world, with a gross domestic product (GDP) of 3.21 trillion US dollars and a per capita number of 37,488 US dollars. As a result, Turkey is an active member of the G20, which is a club of the world's twenty largest economies. In spite of this, for the purpose of the author's investigation, it is absolutely necessary to have a look at the sector structure of the nation and comprehend the function that agriculture plays in the economy of Turkey (Gokmenoglu, 2015). The percentage contribution of each industry to the total GDP is shown in the following chart.

Figure 5, share of each sector in Turkish GDP
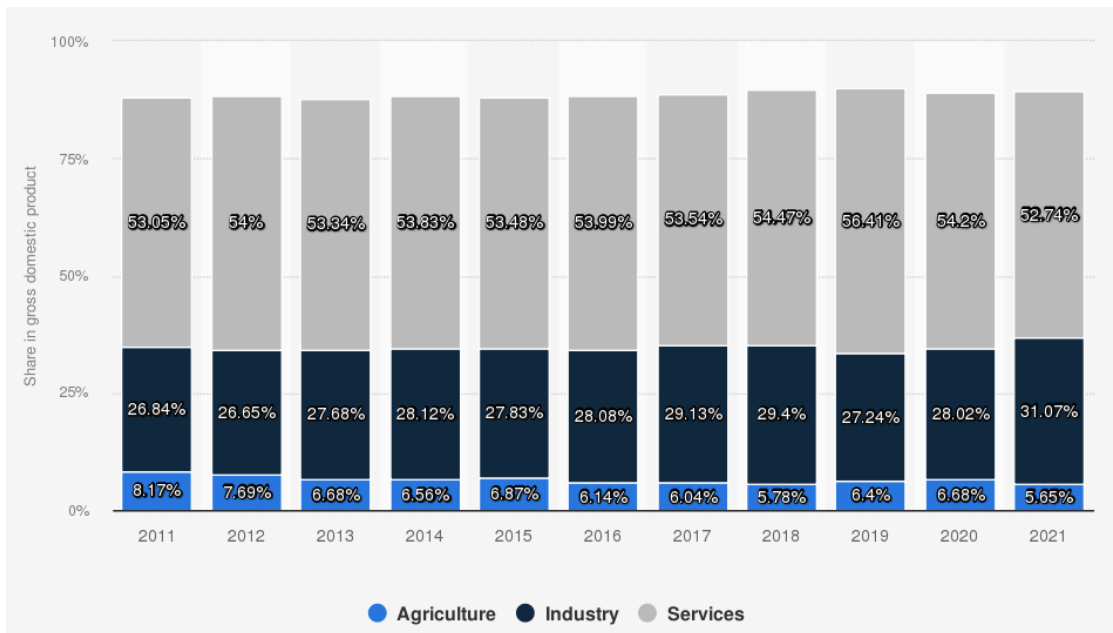
Source: O'Neill, 2022

The percentage of Turkey's gross domestic product that is contributed by agriculture is expected to fall to 5.65% in 2021, from 8.17% in 2011. In addition to this, one might argue that the nation itself is an example of a post-industrial civilization given that the percentage of the economy that is devoted to the tertiary (service) sector is equivalent to 52.74 percent. Despite this, the proportion of the economy devoted to industry is gradually growing, which is not the typical pattern in civilizations that are relatively economically developed. After taking a look at the following statistic, it is clear that the nation does not seem to have any plans to boost the amount of crops it produces in the immediate future (O'Neill, 2022).

Figure 6, Turkey wheat production
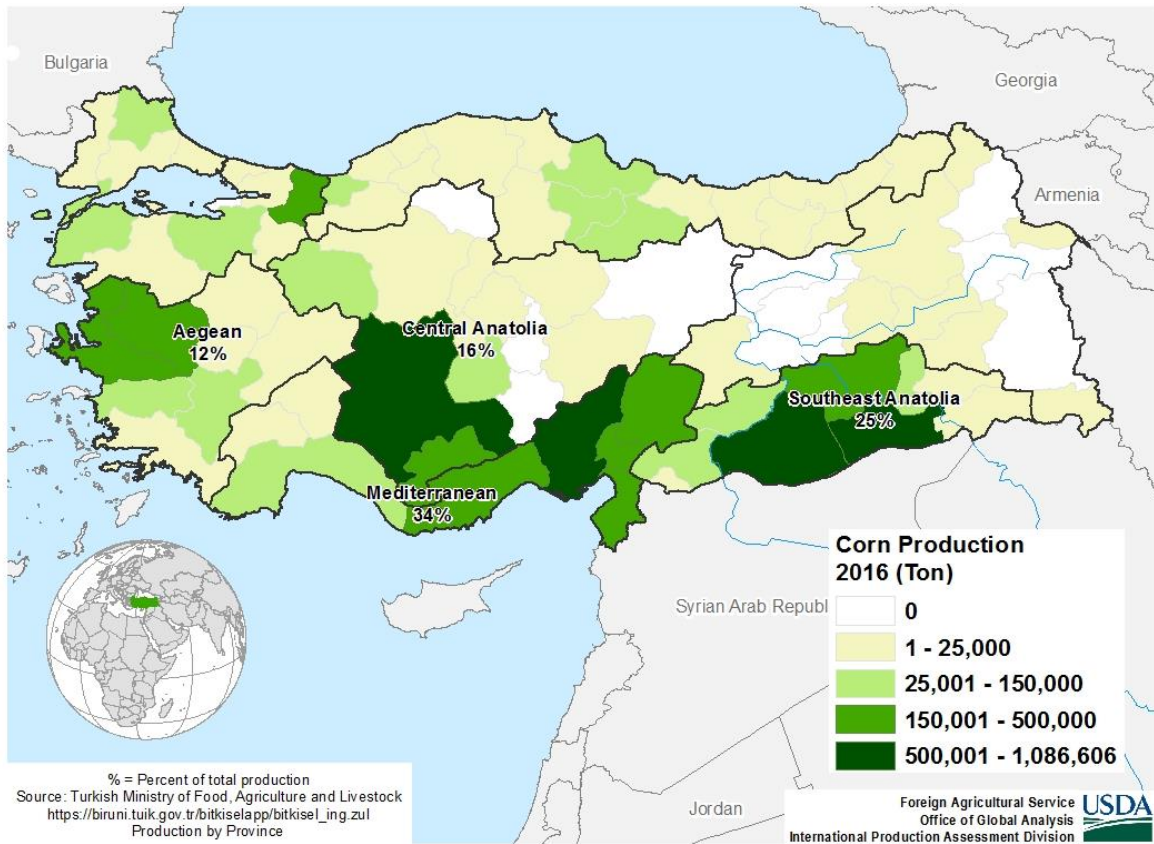
Source: USDA, 2022

Wheat is mostly grown in the south of the nation, in the Mediterranean area adjacent to Cyprus, and in the southeast of Anatolia, close to Iran and Syria. This is where the majority of the country's wheat is produced. Wheat is grown there because of the kind of terrain that exists there, which is mostly arable ground that is suited for producing permanent crops. The remainder of the nation is covered in steppe in the middle and on the east, while the northern part of the country is covered in woods.

In addition to the cultivation of wheat, the nation is also interested in cultivating maize and other crops that are mostly connected to legumes rather than grains. It should come as no surprise that Turkey is an active supplier of fruits and vegetables to neighboring countries such as Georgia, Russia, and Azerbaijan; however, Turkey does not supply Armenia because of the ongoing political and social conflict that has lasted for one hundred years. Turkey's agricultural diversity is quite rich because almost anything can be grown there (USDA, 2022).

3.3.2 Recent Development

Nevertheless, in spite of the comparatively upbeat story presented in the preceding chapter, the present-day economic progress of the nation is in no way deserving of the labels "optimistic" or "pleasant" for the people living within the country. Because of the unconventional economic policy actively promoted by the Turkish leader, Recep Tayyip Erdogan, the country has found itself mired in an ever-increasing inflation rate as well as a depreciating domestic currency known as the Turkish lira. Both of these problems are a direct result of the unorthodox economic policy.

The unconventional approach that the president takes to governing the country is carried out in a manner that is quite at odds with the economic theory and the foundations of macroeconomics. Thus, instead of increasing the interest rate in the country and thereby limiting the inflation rate, as it is done in almost every country on Earth regardless of the category to which it belongs, the Turkish authorities decided to initially do not touch the interest rate and then, they have decided to even increase it by a given percentage point, what caused the domestic currency to depreciate even more and literally put poorer people on the brink of survival in rural agrarian areas. In other words, the Turkish authorities decided to increase the interest rate

To summarize, the president and his administration are operating on the presumption that not all economies function in the same manner and that there is the potential for a positive impact to be generated as a result of this choice. In support of the direction of economic development that is currently being pursued by the Turkish government, it is logical to state that the depreciating currency, which has become almost three times cheaper compared to the United States dollar as of 2018, will inevitably lead to an increase in exports. This is because domestic products will become quite affordable for foreign buyers, and this will help to partially boost the economy, as export is a component of the GDP equation along with government expenditure, consumption, imports, and international trade (Kenc, 2022).

Figure 7, Turkish interest rate and inflation rate
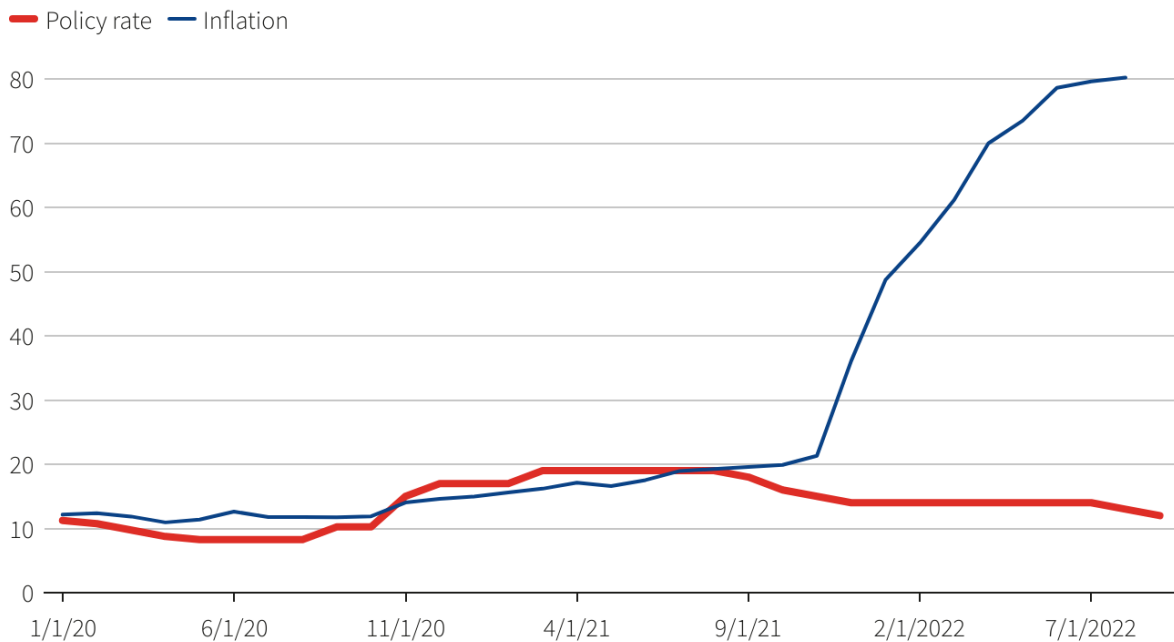
Source: Kucukgocmen, 2022

To get to the heart of it, this is a type of an opposite impact to the Dutch illness, which occurs when the home currency significantly gains owing to high revenue in the export of natural resources and other sectors suffer as a result. It is safe to conclude that Turkey's current economic philosophy has a good influence on the country's exports, most notably in the agricultural sector, and this assumption is supported by the fact that agriculture exports are the most significant sector. In other words, it is highly possible that the economic policy will result in the inevitable growth in revenue from farm exports. This prediction is based on the likelihood that the policy would have the desired effect.

The inflation rate in the country is not just a two-digit one, but it can even reach three digits, which will result in a pure catastrophe for the domestic economy and a drop in the purchasing power of people who are already living on the verge of a catastrophe. However, it is sensible to question whether or not this is actually worth it given that the inflation rate in the country is not just a two-digit one.

Overall, the Turkish economy is experiencing obvious difficulties, and the situation is not expected to improve in the near future owing to the rather controversial reaction of the Turkish government to the skyrocketing inflation that followed the coronavirus outbreak (Kenc, 2022).

3.3.3   Foreign Trade

Finally, it is essential to take a look at the export and import structure of the country and define Turkey's main trading partners and the most exported goods.

Figure 8, Turkish exports in 2020
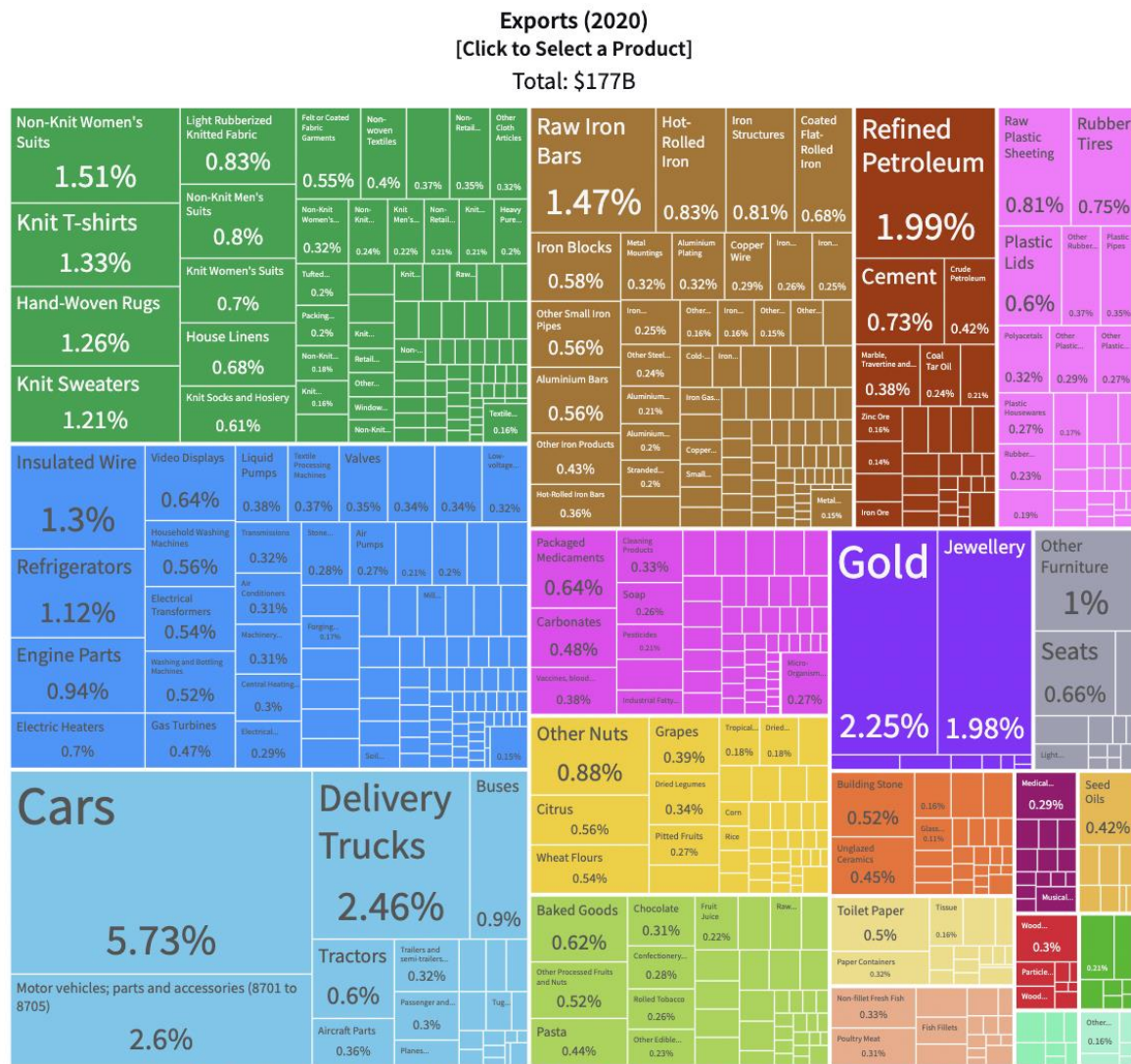
Source: OEC, 2022

Clearly, it can easily be noted that the most exported type of commodity are cars and other machinery, while the percentage of agricultural commodities is extremely low, that serves as a partial piece of evidence that Turkey's main exporting objective is industry. Also the country exports valuable metals and refined petroleum, so there are seemingly many oil-refining facilities.

Figure 9, exporting destinations
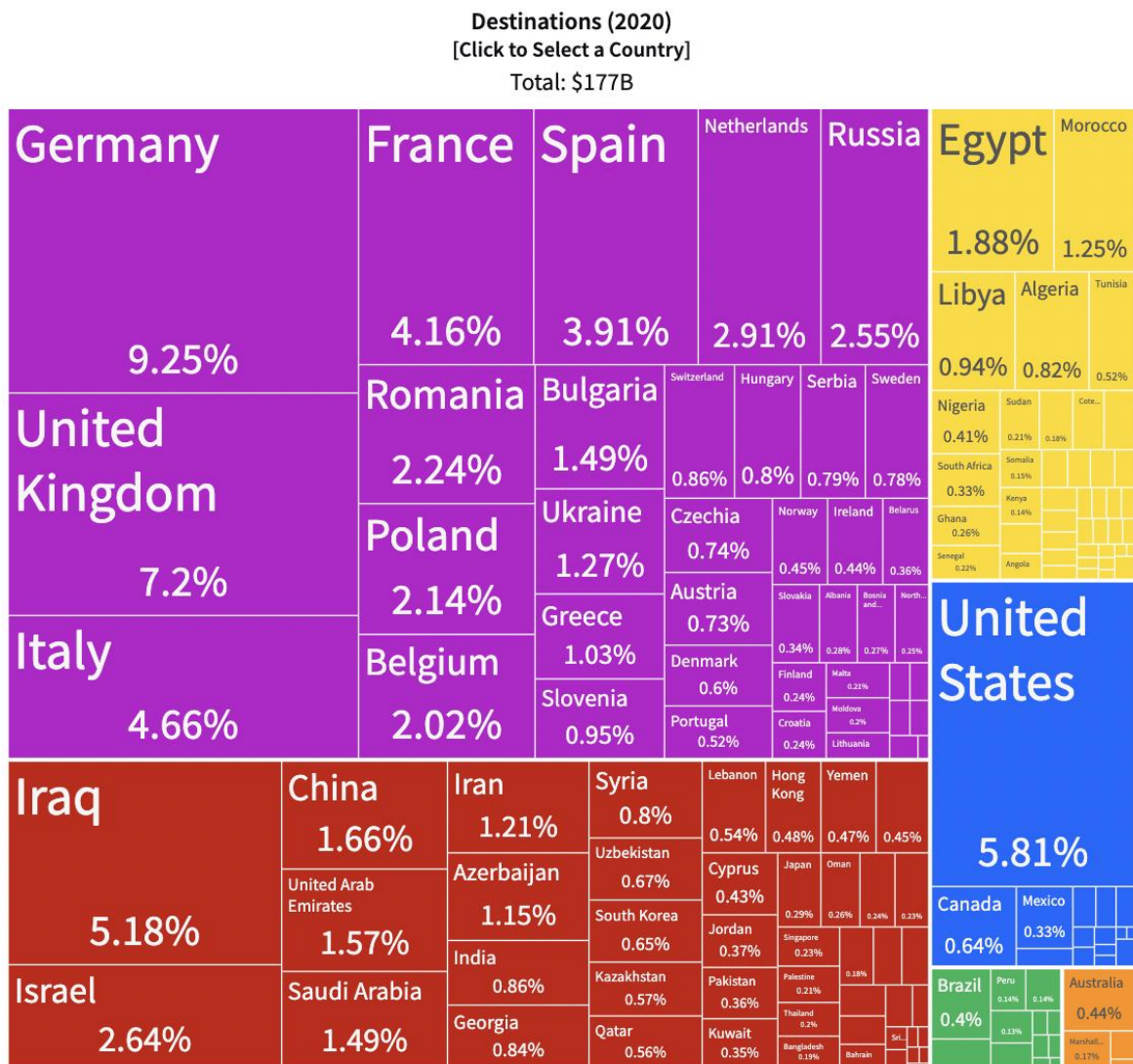
Source: OEC, 2022

Unsurprisingly, the biggest share of exports is sent to Europe with Germany as a leading importer of Turkish goods along with the United Kingdom. Middle Eastern and Asian region is the second-most popular destination of Turkish exports.

Now, it is essential to take a quick look at the structure of imports from other countries. The following figure contains the structure of Turkish imports.

Figure 10, Turkish imports in 2020

Source: OEC, 2022

Interestingly, the most imported commodity to Turkey is gold. Also, it seems that Turkey is a wheat-importing country since the share of import is significantly higher than the import, so presumably, the amount of wheat produced in the country is not enough to satisfy the needs of the domestic population, according to the report from OEC and also to reports published by independent researchers interested in the topic of the wheat production in Turkey.

Finally, the following figure (Figure 11) contains the information about the main origins of Turkish imports with information obtained from the latest OEC report.

Figure 11, importing origin

Origins (2020)
[Click to Select a Country]
Total: $207B
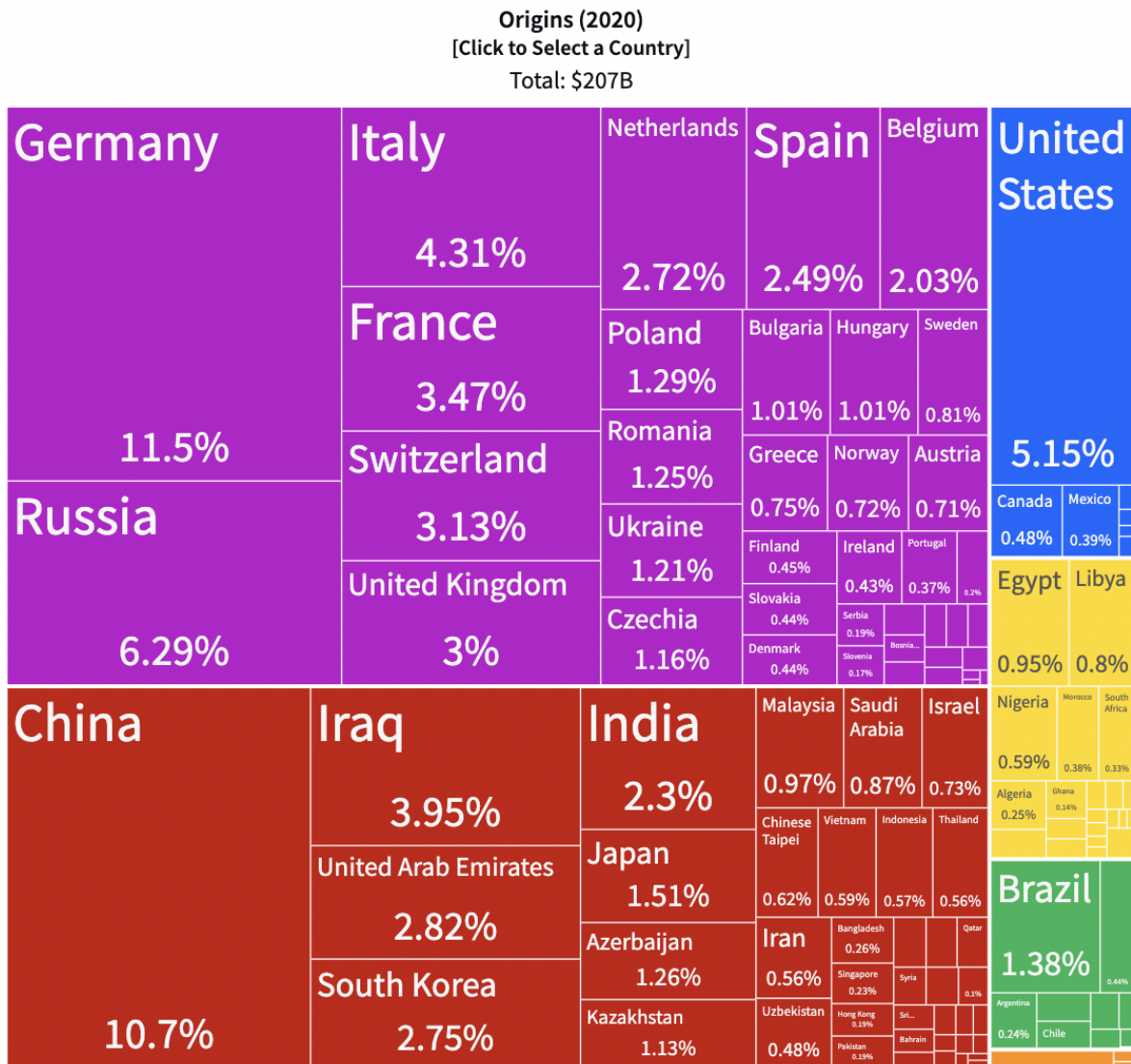
Source: OEC, 2022

Germany is Turkey's biggest trading partner with 11.5% of all imports coming from this country and followed by China with 10.7%. In addition, it is visible that the import share from Russia is higher than exports. Given Russia's status of the world's biggest exporter of wheat, it can be the case with Turkey. All in all, authors suggest that when it comes to trading partners of Turkey, there are just a couple of countries that are in fact considered as key ones, while the trade with other countries is somewhat close to zero. According to the report published and also to the articles of scientists, China, Germany and Russia are considered as key trading partners for Turkey. (Kuştepeli, 2012).

3.4 World Wheat Production

As the author mentioned it in one of the earlier chapters, the current world uncertainty drives particular communities rather worried and distressed, because the growing number of international issues drives not only the average price of wheat up, but also the number of people undernourished or in absolute hunger, which has to be prevented at all cost according to international organizations, bodies of the United Nations and the sustainable development goals – 17 most important goals that should be achieved by countries all over the world.

Figure 12, sustainable development goals

Source: The United Nations, 2022

Despite the fact that it may seem too hopeful, the second aim is something that is directly impacted by the consistent supply of wheat grain that is brought to the market. Unfortuitously, the recent events that took place first in 2020-2021 and then were followed by the event that is presently taking place in Ukraine from the 24th of February have both contributed to the globe moving even farther away from accomplishing this aim (Carriquiry, 2022).

To be more exact, it is prudent to remark that the pandemic not only kept individuals at home for some time without any means to continue their routine economic activities, but it also caused industries and products to come to a standstill. In addition to this, it is wise to say that

despite the growing share of automation and robotization in the sector of agriculture, a lot of processes still involve direct presence of humans, so the global production of wheat suffered a tremendous series of drawbacks and complications due to those restrictions and overall drop in productivity. This is because a lot of the processes still involve direct presence of humans. The progression of the annual average price of a bushel of wheat is shown on the following chart over the course of the last five years.

Figure 13, average price per bushel of wheat
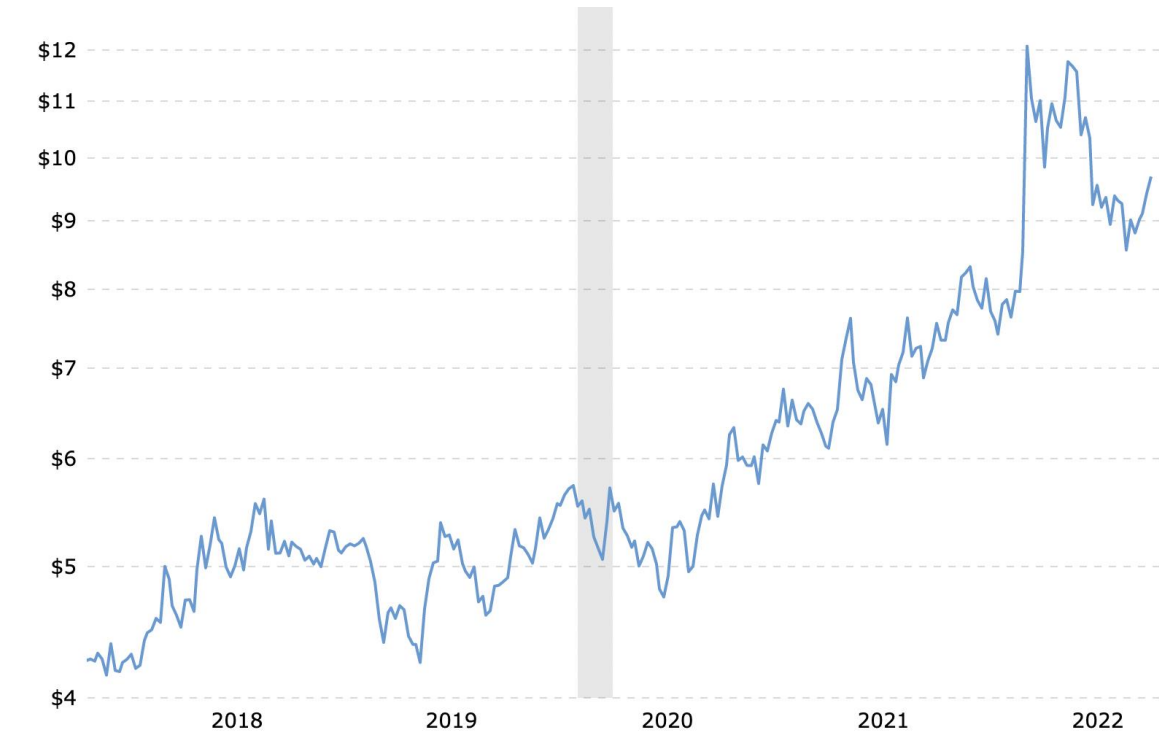
Source: Macrotrends, 2022

It can be easily observed that the prices started soaring right after the outbreak of the pandemic of COVID-19 in Spring of 2020. The increase in the price per bushel of wheat is approximately equal to 6 USD dollars, which is undoubtedly a huge difference, especially for poorer region (Haase, 2021).

Figure 14, world wheat production over years
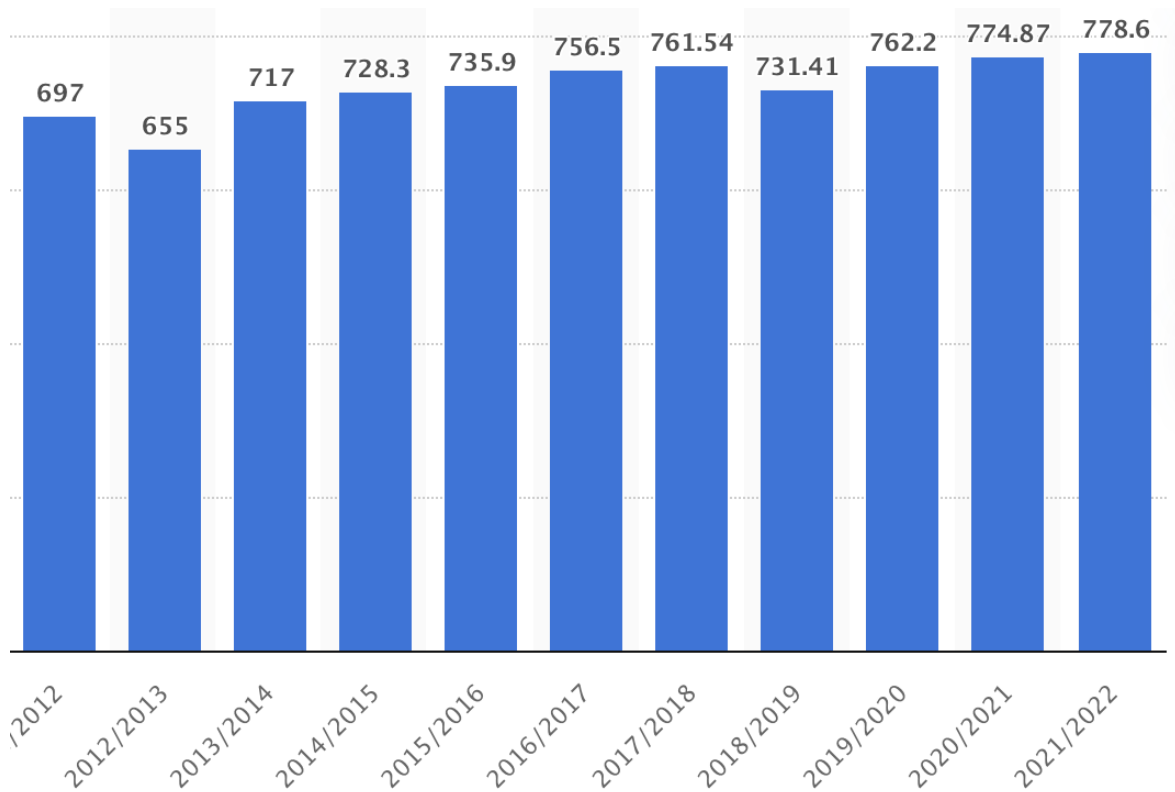
Source: Shahbandeh, 2022

The commencement of conflict in Ukraine contributed, although to a lesser extent, to a minor increase in costs, but it is anticipated that this rise will be considerably more pronounced in the future. Unfortunately, the upward price trend is expected to continue. Given that the crop (winter wheat) is planted in the autumn, it is more than certain that the harvested area will be shorted by approximately 30 percent as a consequence of a partial occupation of Ukrainian territory and irreversible damage to the soil. Ukraine is one of the largest exporters of wheat, and given this fact, it is more than certain that the harvested area will be shorted by approximately 30 percent. Therefore, the wheat production for 2023, when the wheat that was planted in 2022 will be harvested, is likely to be significantly lower. This is the case if there won't be any country that will increase its wheat production to make up for the amount that was lost and will be willing to export it to other countries. In addition to this, the difficulties that will arise with the transportation of wheat grown in 2022 and the partial blockade of Odessa port are something that will contribute to an even greater increase in the degree of uncertainty.

However, active collaboration from Turkey and failed efforts to solve the dilemma may have something to do with Turkey's aim to ameliorate the situation with wheat on a global scale and provide greater quantity in order to partly replace the amount that was lost. In order to accomplish this goal, the author will investigate the wheat production in Turkey and try to determine whether or not the nation is actually capable of rapidly increasing its wheat production within just a couple of years and assuming the position of regional leader in terms of wheat exports.

In addition to this, it is prudent to assert that an increasing number of nations all over the globe are gradually beginning to impose outright prohibitions on the export of wheat abroad, similar to what India did during the spring and summer months. This is probably the most compelling evidence that the world is currently going through a difficult period, and it is quite likely that the overall status of food security is quite likely to be damaged even further because almost all aspects of nutrition policy will be put in jeopardy, including access, quality, and availability. This is probably the most compelling evidence that the world is currently going through a difficult period.

Figure 15, projection of undernourishment
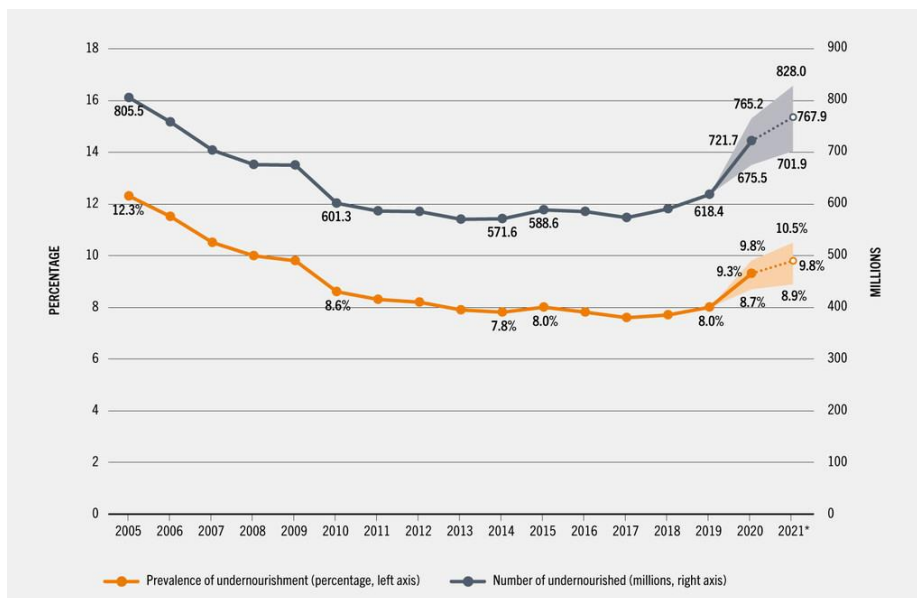
Source: The World Economic Forum, 2021

Overall, the chart presented above is another piece of crucial evidence for the fact that the world's tendency is rather an unpleasant and depressing one.

4 Practical Part

4.1 Factor Analysis

In order to get started with the analysis, it is necessary to first have an understanding of which element plays the most significant role in terms of the change it brings about in the wheat output in Turkey. The author accomplishes this goal by using a method known as the logarithmic dissolving of factors, which is a technique that enables one to assess the influence of change in each component on the change in wheat output in terms of both percentage and unit.

The steps involved in the computation are detailed in the table that can be seen below. When doing his estimate, the author takes into account just two variables: yield and area. The period of time that was looked at was from 2017 all the way through 2020.

Table 2, logarithmic dissolution of factors

Year	2017/2018	2018/2019	2019/2020
Harvested area (mio. ha)	7,3	6,8	6,9
Yield (t/ha)	2,74	2,78	2,96
Production (mio. t)	19,98	18,99	20,45

Year	2018/2019	2019/2020
Change of Production (ΔP)	-0,98892	1,46620
I_P	0,950495387	1,07721963
I_A	0,9	1,0
I_Y	1,013119534	1,064748201
ln I_A / ln I_P	126%	16%
ln I_Y / ln I_P	-26%	84%
Sum of lns (check)		
ΔP_A	-1,242796273	0,229538692
ΔP_Y	0,253876273	1,236661308

Source: own processing

It is thus feasible to draw the conclusion that in 2018/2019, the change in area was responsible for 126% of the change in production, whilst the change in yield only accounted for a negative proportion of 26% of the change in production. In other words, this indicates that the component that is most responsible for the drop in the volume of wheat output in Turkey in 2018/2019 is the amount of land available for cultivation.

It is conceivable to declare that the trend has changed in 2019/2020, and that yield will account for a bigger proportion of the change in the overall output of wheat in the nation. This is something that can be said with certainty. This would imply that neither element is more relevant than the other when it comes to wheat production in Turkey, suggesting that neither trend exists.

4.2   Self-Sufficiency

The author selects a time interval of ten years to evaluate the development of this indicator. The following table contains the calculation of the relevant index for the selected time period from 2011 to 2020.

Table 3, self-sufficiency calculation

| Year	Production	Import	Export	S/S index
2011	21800000	4754682	5233	82,11%
2012	20100000	3719154	116079	84,80%
2013	22050000	4053001	275132	85,37%
2014	19000000	5285243	68572	78,46%
2015	22600000	4349820	68798	84,07%
2016	20600000	4225784	26503	83,07%
2017	21500000	4990865	42014	81,29%
2018	20000000	5781712	69998	77,79%
2019	19000000	10004830	135157	65,81%
2020	20500000	9659186	124643	68,25%

Source: own processing

The index is lower than 1, so it is possible to conclude that the amount of wheat in Turkey is not sufficient.

4.3   Wheat Production Trend

Now, the author focuses on estimating the trend that will describe the development of wheat production in time. The following chart contains the development of wheat in tons from 2011 to 2020.

Figure 16, wheat production trend

y = -146364x + 3E+08
R² = 0,1266
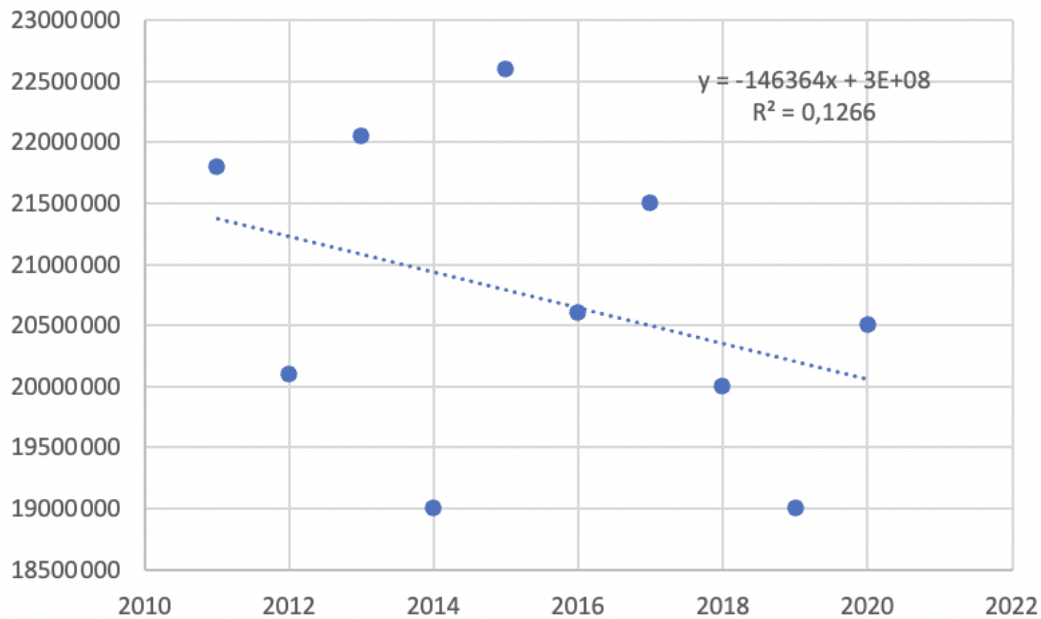
Source: own processing

With a coefficient of determination equal to merely 0.1266, which totals 12.66% of variance in the production of wheat explain, it is without a doubt the case that the standard of the trend that was generated is in no way regarded as being attractive. In spite of this, the chart is an exceptionally helpful tool for comprehending the fact that the amount of wheat output in Turkey is subject to consistent shifts, and that there is neither a general trend nor a pattern; rather, the production varies from one year to the next. However, it is fair to state that the trend as a whole is rather heading in a negative direction, with an annual decline of 146 364 tons of wheat on average. Turkey clearly displays a downward trend in terms of population.

4.4 Import and Export of Wheat Analysis

Figure 17, comparison of import and exports
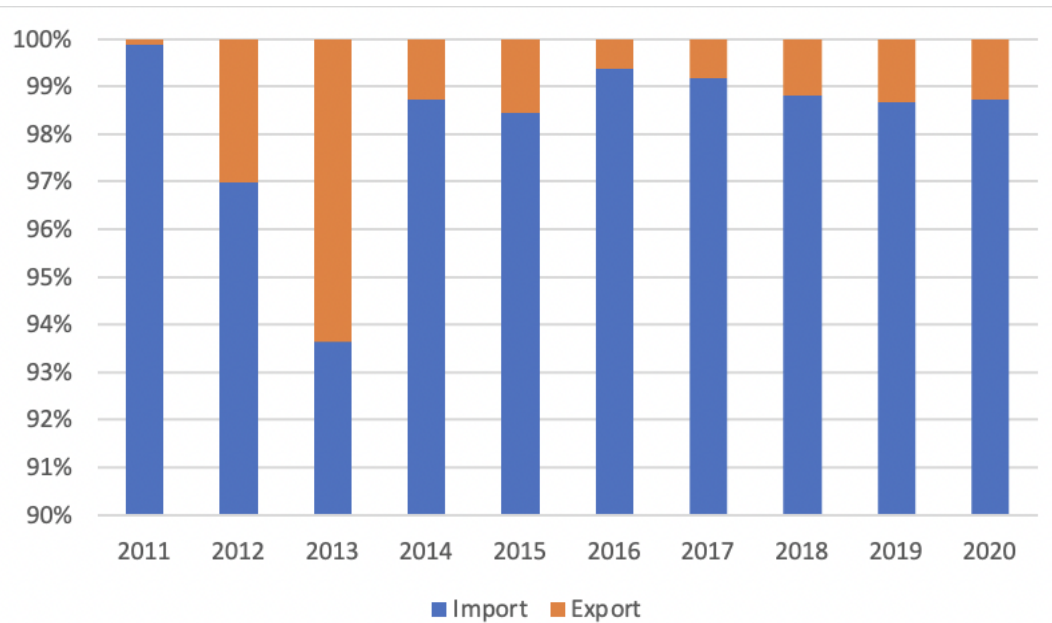
Source: own processing

After looking at the following histogram that indicates the difference in the quantities of wheat imported and exported in Turkey, it becomes quite evident that Turkey is surely a wheat importing country with the share of export exceeding import only in the year 2013.

In addition to that, the author estimates two trends, each reflecting the development of relevant indicator – export and import.

Figure 18, import trend

Import

$y = 580465x - 1E+09$
$R^2 = 0,5989$
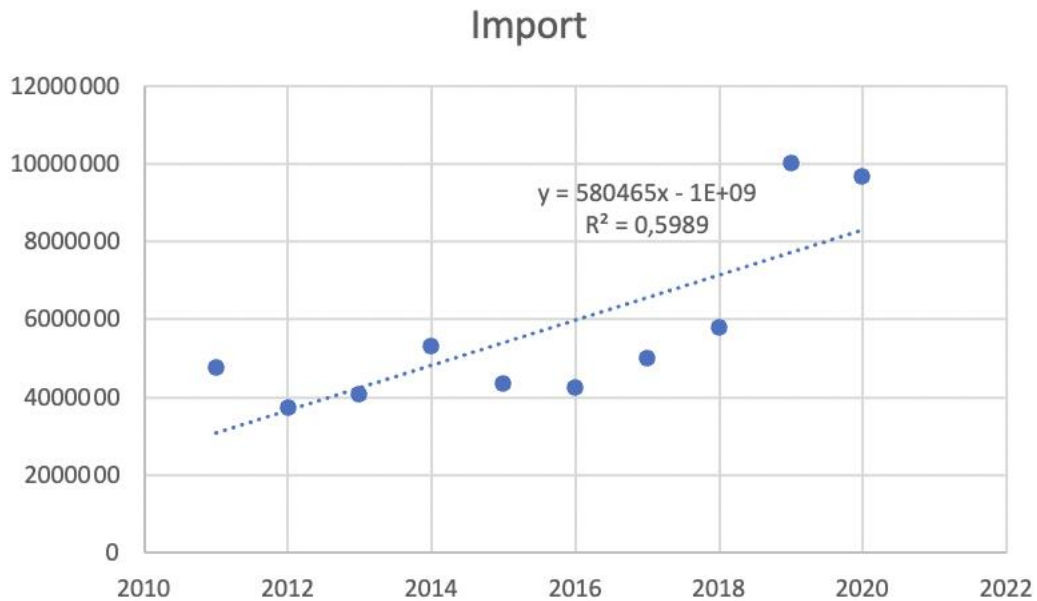
Source: own processing

The following charts helps to understand that the quantity of the import is an upward pointed function with the yearly average increment of 580 465 tons imported to Turkey. The next chart contains the information about the moving average reflecting the development of exports from Turkey to other countries.

Figure 19, export moving average

Export

Source: own processing

The quantity of wheat exported is fluctuating so intensively from one year to another that it is irrelevant to create any chart. All in all, it is visible that Turkey is starting to slowly export particular amounts of wheat to other countries.

4.5 Terms of Trade

Terms of trade is a useful concept that helps to understand the trading standing of a given country in terms of any commodity or good. This indicator helps to understand if the country is benefitting in the trade of a particular commodity or not.
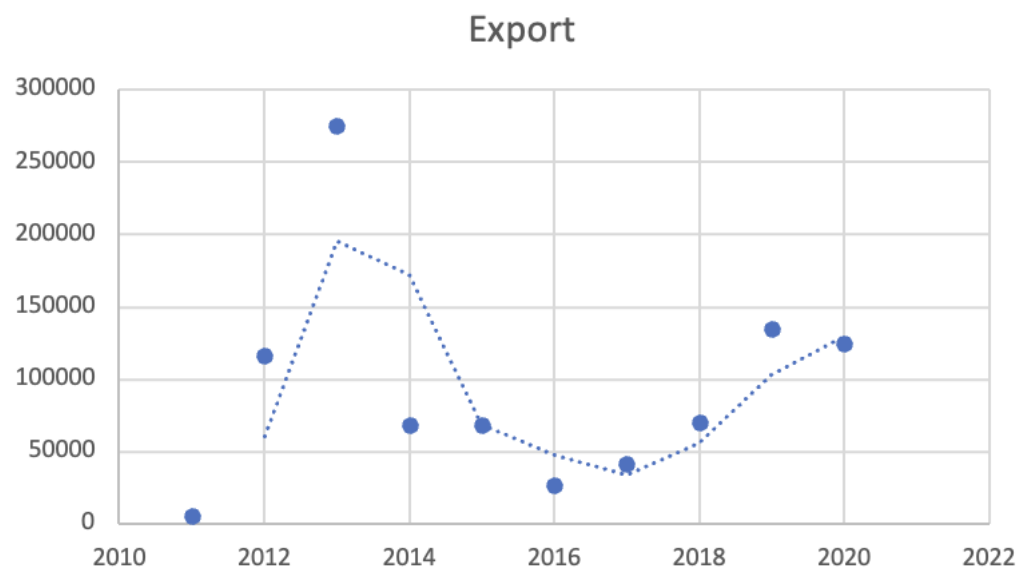
In order to understand Turkey's terms of trade in wheat, the author uses the original dataset available from Comtrade and he analyses the time interval starting from 2017 until 2021 covering just 5 recent years. The following table contains the aggregate information about the country's value of imports and exports in US dollars alongside the quantity imported and exported.

Table 4, aggregate information about wheat trade

Row Labels	Export Sum of Netweight (kg)	Sum of Trade Value (US$)	Import Sum of Netweight (kg)	Sum of Trade Value (US$)
2017	6976429184	2103992336	212842978	66445322
2018	6614276316	2011541210	30520096	9594836
2019	6521917972	2103812150	30583746	9282240
2020	5980829280	1902148632	26188686	8000790
2021	5999705307	2213106998	28224724	9688542
Grand Total	32093158059	10334601326	328360230	103011730

Source: own processing based on data from Comtrade

Then, the author focuses on calculating the average prices per 1 kg of wheat exported and imported and consequently calculates the terms of trade index. The following table contains the relevant calculations.

Table 5, Turkey terms of trade in wheat

	Average price of export per 1 kg of wheat	Average price of import per 1 kg of wheat	Terms of Trade
2017	0,301585852	0,312180005	96,61%
2018	0,304121133	0,314377648	96,74%
2019	0,322575684	0,30350239	106,28%
2020	0,318040951	0,305505591	104,10%
2021	0,368869284	0,343264366	107,46%

Source: own processing

In general, it is feasible to draw the conclusion that Turkey's terms of trade increased from 2017 to 2021. This is achievable despite the fact that the value was less than 100 in both 2017 and 2018, which, in essence, indicates that the situation was fairly adverse for the nation.

The trend, however, began to shift in 2019, when the terms of trade began to improve and became more than 1, highlighting the fact that the current trading environment is one that is rather favorable. It should come as absolutely no surprise that Turkey is eager to increase its wheat imports at this point.

4.6 Linear Regression

Finally, the very last part of the empirical analysis is represented by a linear regression analysis that will help the author to estimate the most important factors influencing the volume of wheat production in Turkey.

The author creates an econometric model that will have the following characteristics:

$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + \beta_5 X_{5t} + \beta_6 X_{6t} + U_e$, where:

1) Y_t = production of wheat in Turkey in million tons

2) X_{1t} change in harvested area of wheat in million hectares

3) X_{2t} yield of wheat in ton/hectare

4) X_{3t} export of wheat in million tons

5) X_{4t} import of wheat in million tons

6) X_{5t} inflation rate in Turkey percentage points

7) X_{6t} population of Turkey in million people

8) $\beta_{0,1,2,3,4,5,6}$ parameters of elements

9) U_e = error term.

The following table contains the dataset used for the estimation.

Table 6, dataset used for estimation

Year	Production, mln tons	Change in Area (ha)	Yield (t/ha)	Export	Import, mln tons	Inflation, %	Population, mln people
2007	17,234	-0,529493	2,3595	0,018281	2,147107	8,8	69,581
2008	17,782	-0,368706	2,1675	0,008005	3,708003	10,4	70,418
2009	20,6	0,443367	2,3451	0,301505	3,392072	6,3	71,321
2010	19,674	0,037172	2,5667	1,174014	2,554189	8,6	72,326
2011	21,8	-0,00022	2,7038	0,005233	4,754682	6,5	73,4
2012	20,1	-0,54116	2,6723	0,116079	3,719154	8,9	74,7
2013	22,05	0,228582	2,8451	0,275132	4,053001	7,5	75,9
2014	19	0,070478	2,4294	0,068572	5,285243	8,9	77,2
2015	22,6	0,025731	2,8803	0,068798	4,34982	7,7	78,5
2016	20,6	-0,236613	2,707	0,026503	4,225784	7,8	79,8
2017	21,5	0,052405	2,806	0,042014	4,990865	11,1	81,1
2018	20	-0,373651	2,744	0,069998	5,781712	16,3	82,3
2019	19	-0,456768	2,7811	0,135157	10,00483	15,2	83,4
2020	20,5	0,082778	2,9647	0,124643	9,659186	12,3	84,3

Source: own processing based on data from FAO and World Bank

It is crucial to generate a correlation matrix before moving on to the ordinary least squares approach. This is done to guarantee that there is not a significant link between the explanatory variables, also known as multicollinearity, which leads to the fact that estimators are not the best.

In order to do this, the author makes use of an application known as Gretl, which generates the correlation matrix that may be found in the table that follows.

Table 7, correlation matrix

	Change in Area (ha)	Yield (t/ha)	Export	Import, mln tons	Inflation, %	Population, mln people
Change in Area (ha)	1					
Yield (t/ha)	0,138082046	1				
Export	0,302939083	-0,052104	1			
Import, mln tons	-0,054769559	0,54740886	-0,2563518	1		
Inflation, %	-0,471770478	0,26060906	-0,1479946	0,6647512	1	
Population, mln people	-0,021678218	0,77462721	-0,2474585	0,797900293	0,653551904	1

Source: own processing

Following the output, it is visible that there is no case of correlation greater than 0.8 in absolute terms, so the author can conclude that there is no multicollinearity, and it is possible to proceed to the ordinary least squares method.

The following table contains the output for the OLS method for relevant model from Gretl.

Table 8, OLS method output

```
Model 1: OLS, using observations 2007-2020 (T = 14)
Dependent variable: Productionmlntons

                    coefficient   std. error    t-ratio    p-value
  ------------------------------------------------------------------
  const                8.20051      5.49905       1.491     0.1795
  ChangeinAreaha       2.49558      0.942873      2.647     0.0331   **
  Yieldtha             5.95771      1.68006       3.546     0.0094   ***
  Export              -1.11915      0.802852     -1.394     0.2060
  Importmlntons       -0.235979     0.161951     -1.457     0.1884
  Inflation           -0.0291456    0.140469     -0.2075    0.8415
  Populationmlnpeo~   -0.0240513    0.121743     -0.1976    0.8490

Mean dependent var    20.17429   S.D. dependent var    1.561158
Sum squared resid      3.613503   S.E. of regression    0.718481
R-squared              0.885951   Adjusted R-squared    0.788195
F(6, 7)                9.062861   P-value(F)            0.005151
Log-likelihood       -10.38448    Akaike criterion     34.76896
Schwarz criterion     39.24237   Hannan-Quinn         34.35487
rho                   -0.168199   Durbin-Watson         1.691046
```

Source: own processing

Thus, the author estimates the following model based on the output from the relevant statistical software:

$$Y_t = 8.2 + 2.49X_{1t} + 5.95X_{2t} - 1.11X_{3t} - 0.235X_{4t} - 0.029X_{5t} - 0.024X_{6t} + U_e$$

Before testing if the model complies with econometric standards, it is essential to check if it is significant as a whole and which predictor do not contribute significantly to the production of wheat in Turkey. The author uses F test to find out if the model is significant or not.

$H_o : ß_0 = ß_1 = ß_2 = ß_3 = ß_4 = ß_5 = ß_6 = 0$ *(the model is not significant)*

H_a: *At least one ß ≠ 0 (the model is significant)*

P = 0.005

0.005 < 0.05 => Ho is rejected. **The model is significant**.

Now, the author performs t-tests for each individual predictor to find the degree to which it is significant or not. The testing is continued in the next table.

Table 9, t-tests

$H_o: \beta_1 = 0$ (x_1 is not significant) $H_a: \beta_1 \neq 0$ (x_1 is significant)	$H_o: \beta_2 = 0$ (x_2 is not significant) $H_a: \beta_2 \neq 0$ (x_2 is significant)	$H_o: \beta_3 = 0$ (x_3 is not significant) $H_a: \beta_3 \neq 0$ (x_3 is significant)	$H_o: \beta_4 = 0$ (x_4 is not significant) $H_a: \beta_4 \neq 0$ (x_4 is significant)	$H_o: \beta_5 = 0$ (x_5 is not significant) $H_a: \beta_5 \neq 0$ (x_5 is significant)	$H_o: \beta_6 = 0$ (x_6 is not significant) $H_a: \beta_6 \neq 0$ (x_6 is significant)
$P = 0.03$ $0.03 < 0.05$ => change in area is significant	$P = 0.009$ $0.009 < 0.05$ => yield is significant	$P = 0.2$ $0.2 > 0.05$ => export is not significant	$P = 0.03$ $0.18 > 0.05$ => import is not significant	$P = 0.84$ $0.84 > 0.05$ => inflation is not significant	$P = 0.84$ $0.84 > 0.05$ =>population is not significant

Source: own processing

Thus, just two predictors significantly contribute to the production of wheat in Turkey, and they are: change in area in million hectares and yield in ha/tons. The author recreates the model by just leaving two significant variables. The output is presented below.

Table 10, restructured model

```
Model 2: OLS, using observations 2007-2020 (T = 14)
Dependent variable: Productionmlntons

                   coefficient   std. error   t-ratio   p-value
   ---------------------------------------------------------------
   const             9.24826      2.71786      3.403     0.0059   ***
   ChangeinAreaha    2.58529      0.784664     3.295     0.0071   ***
   Yieldtha          4.24675      1.02040      4.162     0.0016   ***

   Mean dependent var   20.17429    S.D. dependent var    1.561158
   Sum squared resid     7.996442   S.E. of regression    0.852613
   R-squared             0.747617   Adjusted R-squared    0.701730
   F(2, 11)             16.29230    P-value(F)            0.000514
   Log-likelihood      -15.94472    Akaike criterion     37.88943
   Schwarz criterion    39.80660    Hannan-Quinn         37.71196
   rho                   0.220875   Durbin-Watson         1.334558
```

Source: own processing

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The final model has the following parameters:

$$Y_t = 9.24 + 2.5X_{1t} + 4.24X_{2t} + U_e$$

The overall quality of the model decreased (78% for the first and 70% for the final) but this model has better predictors that do really reflect the development of wheat production in Turkey.

- *When the harvested area of wheat in Turkey goes up by 1 million hectares, the wheat production in Turkey goes up by 2.58 million tons.*
- *When the yield of wheat in Turkey goes up by 1 ha/ton, the wheat production in Turkey goes up by 4.24 million tons.*

Now, the author verifies if the model complies with the econometric theory by checking if the estimator is BLUE – best linear unbiased estimator. It has already been decided that the estimator is the best, since there is no multicollinearity. Now, the author, according to three tests: Breusch-Godfrey, White's test and Jarque-Bera test, verifies if the model has no autocorrelation of the first order, residuals are not heteroscedastic and residuals are normally distributed.

The author uses Gretl for the relevant analysis once more. The output is available in the following table.

Table 11, econometric verification of the model

```
LM test for autocorrelation up to order 1 -
  Null hypothesis: no autocorrelation
  Test statistic: LMF = 0.368706
  with p-value = P(F(1, 10) > 0.368706) = 0.557246

Test for normality of residual -
  Null hypothesis: error is normally distributed
  Test statistic: Chi-square(2) = 0.45906
  with p-value = 0.794907

White's test for heteroskedasticity -
  Null hypothesis: heteroskedasticity not present
  Test statistic: LM = 5.01319
  with p-value = P(Chi-square(5) > 5.01319) = 0.414273
```

Source: own processing

As a result of accepting the null hypothesis for all three tests, it may be concluded that there is no autocorrelation of the first order, that residuals follow a normal distribution, and that residuals are homoscedastic.

As a result, the author arrives at the conclusion that his model completely conforms with the econometric theory, that the residuals are BLUE, and that the model may be used for the generalization of the wheat production in Turkey. In addition to this, it is clear that other economic variables, most of which are associated with international trade (both imports and exports), as well as the inflation rate, which has been the primary source of debate in Turkish society in recent times, do not appear to have any kind of significant influence on the growth of wheat production at all.

However, the findings of the model imply that there is not just a direct effect; however, when it comes to a variable such as the population, it is prudent to assert that it inexorably has an effect on the production of wheat. This is due to the fact that the population needs to be fed, and wheat is a universal solution that satisfies all individuals regardless of their social class and status. Despite this, the increase in yield as well as the shift in the amount of land used for wheat cultivation are seen to be the two most significant elements behind the growth of wheat production in the selected nation. The next chapter contains some more thoughts and insights.

5 Results and Discussion

The results of the study on the country's ability to provide for its own needs revealed that the general level of output in Turkey is not at all satisfactory. This was one of the findings of the study. The author makes the premise that Turkey could be able to assist other nations who are suffering from a lack of wheat and high prices for this product; nevertheless, the reality for the country is not quite as hopeful as the author believes it to be.

The self-sufficiency index for the country is somewhat lower than 100% or 1 for the entire time period selected (from 2011 to 2020), and the situation appears to be even deteriorating with the value of the coefficient falling from approximately 85% at the beginning of the 2010s to values that are approaching just 60%. The time period selected runs from 2011 to 2020.

It's possible that Turkey's rapidly expanding population is the primary driver behind the current wheat scarcity. Alternatively, recent shifts in consumption patterns may be to blame. For example, Turks have recently begun to consume more wheat and products derived from wheat than in the past. In conclusion, as the book author says it, there is a noticeable scarcity of wheat in the nation and changing the trend will not be possible in the near future.

The findings of the author are consistent with the statement that was made; prior to any potential expansion to other marketing and increase in Turkish wheat exports, it is absolutely necessary for the country to stabilize the domestic situation and make sure that the country becomes self-sufficient in this kind of commodity. The author's findings are consistent with the statement that was made (Chandio, 2021).

The results of the author may then lead one to the conclusion that there is no one right method to respond to the issue of which aspect of wheat production is the most significant for the nation. This can be reached by continuing with the findings of the author. Following the logarithmic breakdown of the components, it was discovered that yield and area both have a tendency to vary the degree to which they impact changes in output, and that both elements are of similar importance.

According to the findings of the other author's research, this predicament occurs quite frequently in relatively large countries that have restricted capabilities to produce a particular

commodity (only two regions are used for wheat production), and as a result, the nation strives to find the optimal balance between yield and area. After all, economics is about how resources are distributed, thus it is crucial for Turkey to correctly manage its few resources. Area is likely one of the scarcest resources that a nation may have, so good management of this resource is very important for Turkey.

In addition to that, the fluctuations in yield can be explained by frequent inceptions on the part of the Turkish government, which is keen on trying new approaches to existing phenomena. Therefore, the apparent application of new technology might be one of the primary driving forces behind the fluctuation in yield (Vanli, 2020).

It is fair to suggest that there is no way to precisely estimate the future development of the following indicators when it comes to the study of wheat import, export, and the overall volume of production in Turkey; however, it is possible to say that Turkey is a country that intensively imports wheat from other countries, and this has its inevitable effect on the country's production, which returns a tendency of steep decline over the years. When it comes to the study of wheat import, export, and the overall volume of production in Turkey, it is fair Surprisingly, the nation's exports have been on the rise during the last few years, but this can be attributed, in large part, to the occurrence of other phenomena that will be discussed in the next paragraph.

In addition to the trend, factor, and self-sufficiency studies, the author also carried out the terms of trade study, which helped throw further light on the current state of Turkey's trading condition with the rest of the world. The author was able to arrive at the conclusion that the terms of trade index is gradually climbing from values significantly lower than 100% to values significantly higher than 100%. Therefore, the situation is quite satisfactory, and Turkey unquestionably derives sufficient advantages from the conditions of the wheat trade. It is reasonable to assume that Turkey is reselling the wheat that it purchases at a lower cost to the nations that are geographically close to it. When analyzing the function of re-export in international commerce, the author reaches the same verdict as the group of academics that conducted the study (Kirillov, 2021).

Following the completion of the regression analysis, the author arrived at the conclusion that macroeconomic indicators do not really have an effect on the growth of wheat output in

Turkey. This was the author's conclusion since the variables in question were determined to be unimportant. However, at the same time, the factors that are directly associated to production and the microenvironment are the ones that are the ones that directly impact the volumes of production in Turkey. Some examples of these variables are changes in area and yield. The author arrived at a somewhat different result than what Pena, R. J. presented in his scholarly study since, surprisingly, the population does not seem to have any substantial influence on the wheat productivity in Turkey (Pena, 2007).

6 Conclusion

To summarize, the author of the following diploma thesis is able to reach the following conclusions as a whole:

Turkey is not a self-sufficient nation when it comes to wheat, and the quality of the wheat produced there is not satisfactory. The amount of wheat production in Turkey is impacted most strongly by changes in both yield and area, which are two of the most significant elements. There is no way to say that one aspect of production is more significant than the other; they are both equally vital to the manufacturing process. Turkey profits from the conditions of wheat commerce with the rest of the globe, and the nation is probably interested in reexporting wheat that it buys for low costs in Ukraine and Russia and then sells to its neighbors who are located in the Middle East Region of the world.

Also, the future of wheat production in the nation seems to be somewhat uncertain and equivocal due to the fact that the government has to produce the commodity in order to provide for the demands of its local population. It is quite unlikely that this nation would take Ukraine's position as the primary supplier of wheat to the nations of the Middle East and the least developed countries, who are in severe need of the product. Troubled domestic situation with the inflation rate can cause a series of significant troubles for the population who already do not have sufficient quantities of wheat.

The author suggests conducting a similar analysis at some point in the future, after the conflict between Russia and Ukraine has been resolved, in order to determine whether or not Turkey has made any progress toward becoming more self-sufficient and becoming involved in the trade of wheat with other nations

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