Research Article
(Araştırma Makalesi)

Kurtuluş MERDAN[1] * (iD)

Şafak Ertan ÇOMAKLI [2] (iD)

[1] Gümüşhane University, Vocational School of Social Sciences, 29000, Gümüşhane, Türkiye

[2] Hacı Bayram Veli University, Faculty of Economics and Administrative Sciences, 06000, Ankara, Türkiye

* Corresponding author (Sorumlu yazar): kurtulus_m@hotmail.com

Analysis of factors affecting the import demand for wheat and corn in Türkiye using the Seemingly Unrelated Regression Method

Türkiye'de buğday ve mısır ithalat talebini etkileyen faktörlerin Görünüşte İlişkisiz Regresyon Yöntemine göre analizi

ABSTRACT

Objective: In this study, it is aimed to analyze the determining factors on the import demand for wheat and corn, which have an important place in Türkiye's grain imports, with the "Apparently Unrelated Regressions" model.

Material and Methods: The data set used in this study consists of annual data covering the years 2006-2021. Stata program was used to analyze the data used in the study. Since Stata or Eviews programs do not provide the Standardized Beta (β) coefficient, statistical analyzes were performed using the formula in Microsoft Excel (β=B*SSXi / SSY).

Results: Only the one-year delayed value of wheat imports, which is one of the explanatory variables in the wheat import model, was found to be significant, according to the study's findings. In terms of factors influencing corn import demand, similar results were obtained. Only total corn consumption was found to be statistically noteworthy among the explanatory variables in the corn import model.

Conclusion: Based on these findings, wheat imports are influenced by changes in wheat imports from a year ago, while corn imports are influenced by changes in total corn consumption. Based on Türkiye's current structure and the findings obtained, it is understood that the country may continue to maintain its position as an importer of wheat and corn in the future.

ÖZ

Amaç: Bu çalışmada, Türkiye'nin tahıl ithalatı içerisinde önemli yer tutan buğday ve mısır ithalat talebi üzerinde belirleyici faktörlerin "Görünüşte İlişkisiz Regresyonlar" modeli ile analiz edilmesi amaçlanmıştır.

Materyal ve Yöntem: Bu çalışmada kullanılan veri seti 2006-2021 yıllarını kapsayan yıllık verilerden oluşmaktadır. Çalışmada kullanılan verilerin analizinde Stata programından yararlanılmıştır. Stata veya Eviews programları Standardize Beta (β) katsayısını vermediğinden dolayı, Microsoft Excel'de formül kullanılarak (β=B*SSXi / SSY) istatistiki analizlere ulaşılmıştır.

Araştırma Bulguları: Çalışmada elde edilen sonuçlara göre; buğday ithalat modelindeki açıklayıcı değişkenlerden sadece buğday ithalatının bir yıl gecikmeli değerinin anlamlı olduğu tespit edilmiştir. Benzer sonuçlar mısır ithalat talebine etki eden faktörler açısından da elde edilmiştir. Mısır ithalat modelindeki açıklayıcı değişkenlerden sadece toplam mısır tüketiminin anlamlı olduğu tespit edilmiştir.

Sonuç: Tüm bu bulgulardan hareketle buğday ithalatını bir yıl önceki buğday ithalatında meydana gelecek değişim, mısır ithalatını ise toplam mısır tüketiminde meydana gelecek değişim etkilemektedir. Türkiye'nin mevcut yapısı ve elde edilen bulgular dikkate alındığında gelecekte buğday ve mısır ithalatçısı konumunu sürdürebileceği anlaşılmaktadır.

INTRODUCTION

The rapid increase in the world population triggers the demand for food in the same direction. The sufficient amount of food necessary for the continuation of human life is tried to be met with limited resources. In terms of meeting this need, emphasis has been placed on wheat and corn products, which can adapt to climatic and soil conditions, are easy to produce, and have high yields and high nutritional value.

Grains are among the most common nutrients consumed by people in Türkiye, and wheat ranks first among the grains. Wheat and corn are the raw materials of flour and bakery products and are among the most necessary essential nutrient sources. Bakery products obtained from wheat are consumed in almost every region, and bakery products obtained from corn are widely consumed in the Black Sea Region. Products such as bread, pasta, beer, and animal feed can be obtained from wheat grains and corn is mainly used in the production of bread, corn syrup, starch, and animal feed.

When there is a decrease in wheat production both in the world and in Türkiye, the price of wheat and foodstuffs obtained from wheat increases. Similarly, the high demand for wheat and wheat products increases wheat prices. The price of red hard wheat, which was \$219/ton in 2019, especially when the effects of COVID-19 started, increased by 30% and reached \$284/ton in 2021. While the producer price in Türkiye was 1.21 TL/kg in 2019, it increased by 42% to 1.73 TL/kg in 2021 (TEPGE, 2022). No effect was observed on corn production that could cause market disruption. Recently, the increase in livestock raising has also increased the need for feed. The failure of the corn produced to meet the consumption needs has made import necessary. The most important factor affecting the corn market in recent years has been the increase in exchange rates. Therefore, each country should ensure sufficient production to feed itself and have sufficient wheat and corn in stock.

Unfair competition may arise in pricing due to the high quantity and limited demand of some products in the market. This may cause a decline in the cost coverage ratio of the producers and interruption of production. Accordingly, certain regulations have been made within the framework of the "Tenth Development Plan", such as ensuring food safety, effective marketing, ensuring stability in farmer incomes, reducing consumption losses, strengthening the administrative and technical structure, and using foreign trade tools effectively. These regulations were implemented in practice; however, farmers encountered certain problems in reality (Kızılaslan et al., 1996). Therefore, permanent steps should be taken to address the problems of the agricultural industry. The obstacles of the agricultural industry can be eliminated, and its competitive power can be increased by solving the problems related to infrastructure and operation. Problems in the agricultural structure are also present in the marketing of agricultural products. The distribution costs increase since there are many intermediaries in marketing channels and a large number of transfers of goods (Emeksiz et al., 2005).

Agricultural activities are dependent on climate events; therefore, they have certain risks and uncertainties. Hence, the supply of agricultural products cannot be increased or decreased at any time. In light of all these findings, support should be provided for agricultural products and support policies should be developed to reduce the negative effects that could be experienced in the agricultural industry. As in all countries of the world, support policies have become important tools for increasing agricultural production in Türkiye (Karlı et al., 2018).

In Türkiye, the first price support for agricultural products was provided by the "Wheat Act" in 1932 (Demirdöğen & Olhan, 2017). It was enacted to prevent the price decreases in agricultural products because of the "World Economic Depression" in the 1930s (Birtek & Keyder, 1975; Tezel, 2015). Later, wheat prices were determined by the government through Ziraat Bank, and the government started to buy wheat at a price above the market price (Birtek & Keyder, 1975). Due to the increase in purchases and the difficulty of storage, Ziraat Bank fell behind in the following years and was replaced by the Turkish Grain Board (TGB) in 1938. The TGB was assigned to purchase the products at the prices determined by the government and manage the prices (Tuna, 1989). During harvest periods, the Board purchased products from farmers according to the determined base and ceiling prices (Tuna, 2011). In light of this aim, the TGB purchased

corn for the first time in 1941 (Kırtok et al., 1997). This purchase continued irregularly until 1986. The authorities of the TGB were expanded after 1986 and it was authorized to purchase products at market prices, process and store the products, and regulate the domestic market to regularize purchases (Gül, 1998). During the production period between 1986 and 2001, the TGB continued to purchase grains and the agricultural market was shaped according to these purchases. This effect has continued since 2001 (Aktaş & Yurdakul, 2005; Taşdan, 2005; Narin, 2008; Karlı et al, 2018).

The Ministry of Food, Agriculture and Livestock has been providing deficiency payment support for grain production since 2004. Fuel support was added to the deficiency payment in the same year, and fertilizer support was started in 2005. Recently, premiums and fuel-fertilizer support have become the most important support tools for wheat and corn producers (Karlı et al., 2018).

In this study, it was aimed to analyze the determining factors effective on the import demand for wheat and corn, which hold a significant place in Türkiye's grain imports, using the 'Seemingly Unrelated Regressions' model. The study, covering the period of 2006-2021, initially established a conceptual framework, followed by an examination of developments in international markets. Subsequently, wheat and corn trade in Türkiye was addressed, and finally, factors influencing the import demand for corn and wheat in Türkiye such as per capita national income, exchange rates, import prices of wheat and corn, consumption of wheat and corn, as well as lagged values of wheat and corn production were examined. In the conclusion of the study, an assessment was made, and various solution proposals were presented. This study also aimed to contribute to the existing literature, provide guidance for researchers planning future similar studies, and offer insights for the implementation of economic policies.

Developments in international markets

Grains are widely produced and consumed in almost every part of the world and used in both human nutrition and the production of basic foodstuffs. The most preferred grain groups include products such as wheat, corn, rice, barley, oats and rye.

Information on the world grain production by years was summarized in Table 1. The volume of grain production constantly increased from the 2011-12 production year to the 2020-21 production year. The increase in global grain production was due to the continued industrial use of corn and the increase in the use of wheat as animal feed. Grain production increased in countries such as Russia, the USA, Brazil, Kazakhstan, Canada and Australia, and it decreased in Argentina, Ukraine and the EU countries. The increase in the volume of production was greater than the increase in the amount of consumption. The increase in world grain stocks was due to the record-breaking increase in wheat stocks. World trade peaked in the 2020-21 production year compared to the previous year with a 21 million tons of increase and reached 416 million tons (Table 1).

Table 1. World grain quantity by years (Million tons)

Çizelge 1. Yıllara göre dünya hububat miktarları (Milyon ton)

Years	Production	Consumption	Stock	Trade
2011-12	1.879	1.862	431	274
2012-13	1.829	1.841	420	271
2013-14	2.043	1.956	506	310
2014-15	2.092	2.045	553	322
2015-16	2.058	2.013	598	346
2016-17	2.187	2.126	658	353
2017-18	2.142	2.152	648	369
2018-19	2.139	2164	625	364
2019-20	2.185	2.190	617	395
2020-21*	2.226	2.235	609	416

Source: International Grain Council (IGC) April 2021. (*) Estimation Retrieved on March 20, 2023 from http://www.igc.int/downloads/gmrsummary/gmrsumme.pdf

The findings about global grain production per year were presented in Table 2. World grain quantity has been increasing constantly. Production of wheat and corn is considered to increase due to the increase in world grain quantity. After corn, the volume of barley production has also increased; however, this increase has a spotty graphic. There is a slight increase in the production of oat and rye (Table 2).

Table 2. World grain production by years (Million Tons)

Çizelge 2. Yıllar itibariyle dünya hububat üretim miktarları (milyon ton)

Years	Wheat	Corn	Barley	Oat	Rye	Other	World
2011-12	701	907	134	23	13	101	1.879
2012-13	659	901	131	21	14	103	1.829
2013-14	718	1.032	145	24	17	107	2.043
2014-15	732	1.061	144	23	15	117	2.092
2015-16	740	1.023	150	22	13	111	2.058
2016-17	757	1.132	148	24	13	112	2.089
2017-18	763	1.090	145	24	13	105	2.139
2018-19	732	1.129	139	22	11	105	2.141
2019-20	762	1.125	156	23	13	106	2.185
2020-21*	774	1.140	159	26	15	112	2.226

Source: IGC April 2021 (*) Estimation, (**) Sorghum, Triticale, Millet and Hybrid Grain**.** Estimation Retrieved on March 20, 2023 from http://www.igc.int/downloads/gmrsummary/gmrsumme.pdf.

Numerical overview of wheat production and trade in Türkiye

The decrease in the food supply versus the continuous increase in the population has caused agriculture to become an important sector. Türkiye has many different climate regions and microclimate areas due to its geographical location and structure, which is positively reflected in its agricultural production capability and agricultural competitiveness. The main elements that distinguish the agricultural industry from other sectors include its hypersensitivity to the climate and the lower amount of income earned by farmers in agricultural activities compared to other industries. Agricultural products are known to be sensitive to the supply-demand balance; however, the poor supply flexibility of agricultural products remains an important problem. This negativity is reflected in the economy in the form of excessive price fluctuations (Badem & Hurma, 2021).

The population of Türkiye, which was 68.626.337 in 2006, reached 84.680.273 in 2021. The population of Türkiye increased by more than 15 million and wheat production decreased by 3.350.000 tons in 16 years. Since wheat and wheat products were insufficient to meet the basic nutrition requirements of people during this period, it was necessary to import to meet this need. In light of these findings, it was concluded that the amount of wheat production failed to meet the amount of consumption and increased dependence on international resources.

Wheat production areas in Türkiye have decreased continuously from 2006 to the present day. Wheat production areas decreased from 8.490.000 hectares in 2006 to 6.628.739 hectares in 2022. Similarly, the production volume decreased from 21.010.000 tons to 19.750.000 tons. The amount of consumption shows a spotty distribution; however, the trend is constantly upward. The consumption amount, which was 18.943 thousand tons in 2006, increased by approximately 5.500 thousand tons in 2022 compared to 2006 and reached 24.400 thousand tons (Table 3).

The data on the wheat trade of Türkiye were summarized in Table 9. Between 2006 and 2021, wheat import volumes increased continuously, except for some years. The import volume, which was 239.874 tons in 2000, increased to 8.877.307 tons in 2021. While the wheat export volume was 685.673 tons in 2006, it reached 7.406.000 tons in 2021. The wheat export volume was higher than the import volume between 2006 and 2014; however, the increase in the wheat export volume remained well below the increase in import volume after 2014 (Table 4).

Table 3. Wheat production areas, production volumes, and consumption values in Türkiye by years

Çizelge 3. Yıllara göre Türkiye'de buğday üretim alanları, üretim hacimleri ve tüketim değerleri

Years	Production Areas (Ha)	Production Volumes (Ton)	Amount of Consumption (A thousand tons)
2006	8.490.000	21.010.000	18.943
2007	8.100.000	17.234.000	16.882
2008	8.090.000	17.782.000	17.781
2009	8.100.000	20.600.000	16.961
2010	8.103.400	19.674.000	18.187
2011	8.096.000	21.800.000	19.610
2012	7.529.639	20.100.000	18.960
2013	7.772.600	22.050.000	19.230
2014	7.919.208	19.000.000	18.970
2015	7.866.887	22.600.000	18.795
2016	7.671.945	20.600.000	18.756
2017	7.668.879	21.500.000	18.187
2018	7.299.270	20.000.000	18.805
2019	6.846.327	19.000.000	20.070
2020	6.922.236	20.500.000	22.541
2021	6.744.666	17.650.000	24.200
2022	6.628.739	19.750.000	24.400

Source: TMO, 2024, Agricultural Products Markets. Strategy Development Directorate Agricultural Economics and Policy Development Institute. Retrieved on July 29, 2024 from https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/2024Temmuz%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Raporu/Bu%C4%9Fday%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1%20Raporu%20Temmuz-2024-v4.pdf.

Table 4. Wheat import and export values of Türkiye by years

Çizelge 4. Yıllara göre Türkiye'nin buğday ithalat ve ihracat değerleri

YEARS	IMPORT			EXPORT		
	Volume (Ton)	Value (1000 US Dollars)	Mean Export Price (US Dollars/Ton)	Volume (Ton)	Value (1000 US Dollars)	Mean Export Price (US Dollars/Ton)
2006	239.874	52.624	219	685.673	100.853	147
2007	2.147.107	570.390	266	18.281	9.132	500
2008	3.713.421	1.483.190	400	8.005	5.569	696
2009	3.380.378	901.858	266	301.457	60.692	201
2010	2.554.208	655.044	256	1.171.002	200.848	172
2011	4.770.836	1.685.391	353	3.877.699	1.897.485	489
2012	3.737.494	1.195.121	320	4.160.707	2.055.941	494
2013	4.074.862	1.371.838	337	4.935.452	2.507.376	508
2014	5.312.480	1.622.041	305	4.995.231	2.552.513	511
2015	4.380.795	1.175.849	268	5.685.425	2.468.153	434
2016	4.341.241	984.338	227	7.025.117	2.526.235	360
2017	5.159.613	1.149.518	223	7.389.854	2.626.173	355
2018	5.821.561	1.360.506	234	7.485.819	2.715.860	363
2019	9.841.621	2.330.944	237	7.578.535	2.905.105	383
2020	9.791.057	2.444.384	250	7.560.885	2.983.472	395
2021	8.877.307	2.692.627	303	7.406.000	3.259.000	440

Source: TUIK, 2022, https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2022-45504.

The data on the current and real wheat prices in Türkiye were summarized in Table 5. Within the scope of the findings obtained from the table, it was observed that the current wheat price increased from 0.40 TL to 2.25 TL/kg between 2006 and 2021. The current price of wheat increased 17.78 times from 2006 to 2021. The greatest increase in current wheat prices was between 2018-2020. During this period, the increase in current prices was approximately 57.1%. Double-digit increases in inflation rates had a great effect on this price increase. When we realized wheat prices as of 2006 and 2021, it was found that they increased from 0.31 TL to 0.39 TL in 2006 prices. The lowest wheat price in real terms was calculated as 0.29 TL/Kg in 2018. The greatest difference between real wheat prices and current wheat prices was 24.94% in 2021 (Table 5).

Table 5. Wheat prices in Türkiye (Real and Current Prices)

Çizelge 5. Türkiye'de buğday fiyatları (Carı ve Reel Fiyatlarla)

Years	Current Wheat Price (TL/kg)	Real Wheat Price (based on 2003)	Rate of Change in Current Wheat Price (%)	Rate of Change in Real Wheat Price (%)	Difference Between Rates of Change (%)
2006	0.40	0.31	-	-	-
2007	0.43	0.30	6.25	-2.30	-8.55
2008	0.48	0.31	11.76	1.20	-10.57
2009	0.50	0.30	5.26	-0.93	-6.19
2010	0.55	0.31	10.00	1.32	-8.68
2011	0.61	0.32	10.00	3.31	-6.69
2012	0.67	0.32	9.92	0.94	-8.98
2013	0.72	0.32	8.27	0.72	-7.55
2014	0.74	0.31	2.78	-5.58	-8.36
2015	0.86	0.33	16.49	8.19	-8.30
2016	0.91	0.32	5.57	-2.05	-7.62
2017	0.94	0.30	3.30	-7.06	-10.36
2018	1.05	0.29	11.70	-3.98	-15.68
2019	1.35	0.32	28.57	11.63	-16.94
2020	1.65	0.35	22.22	8.86	-13.36
2021*	2.25	0.39	36.36	11.42	-24.94

Source: TUIK, 2022 (*Average prices for the first six months). Retrieved on March 18, 2023 from https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2022-45504.

Within the scope of the findings on wheat production in Türkiye and according to the report published by the United Nations (UN) in 2022, Türkiye ranked first among the countries that imported the highest quantity of wheat. According to this report, the wheat import volume of Türkiye was aimed at use as raw materials in export-oriented production. According to the 2022-2031 Food Outlook report prepared by FAO and the Organization for Economic Cooperation and Development (OECD), Türkiye is one of the countries producing the highest quantity of wheat. Despite all these positive developments, the production volume of Türkiye has decreased, and the consumption volume has increased over years. Compared with the increasing population, it has been revealed that the production volume is not sufficient to meet the amount of consumption. Drought and the increase in fertilizer and fuel prices have been listed as the main reasons for the decrease in production volume in recent years (BBC NEWS, 2023).

Numerical overview of corn production and trade in Türkiye

Bread is the most common basic foodstuff in Türkiye, and the raw material of bread is grain. Although wheat ranks first among the grains, corn bread is also widely consumed in some regions of the Black Sea Region.

Corn plant produced in Türkiye is used both in the form of grain and herbaceous trunk. Corn grains are used in making bread or as snacks, and they are used in the glucose, starch, and feed industry. The herbaceous trunk of corn is used as animal feed (Şahin, 2001).

Corn production has noticeably increased in Türkiye after the 1980s, especially with the increase in the number of irrigable areas with the Southeastern Anatolia Project (GAP). The reasons for this increase include the promotion of corn production by the government, the introduction of modern production techniques, the spread of corn production in irrigation areas, the increase in the use of hybrid seeds, and the use of fertilizers on a certain scale. The largest share of the corn trade in Türkiye belongs to feedstuff with a consumption of approximately 70%. The starch industry ranks second with a consumption capacity of up to 20%. The third is ethanol production. Recently, ethanol production has become an important sector that is constantly growing and developing in Türkiye as well as in the world (Nogay, 2019; Demirbaş & Akkurt, 2021).

The most suitable region for corn production in Türkiye is the Black Sea Region. The widespread cultivation of crops that generate higher income such as tea and hazelnuts in the region and the natural structure of the region restrict the expansion of corn cultivation areas. After the Black Sea Region, the Eastern Mediterranean, and the Southeastern Anatolia Regions, where there is a significant increase with the effect of irrigation, have a share in corn production. It was stated that the suitability of climatic conditions and GAP had an effect on the important share of corn in Southeastern Anatolia (Yaşa & Kutlar, 2019). Manisa and Konya were listed among the other provinces with expanded corn cultivation areas (TEPGE, 2021).

Corn cultivation areas in Türkiye had spotty progress from 2006 to 2021. The greatest decrease in corn cultivation areas during this period was experienced in the 2018 marketing year. Corn cultivation areas started to increase again with the marketing years of 2019 and 2020. Although the corn production volume was parallel to the amount of consumption over the years, the increase in the production volume was greater than the increase in the amount of consumption. The volume of corn production decreased in the 2007, 2009, 2011, 2017, and 2018 marketing periods and started to increase at increasing rates as of 2019 (Table 6).

Table 6. Corn cultivation areas, production volume and consumption values in Türkiye by years

Çizelge 6. Yıllar itibariyle Türkiye'de mısır ekim alanı, üretim miktarı ve tüketim değerleri

Years	Cultivation Areas (Ha)	Production Volume (Ton)	Amount of Consumption (A thousand tons)
2006	536.000	3.811.000	4.000
2007	517.500	3.535.000	4.600
2008	595.000	4.274.000	5.125
2009	592.000	4.250.000	5.142
2010	594.000	4.310.000	5.153
2011	589.000	4.200.000	5.253
2012	622.609	4.600.000	5.112
2013	659.998	5.900.000	5.757
2014	658.645	5,950,000	6.650
2015	688.170	6.400.000	6.834
2016	680.019	6.400.000	5.913
2017	639.084	5.900.000	7.074
2018	591.900	5.700.000	7.804
2019	638.829	6.000.000	7.866
2020	691.632	6.500.000	7.706
2021	-	6.750.000	7.430

Source: TMO, 2022. Retrieved on March 23, 2023 from https://www.tmo.gov.tr/Upload/Document/alim/2022/hubmudalimfyt.pdfTUİK, 2022. Retrieved on March 18, 2023 from https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2022-45504.

The findings about the import and export values of corn in Türkiye were presented in Table 7. Between 2006 and 2021, the import volume had a spotty but increasing course. The import volume of corn, which was 30.579 tons in 2006, increased to 1.566.200 tons in 2021. On the other hand, there was a decrease in the export volume from 2006 to 2021. Despite the increase observed in some years, there was a decrease in general. The export volume, which was 192.950 tons in 2006, decreased to 25.454 tons in 2021. The value paid for imports was always above the value obtained from exports except in 2006 (Table 7).

Corn prices in Türkiye by year are given in Table 8 as TGB and Stock Exchange Prices. According to the table, TGB corn purchase prices have started to be announced since 2008. The purchase price of corn, which was 361 $/ton in 2008, decreased to 230 $/ton in 2021. Corn purchase prices decreased in 2009, 2011, 2015, 2017 and 2018. In other years, purchase prices have increased. The stock market price decreased in 2008, 2012 and 2015 compared to the previous year. In other years, the stock market price of corn increased continuously (Table 8).

Table 7. Import and Export Values of Corn in Türkiye

Çizelge 7. Türkiye'de Mısırın İthalat ve İhracat Değerleri

YEARS	EXPORT		IMPORT	
	Volume (Ton)	Value (1000 US Dollars)	Volume (Ton)	Value (1000 US Dollars)
2006	30.579	12.702	192.950	29.219
2007	1.128.456	269.338	8.320	8.896
2008	1.151.407	381.938	15.056	24.948
2009	485.131	135.136	32.534	81.323
2010	452.363	124.157	10.649	26.006
2011	381.293	136.119	13.945	27.923
2012	807.481	245.919	20.359	33.820
2013	1.548.133	473.138	180.511	88.124
2014	1.423.595	350.247	64.618	63.290
2015	1.487.005	344.333	75.185	51.032
2016	534.791	128.639	44.136	49.044
2017	2.055.543	425.673	117.976	53.038
2018	2.122.734	438.014	37.762	43.878
2019	2.862.081	572.604	22.859	24.687
2020	2.678.592	514.703	15.055	21.432
2021	1.566.200	390.450	25.454	23.435

Source: TUIK, 2022. Retrieved on March 18, 2023 from https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2022-45504

Table 8. Corn prices in Türkiye by years

Çizelge 8. Yıllara göre Türkiye'de mısır fiyatları

Years	TGB Purchase Price($/Ton)	Rate of Change in TGB Purchase Price (%)	Stock Exchange Price (TL/Ton)	Stock Exchange Price Rate of Change (%)
2006	No Price	-	390	**-**
2007	No Price	-	452	**13.72**
2008	361	-	430	**-5.12**
2009	302	-19.54	455	**5.50**
2010	327	7.65	530	**14.15**
2011	300	-9.00	593	**10.63**
2012	330	9.10	576	**-2.95**
2013	331	0.30	601	**4.16**
2014	333	0.60	678	**11.36**
2015	245	-35.91	677	**-0.15**
2016	252	2.77	694	**2.45**
2017	217	-16.13	782	**11.25**
2018	173	-25.43	943	**6.47**
2019	210	17.62	1.152	**18.14**
2020	223	5.83	1.396	**17.48**
2021	**230**	**3.04**	**1.440**	**3.19**

Source: TMO, 2021. Retrieved on March 18, 2023 from https://www.tmo.gov.tr/Upload/Document/istatistikler/Çizelgelar/5misireuva.pdf

Customs duties have been one of the main policy tools affecting the corn market in recent years. With the decree published on October 21, 2020, the tax rate of 25% was reduced to zero and this implementation was extended until January 1, 2022. Zero customs duty facilitated imports and contributed to the production. Nevertheless, increases in exchange rates can increase the cost of imports (TEPGE, 2021).

The legal regulations regarding the markets where corn and its derivatives are traded directly affect the domestic and foreign markets. The best example of this was the GMO regulation enforced in November 2019 and the "Biosafety Law" enacted in March 2010. In addition to these laws, two GMO corn varieties were allowed for feed use in the 2020 marketing year. As a result of the implementation of these laws and permits, the GMO corn variety with feed use permits increased to 23 (TEPGE, 2021).

Literature Review

Although there are numerous studies in the literature on staple food products examining demand forecasts and factors affecting demand, there are very few studies specifically addressing the factors influencing import demand for wheat and corn. In the domestic literature, the first study was conducted by Karkacıer (2000), who attempted to identify the factors influencing the import demand for dairy products in Türkiye. In the study, it was found that domestic prices, per capita income, and exchange rate affected the import demand for milk and dairy products in Türkiye. The second study was conducted by Hatırlı et al. (2002). The study covered the period between 1983 and 2000 and used the "Seemingly Unrelated Regressions" method. According to the findings of the study, per capita income, import prices of sunflower and soybean oil, the volume of soybean oil production in the previous year, and the import amounts were found to be statistically significant among the factors affecting soybean oil. In terms of the sunflower oil import model, it was determined that the sunflower oil production, total sunflower oil demand, and import amounts of the previous year were significant; however, the import prices of soybean and sunflower oil were not found to be statistically significant. The third study was carried out by Şimşek & Kadılar (2004). The study involved the statistical analysis of the total import demand in Türkiye between 1970 and 2002. The study analyzed the long-term relationship between import demand and the factors affecting import demand. As a result, it was mentioned that financial, monetary, and exchange rate policy instruments could be used to correct the trade balance. Another study of the literature was carried out by Göktolga (2006). This case looked at the import demand for meat and meat-related products. The import demand for vegetable oil and its products was looked at in a separate exploratory implemented by Kızılaslan & Kızılaslan (2006) in the same year. The first survey on wheat import demand was prosecuted by Uzunöz & Akçay (2009). The factors influencing the demand for imported wheat from 1984 to 2006 were examined in this investigation. Türkiye's wheat import demand was considered a function of domestic demand in the case study. Prices, GDP per capita, Turkish Lira-US dollar exchange rate, delayed imports, wheat production value, domestic demand, and trend factors were discussed as variables in the study. The case's data indicated that domestic wheat price changes had an outstanding impact on wheat prices. The most substantial development within the scope of the results is that Turkish consumers are gradually preferring to purchase domestic wheat over imported wheat. Another study was conducted by Adıgüzel et al. (2012). This study discussed the long-term effect of the financial system on import demand. The data used in the study included the period of eight years from the date of implementation of the "Transition to a Strong Economy Program". When the data used in the study were analyzed, it was observed that both national cash flow and relative prices positively affected import demand. Another study was conducted by Boz & Hüseyinli (2019) on the production and import of bananas based on data from the period between 1994 and 2015 in Türkiye. As a result of the analysis, a linear but weak relationship was found

between the producer banana price and the banana imports, a positive and strong relationship between the exchange rate and the producer banana prices, and a linear but weak relationship between the exchange rate and the logarithm of the banana imports. As a contribution to the findings obtained in the study, the banana production of Türkiye is far behind in meeting the demand for bananas. For this reason, Türkiye is a country dependent on banana imports to meet the demand for bananas. Arı (2021) conducted another research that is thought to be relevant to the topic. The impact of economic expansion and the exchange rate on import demand was examined in this study. FMOLS (fully modified ordinary least square) and DOLS (Dynamic OLS) estimation methods and cointegration tests were used in the case. According to the analysis's outcomes, income inequality has a positive impact on import demand. The research also found that while economic growth had a positive impression on imports, the real exchange rate had a negative effect.

Lee et al. (1994) conducted the first study on foreign literature. The AIDS (Almost Ideal Demand System) model was employed in the investigation to predict Japan's need for wheat imports. Mao et al. (1997) published another study about Japan. They investigated the demand for wheat import in their research. The study's conclusion revealed that US wheat and Japanese wheat were fierce competitors. Tanyeri-Abur & Russon (1998) published yet another case to designate import demand. The study handled the import demand for dairy products on the basis of Mexico. The case concluded that the amount of dairy product imports could not be predicted in the future and that income elasticity and real exchange rate elasticity were comparable. Ramirez et al. (2003) published yet another study about Mexico. The study estimated cheese import demand. Andino & Kennedy (2004) discussed the elements influencing the import demand for Honduran coffee in another review of the literature. According to the subject, variations in import prices and revenues had an efficiency on sales of Honduran coffee. A final survey on wheat import demand was conducted by Valencia-Romero, Trejo-García & Ríos-Bolívar (2023) in Mexico. The autoregressive distributed delay (ARDL) model and cointegration analysis were both used in the study. Variables such as the real exchange rate, wheat prices, and income level are discussed in the study as factors influencing wheat import demand. At the conclusion of the study, it was confirmed that among the major factors affecting imports in the short term were the exchange rate and the date of imports. In the long run, exchange rates and economic activity were only predictive in the low quantiles.

Studies available in the literature have identified that agricultural product prices, import quantities, and exchange rates generally play a determining role in import demand. Based on findings from both domestic and international literature, factors acknowledged to influence the import of wheat and corn include per capita national income, exchange rates, import prices, total consumption quantities, and one-year lagged values of production and import quantities. The variables examined in this research were constructed by taking into consideration previous studies in the domestic literature, including the works of Hatırlı et al. (2002), Kızılaslan & Kızılaslan (2006), Uzunöz & Akcay (2009), as well as studies in the international literature by Lee et al. (1994) and Mao et al. (1997).

MATERIALS and METHODS

Data and Method

The data set used in this study consists of annual data covering the years between 2006 and 2021. Stata software was used to analyze the data of the study. Since the Stata or Eviews software did not provide the Standardized Beta (β) coefficient, the statistical analyses were performed on Microsoft Excel using a formula (β=B*SSXi / SSY). Definitions of the data are shown in Table 9.

Table 9. Data used in the study

Çizelge 9. Çalışmada kullanılan Değişkenler

Variables	Using Variables	Source
ITM_{bgd}	Wheat import amount	TUIK
GDP	National income per capita	TUIK
RAT	Exchange rate	TCMB
ITH_P_{bgd}	Wheat import price	TUIK
TT_{bgd}	Total wheat consumption	TMO
TU_{bgd_t-1}	One year lagged value of wheat production	TMO
ITM_{bgd_t-1}	One year lagged value of wheat imports	TUIK
ITM_{msr}	Corn import amount	TUIK
ITH_P_{msr}	Corn import price	TUIK
TT_{msr}	Total corn consumption	TUIK
TU_{msr_t-1}	One year lagged value of corn production	TMO
ITM_{msr_t-1}	One year lagged value of corn imports	TUIK

The data for the studies were obtained from various sources, including the Turkish Statistical Institute, the Central Bank of the Republic of Türkiye, the Grain Board, numerous research conducted on the subject, and various institutions and organizations.

When the error term of the estimated equation is presumed to be correlated with the error term of other equations, the application of the 'Seemingly Unrelated Regressions' method becomes necessary. In other words, if there is a relationship among the error terms of the equations, the seemingly unrelated regressions method can be applied to enhance the efficiency of the estimated coefficients. Therefore, when multiple equations are to be estimated, it is necessary to test whether there is a relationship among the error terms of these equations. The general assessment of whether the variance-covariance matrix is diagonal is typically tested using the Likelihood Ratio (LR) and Lagrange Multiplier (LM) methods. The hypothesis test applicable for a two-equation system is as follows: H0: $\sigma12 = 0$, Ha: $\sigma12 \neq 0$. Overall, as a result of the application of tests, if LR and LM are accepted as the alternative hypothesis, it is necessary to estimate each equation using the 'Least Squares Method' (LSM) instead of the 'Seemingly Unrelated Regressions' (SUR) model.

Per capita income, exchange rate, import prices, total consumption amounts, production volume, and import volume were considered factors affecting wheat and corn imports, and it was aimed to determine their development during the period examined. In the models presented below, e_{1t} and e_{2t} refer to the error terms related to wheat and corn import models, respectively.

$$ITM_{bgd} = \beta_0 + \beta_1 GDP + \beta_2 RAT + \beta_3 ITH\_P_{bgd} + \beta_4 TT_{bgd} + \beta_5 TU_{bgd\_t-1} + \beta_6 ITM_{bgd\_t-1} + e_{1t}$$

$$ITM_{msr} = \beta_0 + \beta_1 GDP + \beta_2 RAT + \beta_3 ITH\_P_{msr} + \beta_4 TT_{msr} + \beta_5 TU_{msr\_t-1} + \beta_6 ITM_{msr\_t-1} + e_{2t}$$

The definitions and descriptive statistics of the variables included in the models were presented in Table 10.

Jarque-Bera is a measure of goodness of fit used to measure divergence from the normal distribution and is derived from the transformation of kurtosis and skewness measurements. The H0 hypothesis indicates that the data are normally distributed (IHS Markit-Eviews, 2020). Table 10 shows that all of the variables in the models have a normal distribution.

Table 10. Descriptive statistics of variables
***Çizelge 10.** Değişkenlere ait tanımlayıcı istatistikler*

Variables	Kısaltma	Min.	Maks.	Ort.	SS	J-B(p)
Wheat import amount (Ton/Year)	ITM_{bgd}	239873	9841621	4882936	2664361	0.970(0.615)
National income per capita ($)	GDP	7500	11014	9702	1103	1.604(0.448)
Wheat import price ($/Ton)	ITH_P_{bgd}	221	400	279	52	1.870(0.392)
Total wheat consumption (Ton/Year)	TT_{bgd}	16882	24200	19180	1866	5.129(0.077)
One year lagged value of wheat production	TU_{bgd_t-1}	17234000	22600000	20309375	1502171	0.861 (0.650)
One year lagged value of wheat imports	ITM_{bgd_t-1}	135595	9841621	4336579	2686862	1.080(0.582)
Corn import amount (Ton/Year)	ITM_{msr}	30579	3593167	1272830	964466	1.266(0.531)
Corn import price ($/Ton)	ITH_P_{msr}	195	415	271	60	2.038(0.361)
Total corn consumption (Ton/Year)	TT_{msr}	4000	7866	6140	1186	0.685(0.709)
One year lagged value of corn production	TU_{msr_t-1}	3535000	6500000	5120625	1049296	1.794(0.407)
One year lagged value of corn imports	ITM_{msr_t-1}	30579	3593167	1154787	971154	2.356(0.308)
Exchange rate	RAT	65.25	127.39	101.241	18.197	1.238(0.538)

J-B: Jarque-Bera

RESULTS

While the assumptions of the classical linear regression model hold, the estimation of single-equation models through the 'Least Squares Method' (LSM) yields unbiased, consistent, and efficient predictors. The classical linear regression model assumes that the specification of the model is correct. In other words, the mathematical function of the model and its explanatory variables are comprehensive. If certain additional information exists and is not considered, predictors may fail to provide the characteristics related to the predictors in the classical linear regression model. In cases where multiple equations are to be estimated, the possibility of the error terms of these equations being correlated provides us with additional information, and it is essential to consider this information in predicting the model (Kmenta, 1971, as cited in Hatırlı et al., 2002). In order to determine whether LSM or seemingly unrelated regressions methods will be employed in forecasting wheat and corn import models, it is necessary to test whether the error terms of the two equations are interrelated. For this purpose, the Lagrange Multiplier (LM) and Likelihood Ratio (LR) tests were employed and used consecutively for the equation system. The LM test result was calculated as 0.248 (p=0.618 > 0.05), and the LR test result was 1.84 (p=0.175 > 0.05). Accordingly, both LM and LR test statistics accepted the hypothesis of "no relationship among error terms" (p>0.05). According to the test results, it was understood that there was no relationship among the error terms; therefore, there would be no benefit in obtaining parameter estimates through the SUR method. However, for the presentation of the analysis results obtained from both SUR and least squares methods, the outcomes are illustrated in Table 11.

When examining Table 11, the determination coefficients (R^2) for the wheat import model evaluated through the SUR method were found to be 0.899, and for the wheat import model assessed through the LSM method, it was 0.908. These coefficients were determined as 0.782 for the corn import model evaluated with the SUR method and 0.789 for the corn import model evaluated with the LSM method. It is observed that the determination coefficients in the models conducted with both methods were not different. Accordingly, the explanatory power of the included variables in the model was approximately 85% for wheat import and around 65% for corn import.

In this study, as time series data were used, three primary tests were considered for the evaluation of the distribution of error terms. Primarily, it is essential to test whether issues such as multivariate normal distribution, autocorrelation, heteroscedasticity, and multicollinearity pose significant problems for the

model. The non-significance of the Jarque-Bera test statistic for the multivariate normality distribution (p>0.05) indicates that the residuals conform to a normal distribution (IHS Markit - Eviews, 2020). The p-values associated with the Jarque-Bera statistics for wheat and corn import models were found to be non-significant (p > 0.05), indicating that the residuals exhibited normal distribution and complied with the assumption of multivariate normality.

Table 11. Estimated model results

Çizelge 11. *Tahmin edilen model sonuçları*

Wheat Import Model	SUR Method (Seemingly Unrelated Regression)					LS method					
	B	SH	β	t	p	B	SH	β	t	p	VIF
GDP	-103.54	132.37	-0.042	-0.78	0.434	219.40	339.65	0.091	0.646	0.534	1.941
RAT	-125746	26465	-0.858	-4.75	**0.000**	-134147	35177	-0.916	-3.813	**0.004**	5.670
ITH_P$_{bgd}$	11019	5212	0.216	2.11	**0.035**	8737	7244	0.172	1.206	0.259	1.996
TT$_{bgd}$	-64.173	218.24	-0.044	-0.29	0.769	89.998	316.08	0.063	0.285	0.782	4.814
TU$_{bgd\_t-1}$	-0.289	0.178	-0.163	-1.63	0.104	-0.501	0.291	-0.282	-1.721	0.119	2.646
ITM$_{bgd\_t-1}$	0.200	0.196	0.201	1.02	0.307	0.031	0.293	0.031	0.107	0.918	8.571

X^2 = 151.40 p=0,000 R^2=0.899 ΔR^2=0.832
Durbin Watson H=2.005

$F_{(6; 9)}$ = 14.874 p=0.000 R^2=0.908 ΔR^2=0.847
Durbin Watson H =2.021 B-P-G(p): 2.801(0.080)
J-B(p): 5.315(0.070)

Corn Import Model	B	SH	β	t	p	B	SH	β	t	p	VIF
GDP	-103.54	132.37	-0.042	-0.78	0.434	-193.22	186.68	-0.221	-1.035	0.328	1.945
RAT	-11469	15939	-0.078	-0.72	0.472	-4427	20380	-0.083	-0.217	0.833	6.313
ITH_P$_{msr}$	-1288	2929	-0.029	-0.44	0.660	-1840	3707	-0.115	-0.497	0.631	2.307
TT$_{msr}$	748.66	254.76	0.333	2.94	**0.003**	845.23	323.90	1.039	2.610	**0.028**	6.773
TU$_{msr\_t-1}$	-0.157	0.229	-0.061	-0.68	0.494	-0.103	0.299	-0.112	-0.343	0.740	4.528
ITM$_{msr\_t-1}$	-0.196	0.231	-0.071	-0.84	0.398	-0.235	0.299	-0.236	-0.786	0.452	3.872

X^2 = 50.08 p=0,000 R^2=0.782 ΔR^2=0.637
Durbin Watson H =2.365

$F_{(6; 9)}$ = 5.616 p=0.011 R^2=0.789 ΔR^2=0.648
Durbin Watson H =2.369 B-P-G(p): 0.795 (0.596)
J-B(p): 0.492(0.781)

B-P-G: Breusch-Pagan-Godfrey (Variances Homogeneity Test / Heteroscedasticity Test)

A significant deviation of the Durbin-Watson H statistic from 2 indicates a noteworthy sign of autocorrelation. If the H statistic falls below 1, this situation is considered to be in the region of instability (Gujarati, 1995, as cited in Hatirli et al., 2002). It is observed that the H statistics in the wheat and corn import models did not exhibit a significant deviation from 2, indicating the absence of autocorrelation in the models.

The Variance Inflation Factors (VIFs) are a method for measuring the level of collinearity (multicollinearity) among regressors in an equation. VIFs indicate the extent to which the variance of a regression coefficient estimation is inflated due to collinearity with other regressors (IHS Markit - Eviews, 2020). It was determined that the VIF statistics for multicollinearity were <10, indicating the absence of multicollinearity issues among the independent variables in both wheat and corn import models. The Breusch-Pagan-Godfrey test (Breusch and Pagan, 1979; Godfrey, 1978) is a Lagrange multiplier test that assesses the null hypothesis of constant variance against the alternative hypothesis of changing variance for a vector of independent variables. Since the p-value associated with the Breusch-Pagan-Godfrey test statistic is greater than 0.05 (p > 0.05), it is understood that there is no issue of changing variance.

The analysis results indicate that, in the wheat import model using the SUR method, the effective exchange rate (β=-0.86; t=-4.75; p=0.000) and wheat import price (β=0.22; t=2.11; p=0.035) variables were statistically significant at the 5% significance level in influencing wheat imports. Similarly, in the LSM method, the effective exchange rate (β=-0.92; t=-3.81; p=0.000) variable was found to be statistically significant at the 5% significance level, while the wheat import price (β=0.17; t=1.21; p=0.259) variable

was determined to be statistically insignificant in influencing wheat imports. In both methodologies, the elasticity coefficient exceeding 0.70 indicates that a 1% increase (decrease) in wheat imports from the previous year would result in more than a 0.80% increase (decrease) in wheat imports. The SUR method revealed that the variables of per capita national income, total wheat consumption, lagged value of wheat production, and lagged value of wheat imports in the wheat import model did not have a significant impact on the quantity of wheat imports, while the LSM method indicated that per capita national income, wheat import price, total wheat consumption, lagged value of wheat production, and lagged value of wheat imports in the wheat import model were not statistically significant in influencing the amount of wheat import. There was no significant difference in the elasticity coefficients between the two models, but given the variation in the explanatory variable of wheat import price, a "test of the significance of the difference between two slope estimators" was conducted. This estimator takes into account the slope, standard error, and sample size of each line to determine whether the slopes of the two lines are significantly different from each other. A probability value lower than 0.05 indicates a significant difference between the two slopes (Soper, 2024). There was no significant difference in the coefficients of wheat import price between the two models (t=0.255; p=0.800), indicating that the explanatory effect of wheat import price was similar in both models.

The analysis results indicate that in the corn import model using the SUR method, the variable of total corn consumption (β=0.33; t=2.94; p=0.003) was statistically significant at the 5% significance level in influencing corn imports. Similarly, in the LSM method, the variable of total corn consumption (β=1.04; t=2.61; p=0.000) was found to be statistically significant at the 5% significance level in influencing corn imports. In both methodologies, the elasticity coefficient exceeding 0.70 indicates that a 1% increase (decrease) in corn imports from the previous year would result in an increase (decrease) of more than 0.70% in corn imports. In both the SUR and LSM methods, it was determined that the variables of per capita national income, effective exchange rate, corn import price, total corn consumption, lagged value of corn production, and lagged value of corn imports in the corn import model were not statistically significant in influencing the quantity of corn import (Table 11).

CONCLUSION

Wheat and corn are among the most basic nutrients used in human nutrition in Türkiye, similar to the entire world. Due to the COVID-19 pandemic, which has affected the world and continues to have an economic impact, the demand for wheat and wheat products is constantly increasing since wheat is the raw material of durable dry food products such as bakery products, pasta, semolina, and biscuits. This phenomenon lies in the foundation of the fact that Türkiye is a net wheat importer. Nevertheless, wheat prices are generally determined by supply, which is due to the poor demand elasticity of wheat. Wheat supply is determined by economic policies, climatic conditions, supports provided, and fuel and fertilizer prices. On the other hand, corn is used in making bread, animal feed, industrial raw material, or as a snack dish in some regions of Türkiye. Corn, which has a wide range of uses, has an important share among the grains grown in Türkiye in terms of cultivation area and production. Despite all these positive developments, the yield values of corn production in Türkiye are low; therefore, the amount of product obtained is low. The most basic reason for this is cultivating corn in almost every area without looking for suitable conditions for corn to grow. Only the Black Sea, Marmara, and Aegean regions should be approved for cultivation in order to obtain economic efficiency from corn production. If it is to be grown outside these regions, it is very important to apply the cultivation technique fully, to spread the use of quality seeds, and to solve the irrigation problems. Therefore, it is necessary to apply economic policies according to these variables to increase wheat and corn production.

The findings of the study emphasize that among the explanatory variables in the wheat import model, only the one-year lagged value of wheat imports and the exchange rate are statistically significant. In light of these findings, it is indicated that a 1% increase (decrease) in wheat imports from the previous year would

result in an increase (decrease) of more than 0.80% in wheat imports. The variables of per capita national income, wheat import price, total wheat consumption, and one-year lagged value of wheat production in the wheat import model were determined to be statistically insignificant in influencing the quantity of wheat imports, with only the exchange rate having a significant impact. Similar results were obtained concerning the factors influencing corn import demand. Within the scope of the findings obtained in the study, it was determined that among the explanatory variables in the corn import model, only total corn consumption was statistically significant. Based on this, it is highlighted that a 1% increase (decrease) in total corn consumption would lead to an increase (decrease) of more than 0.70 % in corn imports. It was determined that the variables of per capita national income, exchange rate, corn import price, lagged value of corn production, and one-year lagged value of corn imports in the corn import model were statistically insignificant in influencing the quantity of corn imports. Based on all these findings, it can be claimed that changes in wheat imports are influenced by variations in the previous year's wheat imports and exchange rates, while changes in corn imports are affected by alterations in total corn consumption.

No study has been encountered in the national literature that jointly examines the factors influencing wheat and corn import demand. A study by Uzunöz & Akcay (2009) has been conducted in Türkiye, focusing solely on determining the factors influencing wheat import demand. The results obtained from this study differ from those obtained in the research in terms of the variables employed. The results obtained in the study exhibit parallelism only in terms of the exchange rate variable. Two separate studies, similar to this research, have been conducted to examine the factors influencing the import demand for soybean and sunflower oil, as well as milk and dairy products. In the international literature, there exists a study conducted by Valencia-Romero, Trejo-García & Ríos-Bolívar (2023), focusing on the factors influencing wheat import demand. The results obtained in this study only exhibit similarity in terms of the exchange rate variable.

Considering the findings of the research and the current structure of Türkiye, it is understood that in the future, it can maintain its position as an importer of wheat and corn. At this point, some economic policies need to be revised. Policies regarding the export and import of wheat and corn differ compared to other commodities. The essential role of wheat as a staple food and corn as a fundamental source for both human and animal nutrition makes both products strategic foods. Since 2002, Türkiye has started importing wheat. Over the past 25 years, Türkiye has exported approximately 8 million tons of wheat while importing about 106 million tons in the same period. During this time, the gap between wheat exports and imports has consistently widened in favor of imports. A similar situation applies to corn. In this context, increasing efforts to enhance wheat and corn yields, reverting to the use of local hybrids, considering the prices of essential inputs such as chemical fertilizers and diesel fuel when setting wheat purchase prices, supporting small family farms, ensuring the state acts as the planner and enforcer of all agricultural practices, supporting cooperatives, and ensuring that the Turkish Grain Board (TMO) and agricultural market regulators operate in a manner that protects both producers and consumers are of great importance in reducing import dependency.

What distinguishes this study, which is anticipated to make a significant contribution to the literature, from other works is its fundamental characteristic of delineating the factors influencing wheat and corn import demand in Türkiye using the 'Seemingly Unrelated Regressions' method. No study addressing this topic has been encountered in the literature. The aim of this study was to guide future economic policies based on the findings obtained.

Data Availability

Data will be made available upon reasonable request.

Author Contributions

Conception and design of the study: KM, ŞEÇ; analysis and interpretation of data: KM, ŞEÇ; statistical analysis: KM; visualization: KM, ŞEÇ; writing manuscript: KM, ŞEÇ.

Conflict of Interest

There is no conflict of interest between the authors in this study.

Ethical Statement

We declare that there is no need for an ethics committee for this research.

Financial Support

This study was not financially supported.

Article Description

This article was edited by Section Editor Dr. H. Ece SALALI.

REFERENCES

Adıgüzel, U., T. Bayat & S. Kayhan, 2012. The long-run effect of the financial system on import demand: the case of Turkey. Doğuş University Magazine, 13 (2): 173- 188.

Aktaş, E. & O. Yurdakul, 2005. The effect of support and technology policies on corn agriculture in Çukurova Region. Journal of Çukurova University Faculty of Agriculture, 20 (2): 19-28.

Andino, J. & P. L. Kennedy, 2004. "A dynamic import demand analysis of Honduran coffee, 1-16". Southern Agricultural Economics Association Annual Meeting, Tulsa, Oklahoma, 1365 pp.

Arı, A., 2021. Income inequality and import demand: cointegration analysis. Journal of Dicle University Faculty of Economics and Administrative Sciences, 11 (22): 429-440.

Badem, M. & H. Hurma, 2021. An overview of support policies in wheat, the main strategic product. Trakya University Journal of Engineering Sciences, 22 (1): 21-30.

BBC NEWS, 2023. Why is Turkey the 3rd country that imports the most wheat? (Web page: https://www.bbc.com/turkce/haberler-Turkey-62052338) (Date accessed: March 12, 2023).

Birtek, F. & C. Keyder, 1975. Agriculture and the state: An inquiry into agricultural differentiation and political alliances: The case of Turkey. The Journal of Peasant Studies, 2: 446-467.

Boz, F. & N. Hüseyinli, 2019. A forecast modeling for banana production and imports in Turkey. Journal of the Faculty of Applied Sciences, 1 (1-2): 63-82.

Breusch, T. S. & A. R. Pagan, 1979. A simple test for heteroskedasticity and random coefficient variation. Econometrica, 48: 1287-1294.

Demirbaş, N. & E. Akkurt, 2021. "Evaluation of self-sufficiency in corn production in Turkey, 798-809". XV. IBANESS Economics, Business and Management Sciences Congress Series (29-30 May 2021, Plovdiv / Bulgaria), 1540 pp.

Demirdöğen, A. & E. Olhan, 2014. Evaluation of Turkey and Russia Agricultural Trade in Terms of Policy Change. Journal of Agricultural Economics, 20 (2): 101- 111.

Emeksiz, F., M. Albayrak., Güneş, E., Özçelik, A., Özer, O. O & K. Taştan, 2005. "Evaluation of marketing channels and tools of agricultural products in Turkey, 1155-1171". VI Technical Congress, (3-7 January 2005, Ankara, Türkiye), 1263 pp.

Godfrey, L. G., 1978. Testing for multiplicative heteroscedasticity. Journal of Econometrics, 8: 227-236.

Göktolga, Z. G., 2006. An analysis of import demand for meat and meat product in Turkey. Journal of Agronomy, 5 (1): 98-100.

Gül, M., 1998. Production Costs and Producer Problems in Corn in Irrigated Areas of Yuregir District. Çukurova University, Graduate School of Natural and Applied Sciences, (Unpublished) Master Thesis, Adana, 105 pp.

Hatırlı, S. A., V. Demircan & A. R. Aktaş, 2002. Analysis of sunflower and soybean oil import demand. Akdeniz University Journal of the Faculty of Agriculture, 15 (2):71-79. https://dergipark.org.tr/tr/pub/akdenizfderg/issue/1586/19705.

IGC, 2021. International Grains Council. (Web page: http://www.igc.int/downloads/gmrsummary/gmrsumme.pdf) (Date accessed: March 20, 2023).

IHS Markit- Eviews, 2020. Eviews 12 User's Guide. IHS Global Inc., Seal Beach, CA.

Karkacıer, O., 2000. Milk and dairy products import demand analysis in Turkey. Turkish Journal of Agriculture and Forestry, 24: 421-427.

Karlı, B., B. A. Kadakoğlu & G. Karadağ, 2018. Effects of agricultural supports on corn agriculture in Turkey. Akademia Journal of Social Sciences, Special Issue 1 (ASM5):307-317. https://dergipark.org.tr/tr/pub/asj/issue/40224/479035.

Kırtok, Y., H. Arıoğlu & O. Erkan, 1997. Corn Production in Turkey and Its Place in the Economy. Unpublished Report, Adana, 168 pp.

Kızılaslan, H. & N. Kızılaslan, 2006. An analysis of import demand in vegetal oil and products industry in Turkey. Journal of Applied Science, 6 (4): 905-910.

Kızılaslan, N., A. Z. Gürler & H. Kızılaslan, 1996. "Evaluation of cooperative partner relations in agricultural credit cooperatives in Turkey (example of Tokat Province), 383-393". Turkey 2nd Agricultural Economics Congress, (4-6 September 1996, Cilt.2, Adana, Türkiye), 441 pp.

Lee, J. H., W. W. Koo & M. A. Krause, 1994. Japanese Wheat Import Demand. Agricultural Economics Report No: 317, Department of Agricultural Economics Agricultural Experiment Station North Dakota State University Fargo, N. Dakota, USA, 15 pp.

Mao, W., W. W. Koo., J. P. Suomala & T. Sakurai, 1997. Wheat Import Demand in The Japanese Flour Milling Industry: A Production Theory Approach. AAEA Annual Meetings in Toronto, Canada, 14 pp.

Narin, M., 2008. Change in agricultural support policies implemented in Turkey. Economic Approach,19 (special issue): 183-225.

Nogay, Y., 2019. Corn Seed Market Research and Factors Affecting Producers' Corn Seed Preferences: The Case of Sakarya Province. Tekirdağ Namik Kemal University Institute of Science and Technology, (Unpublished) Master Thesis, Tekirdağ, 187 pp.

Ramirez, M. A., K. M. Jones., F. Arollebe & K. C. Raper, 2003. Estimating Import Demand in The Mexican Cheese Market. Staff-Paper 03-23, Department of Agricultural Economics, Michigan State University, East Lansing, USA, 14 pp.

Şahin, S., 2001. Distribution of corn planting areas and corn production in Turkey. Gazi University Journal of Gazi Education Faculty, 21 (1): 73-90. https://dergipark.org.tr/tr/pub/gefad/issue/6769/9109.

Şimşek, M. & C. Kadılar, 2004. Cointegration analysis of Turkey's import demand function with bounds test method: 1970-2002. Doğuş University Magazine, 5 (1): 27-34.

Soper, D., 2024. Significance of the difference between two slopes calculator. (Web page: https://www.danielsoper.com/statcalc/calculator.aspx?id=103) (Date accessed: February 13, 2024).

Tanyeri-Abur, A. & P. Rosson, 1998. Forecasting Mexican Import Demand for Dairy Products. Department of Agricultural Economics, Texas AM University, T77843-2124, FP 97.5. November, USA, 15 pp.

Taşdan, K., 2005. Turkish Corn Market. Çukurova University, Graduate School of Natural and Applied Sciences, (Unpublished) PhD Thesis, Adana, Türkiye, 213 pp.

TCMB, 2022. Indicative Central Bank Rates. (Web page: https://www.tcmb.gov.tr/kurlar/kurlar_tr.html) (Date accessed: July 19, 2023).

TEPGE, 2021. Agricultural Products Markets. Egypt, Strategy Development Presidency Institute of Agricultural Economics and Policy Development. (Web page: https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/Birle%C5%9Ftirilmi%C5%9F%20T%C3%9CP%20Raporlar%C4%B1/Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasa%20Raporu%202022-Temmuz%20snzip.pdf) (Date accessed: March 10, 2023).

TEPGE, 2022. Agricultural Products Markets. Strategy Development Directorate Agricultural Economics and Policy Development Institute. (Web page: https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/Birle%C5%9Ftirilmi%C5%9F%20T%C3%9CP%20Raporlar%C4%B1/Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasa%20Raporu%202022-Temmuz%20snzip.pdf) (Date accessed: March 13, 2023).

TEPGE, 2024. Agricultural Products Markets. Strategy Development Directorate Agricultural Economics and Policy Development Institute. (Web page: https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/2024-Temmuz%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Raporu/Bu%C4%9Fday%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1%20Raporu%20Temmuz-2024-v4.pdf) (Date accessed: July 29, 2024).

Tezel, Y. S., 2015. Economic History of the Republican Era 1923-1950. Türkiye İş Bankası Cultural Publications, İstanbul, 712 pp.

TMO, 2021. Year 2020 Cereals Sector Report. (Web page: Retrieved on March 18, 2023 from https://www.tmo.gov.tr/Upload/Document/istatistikler/Çizelgelar/5misireuva.pdf.

TMO, 2022. Year 2022 Cereals Sector Report. (Web page: https://www.tmo.gov.tr/Upload/Document/alim/2022/hubmudalimfyt.pdf) (Date accessed: March 23, 2023)

TMO, 2024. Agricultural Products Markets. Strategy Development Directorate Agricultural Economics and Policy Development Institute. (Web page: https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/2024Temmuz%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Raporu/Bu%C4%9Fday%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1%20Raporu%20Temmuz-2024-v4.pdf) (Date accessed: July 29, 2024).

TUIK, 2022. Vegetable Production Amount. (Web page: https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2022-45504) (Date accessed: March 18, 2023).

Tuna, Y., 1989. State intervention in prices of agricultural products and history of intervention price policy in Turkey. Journal of the Faculty of Economics, 47: 345-365.

Tuna, Y., 2011. State intervention in prices of agricultural products and history of intervention price policy in Turkey. Istanbul University Faculty of Economics Journal, 47 (1-4). https://dergipark.org.tr/tr/pub/iuifm/issue/837/9250.

Uzunöz, M. & Y. Akçay, 2009. Factors affecting the import demand of wheat in Turkey. Bulgarian Journal of Agricultural Science, 15 (1): 60-66.

Valencia-Romero, R., J. C. Trejo-García & H. Ríos-Bolívar, 2023. Wheat import demand in Mexico: evidence of quantile cointegration. Agriculture, 13 (5): 980.

Yaşa, S. & İ. Kutlar, 2019. Investigation of information sources and marketing problems of corn producers in Diyarbakir Province. Mediterranean Agricultural Sciences, 32 (2): 167-173. https://doi.org/10.29136/Mediterranean.564396.