



**T.C.
AKSARAY ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
İKTİSAT ANABİLİM DALI**

THE EFFECT OF FUEL PRICE ON FOOD INFLATION IN TÜRKİYE

YÜKSEK LİSANS TEZİ

MESUT GÜDÜKÇAM

**DANIŞMAN
DOÇ. DR. ARİF İĞDELİ**

AKSARAY 2023

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TELİF HAKKI VE TEZ FOTOKOPİ İZİN FORMU

Bu tezin tüm hakları saklıdır. Kaynak göstermek koşuluyla tezin teslim tarihinden itibaren(....) ay sonra tezden fotokopi çekilebilir.

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SOSYAL BİLİMLER ENSTİTÜSÜ
JÜRİ ONAY SAYFASI

Mesut GÜDÜKÇAM tarafından hazırlanan “The Effect Of Fuel Price On Food Inflation In Türkiye” başlıklı tez çalışması aşağıdaki jüri tarafından oy birliği / oy çokluğu ile Aksaray Üniversitesi Sosyal Bilimler Enstitüsü İktisat Anabilim Dalı’nda Yüksek Lisans tezi olarak kabul edilmiştir.

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AKSARAY ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
TÜRKİYE’DE AKARYAKIT FİYATLARININ GIDA ENFLASYONUNA
ETKİSİ
(Yüksek Lisans)
MESUT GÜDÜKÇAM, AKSARAY 2023

ÖZET

Covid 19 pandemisinin ardından gıda enflasyonu Türkiye başta olmak üzere Dünya genelinde politika yapıcıların üzerinde durduğu temel bir sorundur. Gıda enflasyonunun yükselişe geçmesinde çeşitli faktörler rol oynamaktadır. Bu faktörlerden biri akaryakıt fiyatlarıdır. Akaryakıt fiyatları tarımda kullanılan traktörden, lojistik sağlanan tırlara kadar birçok kalemde gıda ürünlerine maliyet olarak yansımaktadır. Türkiye’de akaryakıt fiyatlarının yüksek olduğu görülmektedir. Bunun iki ayrı sebebi vardır. Birinci sebep döviz kuru yükselişleri, ikinci sebep ise akaryakıt fiyatlarındaki yüksek oranlı özel tüketim vergisidir. Gıda enflasyonunun düşürülmesi için gıda üretim ve lojistik maliyetlerinin düşürülmesi şarttır. Bu çalışma akaryakıt fiyatlarının gıda enflasyonu üzerinde etkisinin olup olmadığını araştırmayı amaçlamıştır. Çalışmada 2005-2022 yılları arasındaki aylık benzin ve motorin fiyatları ile gıda fiyat endeksi kullanılmıştır. Covid 19 pandemisi gibi nadir olayların etkisinin de dikkate alınması için araştırmada Fourier KPSS ve Fourier Shin eş bütünleşme testi kullanılmıştır. Analiz bulgularına göre serilerde yapısal kırılmanın varlığı tespit edilmiştir. Ayrıca analiz bulgularında seriler arasında uzun dönemli ilişkinin varlığına rastlanmıştır. Son olarak analiz bulguları uzun dönemde akaryakıt fiyatlarının gıda enflasyonunu artırdığına işaret etmektedir.

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ABSTRACT

In the aftermath of the Covid 19 pandemic, food inflation is a fundamental problem that policymakers around the world, especially in Turkey, have been focusing on. Various factors play a role in the rise in food inflation. One of these factors is fuel prices. Fuel prices are reflected as a cost on food products in many items ranging from tractors used in agriculture to lorries providing logistics. It is seen that fuel prices are high in Turkey. There are two different reasons for this. The first reason is exchange rate increases and the second reason is the high rate of special consumption tax on fuel prices. In order to reduce food inflation, it is essential to reduce food production and logistics costs. This study aims to investigate whether fuel prices have an effect on food inflation. In the study, monthly petrol, diesel prices and food price index between 2005 and 2022 are used. In order to take into account the effect of rare events such as the Covid 19 pandemic, Fourier KPSS and Fourier Shin co-integration test were used in the study. According to the findings of the analysis, the existence of structural breaks in the series was determined. In addition, the existence of a long-run relationship between the series was found in the analysis findings. Finally, the findings of the analysis indicate that fuel prices increase food inflation in the long run.

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LIST OF ABBREVIATIONS

ADF: Augmented Dickey Fuller Test

API: American Petroleum Industry

ARDL: Autoregressive Distributed Lag Bound Test

BOTAŞ: BOTAŞ Petroleum Pipeline Corporation

CHP: Cumhuriyet Halk Party

ECB: European Central Bank

EIA: Energy Information Administration

EPDK: Energy Market Regulatory Authority

FED: Federal Reserve

FKPSS: Fourier Kwiatkowski, Phillips, Schmidt, and Shin Test

FSRU: Floating Storage and Regasification Unit

HICP: Harmonised Index of Consumer Prices

IMF: International Money Fund

KPSS: Kwiatkowski, Phillips, Schmidt, and Shin Test

LNG: Liquefied Natural Gas

LPG: Liquefied Petroleum Gas

NARDL: Nonlinear Augmented Dickey Fuller Test

OPEC: Organization of Petroleum Exporting Countries

PP: Phillips Perron Test

SCT: Special Consumption Tax

SG: Specific Gravity

SPE: The Society of Petroleum Engineers

TCMB: The Central Bank of the Republic of Türkiye

TDK: Turkish Language Institution

TPAO: Turkish Petroleum Corporation

TPIC: Turkish Petroleum International Company

TURKSTAT: Turkish Statistical Institute

USA: United States of America

WTI: Western Texas Intermediate

VAR: Vector Autoregression

VAT: Value Added Tax

INTRODUCTION

The concept of food inflation in the World continues to gain importance in recent days. The Covid-19 pandemic and the Russia-Ukraine war have caused disruptions in food access and production. Apart from this, increasing brent oil prices throughout the World caused an increase in costs, causing an increase in inflation and especially food inflation throughout the World. Türkiye has followed a parallel course with the World, unlike other countries in the World, Türkiye has been negatively differentiated from other countries in terms of inflation and food inflation in recent years. The main reasons for this are the exchange rate movements and the decisions taken on the economy. The Central Bank of the Republic of Türkiye decided to follow a different policy to struggle against inflation. The globally accepted monetary policy was abandoned and a low interest high exchange rate policy was adopted in Türkiye in this period. This policy has led to high increases in inflation and especially food inflation aftermath the Covid 19 pandemic. According to the literature there are many important factors affecting food inflation. These are fuel prices, exchange rate, agricultural productivity, seed and fertilizer costs, logistics costs and profit margins. Unlike other countries fuel prices is the prominent factor to determine the food inflation in Turkey. Food price surge is observed in Turkey aftermath the Covid 19 pandemi due to the exchange rate sky rocketing. Therefore, it is aimed to determine the relationship between fuel prices and food inflation in this study. The reason for choosing fuel prices is that they include a high special consumption tax. Fuel oil, which was charged over 50% by the government between 2002-2021, has been subsidized by the government in the last two years. Since the government is the determinant of taxation, it has the authority to determine fuel prices. For this purpose, the effect of fuel prices on food inflation will be investigated. According to the results obtained, suggestions will be given to policy makers on determining fuel prices. The study is organized as follows. In the first part of the study, inflation, types of inflation,

inflation calculation methods, fossil fuels and their pricing and consumption amount will be explained. In the second part, historical course of inflation in Türkiye will be examined. In addition, food market, food supply and demand, recent trends in food prices in Türkiye and other countries will be evaluated and will be explained. In the third and last part, the studies in the literature will be examined and the results will be evaluated by analyzing the data.



FIRST PART

CONCEPTUAL FRAMEWORK

Firstly, different definition of inflation is presented in this part. Then types of inflation is explained. From now on, inflation measurement method is addressed. In the last section various concepts defined and presented with related to petroleum.

1.1. Definition of Inflation

According to the Turkish Language Institution, the definition of inflation is "money bloat" as an economy term, and its expression used in popular language is "expensiveness" (TDK, TDK, 2023).

Federal Reserve (FED) defines inflation as: "It is mentioned that there is an inflation if the prices of goods and services increase. Inflation is not an increase of one product or service. It is a general increase in the price level of services and goods in an economy". "Inflation occurs when the prices of goods and services increase over time. Inflation cannot be measured by an increase in the cost of one product or service, or even several products or services. Rather, inflation is a general increase in the overall price level of the goods and services in the economy." (FED, 2023).

According to European Central Bank (ECB), "Broad increase of goods and services causes inflation, not just of some items. If there is an inflation in an economy, people can buy less for €1 today than yesterday. In other words, the value of the currency decreases with time." (ECB, 2023).

The Central Bank of the Republic of Türkiye (TCMB) defined inflation as a continuous and general increase in the prices of goods and services in an economy (TCMB, 2023).

In light of the definitions above, the keywords related to inflation can be listed as prices of goods and services, general increase, and wide-ranging increase. The emphasis of the FED in the definition of inflation is that there is a general increase in the prices of goods and services. In addition to emphasizing the same definition, the ECB also emphasized the decline in the country's currency. The TCMB, on the other hand, drew attention to the continuous and general price increase. As a result, it can be said that inflation refers to the general increase in the prices of goods and services in an economy.

The priority aim of the Central Banks in many countries try to control inflation. The Central Bank of the Republic of Türkiye has also been authorized with the law no. 1211 to ensure price stability. Turkish Statistical Institute (TURKSTAT) calculates and announces official inflation data in Türkiye. TCMB detect the successive to control inflation according to the TÜİK data. After detecting their policies whether success or not, TCMB continue to previous pursue policy or set new monetary policy to control inflation.

1.2. Types of Inflation

Inflation types are divided into two main headings. These are types of inflation according to the rate of increase in prices, and types of inflation according to its causes. Types of inflation originated from the rate of increase in prices and types of inflation originated from the types of inflation according to causes are presented respectively in this section.

1.2.1. Types of Inflation According to the Rate of Increase in Prices

Inflation is grouped under three headings according to price increase rates. These are low, galloping and hyperinflation. The point that determines the distinction is the inflation rate, in other words, the numerical value of inflation. Low inflation, galloping inflation and hyperinflation are addressed respectively in this section.

1.2.1.1. Low Inflation

It is the type of inflation in which the general rate of increase in prices in an economy is very low and the expectations for increase are low. It can be said that single digit inflation rate is low inflation. The economies which have low inflation are reliable and suitable for investment. People and firms can make their future plans predictably. In economies with low inflation, the harm of inflation to the economy is not observed (Samuelson & Nordhaus, 2010). The low inflation is observed widespread in developed countries. Developed countries inflation rate is observed the interval between %2-%5.

1.2.1.2. Galloping Inflation

Galloping inflation, or leaping inflation, increases rapidly for a short period of time and is usually in two or three digits (Baumol & Blinder, 1991). It is the type of inflation in which the general rate of increase in prices in an economy is very high. In this economy, the balance between the increase in income and the increase in the general level of prices has deteriorated, and the purchasing power has decreased. This causes the demand for goods and services to be purchased later on. Dollarization occurs because the country's currency depreciates. Galloping inflation has range of 20-200 %. It can be two or three digits. The countries that fight with wars, political impotence and diseases have this kind of inflation (Samuelson & Nordhaus, 2010). Aftermath the Covid 19 pandemic most developing countries faces galloping inflation because of the disruption of the supply. Most developing countries are still trying to cope with problems caused by galloping inflation by Covid 19 pandemic.

1.2.1.3. Hyper Inflation

It is a type of inflation in which the increase in the general level of prices in an economy is extremely high. The monthly inflation increase rate can reach millions or trillions percent. In this type of economy, inflation reaches an uncontrollable level due to the excessive money supply. After first World War, Germany faced this type of inflation (Samuelson & Nordhaus, 2010). According to another definition, hyperinflation occurs when monthly inflation

exceeds 50% (Çepni, 2015). The experiences in Venezuela in recent years can be an example of hyperinflation. In the case of hyperinflation, the damage to the economy is high, and the balance of supply and demand is seriously disturbed. Inflation expectations remain high and therefore households bring forward their demand for goods and services. Shortly, inflation expectations feed inflation to remain high.

1.2.2. Types of Inflation by Causes

It is divided into four main groups according to the causes of inflation. These are demand inflation, cost inflation, structural inflation and expectation inflation. Demand-pull inflation, cost-push inflation, structural inflation and expectation inflation is presented respectively in this section.

1.2.2.1. Demand-Pull Inflation

Demand inflation occurs when the supply of goods and services in an economy is less than its demand. In such an economy, there is an abundance of money. Consumers push their demands forward with the expectation that prices will increase (TCMB, 2004). In addition, the increase in the demand for goods and services and the resulting inflation will increase the demand for labor. This will increase labor prices (Meral, 2005).

The high inflation experienced in Türkiye in 2022 can be given as an example of demand-pull inflation. Demand- pull inflation leads to increase economic growth by disturbing the balance of supply and demand. This situation is visualized in Figure 1.

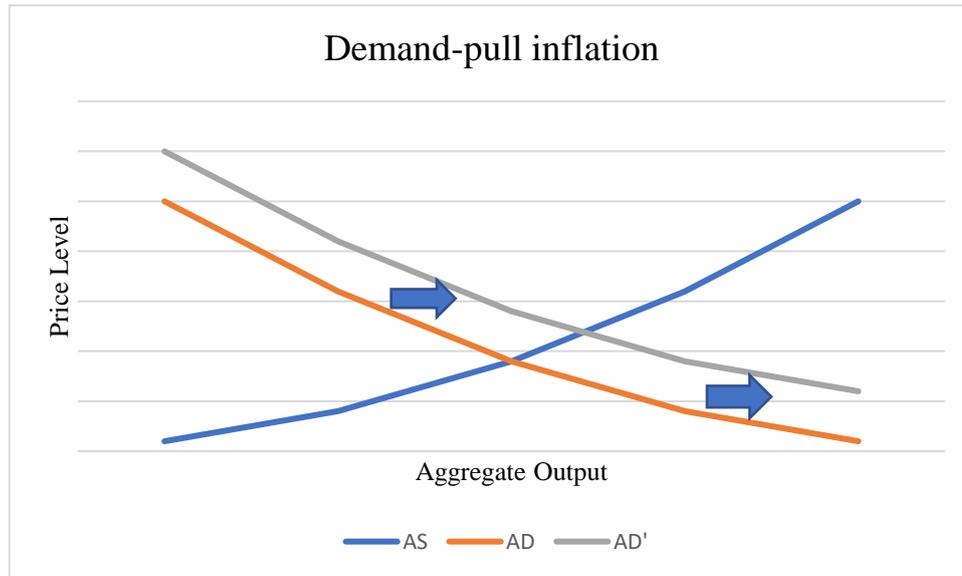


Figure 1: Demand-pull inflation
(Samuelson & Nordhaus, 2010)

Blue curve is demand curve and the red one is supply curve in Figure 1. If demand curve shifts to the right (increase in demand), equilibrium price level changes from P to P' . Point P is the intersection of AS (aggregate supply curve) and AD (aggregate demand curve). Point P' is the intersection of AS and AD' in other words aggregate supply and new aggregate demand curves (McEachern, 2006). Some of the factors that leads to the demand surge are; the increase in the money supply, the expectation of an increase in prices in the economy, that is, the expectation of high inflation, is the increase in the incomes of consumers.

1.2.2.2. Cost-Push Inflation

It is an undeniable fact that the exchange rate has an important place in today's economies. Not only the exchange rate, but also the rise in energy and commodity prices is the factor affecting cost inflation. Cost inflation occurs as a result of a manufacturer's rising costs of production. An increase in the prices of raw materials, energy and labor required for production may affect this type of inflation. (TCMB, 2004) .

The economic results that have emerged with the effect of the Russia-Ukraine war can be given as an example. Rising crude oil prices have increased inflation in many economies. Crude oil is the most basic commodities necessary for the implementation of economies.

Increasing good costs due to oil prices may bring economies to a standstill. How rising cost can upsurge inflation is reflected in the Figure 2.

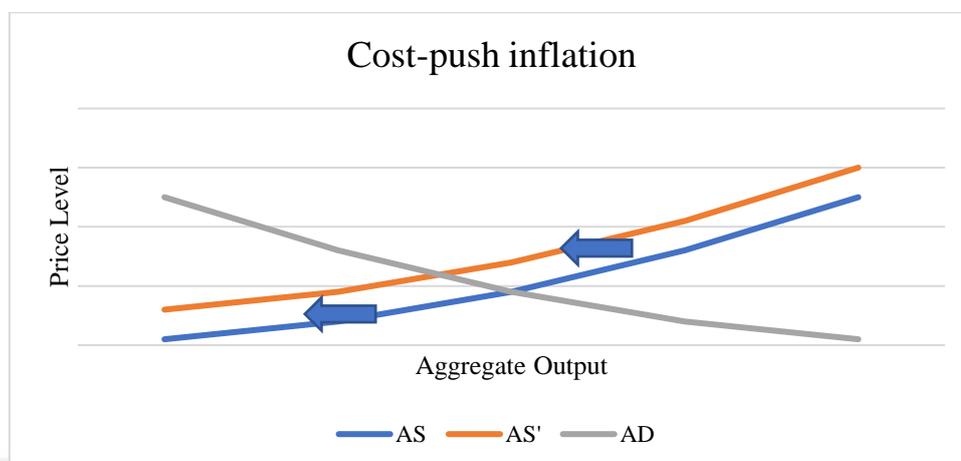


Figure 2: Cost-push inflation
(Samuelson & Nordhaus, 2010)

As shown in the Figure 2, blue curve is demand curve and red one is supply curve. If supply curve shifts to the left side (decrease in supply), equilibrium price level changes from P to P' . Point P is the intersection of AS and AD in other words aggregate supply and aggregate demand curves. Point P' is the intersection of AS' and AD in other words new aggregate supply and aggregate demand curves (McEachern, 2006). Production costs and reduction in production capacity is the essential factor that reduce the supply. As a result of reducing supply, the balance between supply and demand can be deteriorated. As supply fails to meet demand, inflation starts to skyrocketing.

1.2.2.3. Structural Inflation

Structural inflation is the one of the type of inflation by causes. Goods and services in the economy may not be priced according to perfectly competitive market conditions. In monopoly and oligopoly markets, companies are free to set prices for goods and services unless there is a restriction by the government (price ceiling). This pricing, which is higher than the balance of demand and supply, leads to inflation. This is called structural or, in other words, price inflation (Birinci, 1989). Shortly, structural inflation is caused by the price determination power of the firm in the imperfect competitive markets. Perfect competitive

market is the ideal condition and it is rarely observed in the real life. Imperfect competitive market is commonly observed in the real life. Firms have the power to determine the prices of the goods they produce well above the cost.

1.2.2.4. Expectation Inflation

It is the type of inflation that occurs because producers and consumers think that inflation will increase in the future. Workers demand higher wages in expectation of inflation, while employers raise prices for goods and services to meet both expectations and costs (TCMB, 2023).

If there is ongoing inflation in a country, workers, employers and financial institutions expect that inflation will continue. While workers expect their wages to increase in line with past inflation, producers will want to raise goods and services at the rate that wages increase. The finance sector, on the other hand, will keep interest rates high for the future where inflation is expected. This situation is called expectation inflation (Peterson & Estenson, 1992).

1.2.3. Main Expenditure Groups of Inflation

When inflation is mentioned in Türkiye, the first institution that comes to mind is TURKSTAT, an official institution. The term consumer price index is actually commonly used as inflation. TURKSTAT calculates the change of consumer price index according to time as a chain and by updating the weight and the goods and services in the basket. As the requirements of the households change over time, the content and proportion of goods in the basket can change. Calculation is made with a separate item basket for 26 regions and overall Türkiye. Regarding the consumer price index; the number of items, types, workplaces, prices and rents are compiled in the Table 1. (TURKSTAT, 2022).

Table 1: Numerical Data on Consumer Price Index

Consumer Price Index	2016	2017	2018	2019	2020
Number of Items	417	414	407	418	418
Number of Classes	924	910	895	895	897
Number of Workplaces	27.886	27.386	28.015	28.711	28.019
Number of Prices	408.093	400.772	415.000	544.256	553.064
Number of Rentals	4.281	4.275	4.274	4.274	4.274

(TURKSTAT, 2023)

According to Table 1, number of items in the basket change the interval between 407 and 418 in the 2016-2020 period. The goods and services in the basket and their weights are determined using the household budget survey and administrative records. Goods and services with a rate of more than 1/1000 in consumption expenditures are included in the basket. This rate is determined by Eurostat. TURKSTAT has adopted the method used by Eurostat in determining the inflation basket. According to the inflation report announced by TURKSTAT for October 2022, there are 12 main expenditure groups. The weights of the main expenditure groups for October 2020 are presented by Table 2 (TURKSTAT, 2022).

Table 2: Main Expenditure Groups of Consumer Price Index in TURKSTAT October Inflation Report

Main Expenditure Groups	2022
Food and non-alcoholic beverages	25,32
Alcoholic beverages and tobacco	4,31
Clothing and footwear	6,42
Housing, water, electricity, gas and other fuels	14,12
Furnishings, household equipment, routine maintenance of the house	8,86
Health	3,24
Transport	16,80
Communications	3,78
Recreation and culture	3,06
Education	2,03
Hotels, cafes and restaurants	7,11
Miscellaneous goods and services	4,96

(TURKSTAT, 2022)

According to Table 2, the main expenditure group with the highest share is food expenditures, which has a weight of 25.32% in the consumer price index. Table 2 shows that one quarter of household expenditures is made up of food products. The food basket includes all kinds of foodstuffs and soft drinks (TURKSTAT, 2022). After food expenditures, transportation has the highest share in the consumer price index. The least share is taken by education in the consumer price index. The fact that education receives a smaller share than all other main expenditure groups is quite interesting and grave.

When the household budget survey published by Eurostat in 2015 is examined, it is seen that the main expenditure groups used in the consumer price index are the same as those of TURKSTAT. The weight of the main expenditures differs between the Turkstat and Eurostat. The sum of the main expenditure weights of the Eurostat is 1000 unlike TURKSTAT. The main expenditure group weights of Eurostat are shown in the Table 3.

Table 3: Weights of the components of the euro area HICP – 2022

All Items HICP	1000
Food including alcohol and tobacco	208,9
1- Processed food including alcohol and tobacco	159,4
2- Unprocessed food	49,5
Energy	109,3
3- Electricity, gas, solid fuels and heat energy	58,6
4- Liquid fuels and fuels and lubricants for personal transport equipment	50,7
Non-energy industrial goods	265,2
5- Non-energy industrial goods, non-durables only	69,8
6- Non-energy industrial goods, semi-durables only	99,1
7- Non-energy industrial goods, durables only	96,2
Services	416,7
8- Services related to recreation and personal care	120,0
9- Services related to transport	65,8
10- Services related to housing	115,6
11- Services related to communication	26,4
12- Services - miscellaneous	88,9
All items excluding:	
Energy	890,7
Energy, unprocessed food	841,2
Energy, food, alcohol and tobacco	681,8

(Eurostat, 2022)

When the Table 3 is examined and 12 main expenditure groups are considered, the group with the highest share is the food expenditures, as in Türkiye. Unlike Türkiye, the food group were took into account with and alcohol and tobacco products together. The fact that the

food index has the highest with a rate of 20.89% in the consumer price index calculated using the data of 27 member countries of the European Union shows the importance of food inflation. After food expenditures, recreation and personal care has the highest share in the European Union consumer price index. The least share is taken by communication is the European Union consumer price index.

1.3. Inflation Measurement Methods

The economic basis on which inflation measurement methods are based are indices. The index is the numerical values that show how much the other values increase proportionally according to a value equal to 100, that is, the base year. Many indicator indices are presented in the economy. Each index time series has base values. There are two important advantages of using indices. First, it makes economic indicators easier and more understandable if they are expressed in different units of measurement, which would create confusion. Second, it determines how the variable accelerates proportionally, even if it is viewed simply in time series (Çepni, 2015). The formula of the calculation method of indexes is shown as follows:

X_i : Compared value

X_0 : Base value

I: Index

$$I = \frac{X_1}{X_0} \times 100$$

The index is calculated with the above formula. Various methods are used in the index calculation, suitable for the type and scope of the index. Therefore, it is convenient to examine index calculation methods together with index types. Indices are classified as space and time indices, fixed-based and variable-based indices, simple and compound indices. It is generally the case for time series that indices are fixed and variable based. The index obtained by taking a certain period or the average of some certain periods as a basis and showing all the values of the series as a percentage of this is called a fixed-based index. A stable year in which economic events such as inflation (the depreciation of the currency - the consumer's loss of purchasing power), devaluation (the deliberate reduction in the value of the national currency against foreign currencies) and deflation (the general decrease in the

price level) do not become excessive. Shortly, it must be steady. While calculating inflation in Türkiye, the year 2003 is taken a 100. When the base period is variable, that is, when each value is compared with the value of the previous period, it is called a variable-based index. When the denominator of the fraction remains constant, it is a fixed-based index, and when it changes, it is a variable-based index. Simple indices are indices that cover a single item. Composite indices include two or more items. The simple index is used to determine the proportional changes in the price or quantity of a single item over time. Composite indices are used to determine the proportional changes in the prices or quantities of two or more related items over time. The number of items to be included in the composite index should neither be too few nor too many. Because the index based on a small number of items will not be reliable, and a large number of items will complicate the calculation. In practice, the composite index is calculated using the Laspeyres-Paasche Indices and Fisher Index approaches (Mazmanoğlu, 2012). Laspayras Index, Paasche Index and Fisher Index is addressed in this section, respectively.

1.3.1. Laspeyres Index

Laspeyres and Paasche indices allow us to consider the importance differences of the items. These are calculated for both price and quantity series. According to the Laspeyres method; the price index of any period taken as a basis; it is found by dividing the amount of goods calculated in that basket of goods with the value in the current period to the value in the base period (Çepni, 2015). The value of the index in the base year is accepted as 100. In addition, the same weights are used for each period in this method. This causes the effect of weight of the goods and services that have lost their importance in the basket over time or the effect of some newly added and preferred goods and services to the basket to be ignored. The Laspeyres index is a base year weighted index (Mazmanoğlu, 2012). The formula of the calculation method of Laspeyres index is followed as:

$$I_{LPI} = \frac{\sum P_i \cdot Q_0}{\sum P_0 \cdot Q_0} \times 100 \qquad I_{LQI} = \frac{\sum P_0 \cdot Q_i}{\sum P_0 \cdot Q_0} \times 100$$

I_{LPI} : Laspeyres Price Index

I_{LQI} : Laspeyres Quantity Index

P_i : Price in (i)th year

Q_i : Quantity in (i)th year

P_0 : Price in base year

Q_0 : Quantity in base year

Updating the weights of the goods and services basket every year provides a more accurate calculation of inflation. For this reason, the index of the previous year and the index of the current year should be combined with the chain technique. In order to calculate the current year's inflation, the December index of the previous year is accepted as 100. This calculation method ensures that the same index is used even if there are different baskets (Atuk & Sevinç, 2012).

1.3.2. Paasche Index

The amounts and weights in the Paasche index refer to the current year. It is not kept constant compared to the base year, it varies for each year. The most important difference from the Laspeyres index is that it takes into account the changing amounts and weights in each period. Index is obtained by multiplying the prices in the current period with the quantities in the current period and dividing the prices in the base year by the quantities in the current period (Mazmanoğlu, 2012). The formula of the calculation method of Paasche index is followed as:

$$I_{PPI} = \frac{\sum P_i \cdot Q_i}{\sum P_0 \cdot Q_i} \times 100 \qquad I_{PQI} = \frac{\sum P_i \cdot Q_i}{\sum P_i \cdot Q_0} \times 100$$

I_{PPI} : Paasche Price Index

I_{PQI} : Paasche Quantity Index

P_i : Price in (i)th year

Q_i : Quantity in (i)th year

P_0 : Price in base year

Q_0 : Quantity in base year

While focusing on price increases in the Laspeyres index, the change in expenditure groups, that is, weight, is also taken into account in the Paasche index. Comparisons with the base year from the Laspeyres index are easy. However, due to the changing spending habits of consumers, spending groups change from day to day. This is the disadvantage of the Laspeyres index. While the Laspeyres index is used in inflation calculations in an economy where consumer habits do not change much, it is more advantageous to use the Paasche index in an economy where habits change (Kaymaz, 2021). Mainly, Paasche index resembles Laspeyres index for several aspects. However, there is fundamental difference between Laspeyres and Paasche index, depending on whether the base year is taken into account.

1.3.3. Fisher Index

Fisher index is the geometric mean of the Laspeyres index and Paasche index. The same period is calculated with indices (Çepni, 2015). The formula of the calculation method of Fischer index is followed as:

$$I_{FPI} = \sqrt{I_{LPI} \times I_{PPI}}$$

$$I_{FQI} = \sqrt{I_{LQI} \times I_{PQI}}$$

I_{LPI} : Laspeyres Price Index

I_{LQI} : Laspeyres Quantity Index

I_{PPI} : Paasche Price Index

I_{PQI} : Paasche Quantity Index

I_{FPI} : Fisher Price Index

I_{FQI} : Fisher Quantity Index

Since Fischer index is the geometric mean of the Laspeyres index and Paasche index, it is expected to more consistent results than the other indexes. Until this part of the study, the concepts related to food inflation have been introduced, and in the next section, the concepts

related to oil prices will be introduced. Firstly, Fossil Fuels are addressed in the following section.

1.4. Fossil Fuels

Fossil fuels are non-renewable energy sources containing hydrocarbons. Examples of fossil fuels are oil, natural gas and coal. These fuels obtained from natural sources are processed and used for various purposes such as heating, transportation and electricity generation. Petroleum, natural gas and coal from fossil fuels will be defined below. In addition, fuel products obtained from petroleum will be explained in the following sections.

1.4.1. Petroleum

Petroleum is derived from the Latin words “petra” meaning rock and “oleum” meaning oil. Petroleum is mostly in liquid form, is dark in color and has an oil-like structure. Unprocessed oil that is directly extracted from underground is called crude oil. Crude oil is dense and oil-like. It has black, green and brown colors. If the color of crude oil is light, it is lighter and has better quality. If the color of crude oil is dark, it is heavier and has lesser quality. It usually contains carbon and hydrogen in its chemical composition. Petroleum is formed naturally from fossil remains of the past. Remains of pre-existing creatures sink to the bottom of the sea. Over millions of years, with the help of microorganisms, underground temperature and pressure, these remains liquefy to form kerogen. The kerogen found in the rock (source rock) with the geological movements on the earth, when it reaches a certain maturity, finds a migration pathway by cracking the source rock. Oil, which does not encounter any obstacles on the way of migration, reaches the surface. Another pathway of the oil is traps. Reserve traps the oil advancing from the migration path within its body and prevents its up and down movement. This structure is called oil reserve. In order for an oil reserve to be formed, a porous and permeable rock (reservoir rock) that will contain the oil and an impermeable cover rock must be on top of this rock (Chaudhuri, 2011).

In order to measure this in a certain standard, there is a parameter called API Gravity belonging to the American Petroleum Industry. This special parameter helps to determine

the quality of crude oil (Schlumberger, 2023). The formula of the calculation method of the quality of crude oil is followed as:

$$API\ Gravity = \frac{141,5}{SG} - 131,5$$

(API, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method, 2005)

SG: Specific Gravity at 60 F.

Specific gravity is the ratio between the liquid density and pure water density (1 g/ml at 4 C). The migration path of fossil fuel is pictured in Figure 3.

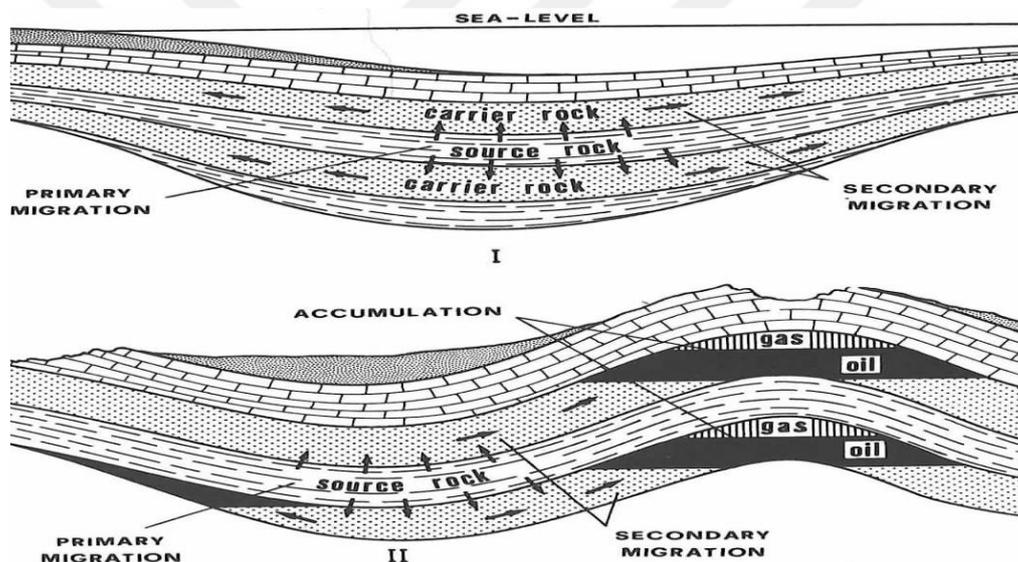


Figure 3: Formation of Oil

(OSGU Geology Engineering Department, 2023)

As seen in the figure, the oil moving from the source rock formed two different reservoirs from two different migration paths. This type of trap is an example of an anticlinal trap. Other types of traps are fault traps, salt mound traps and pinch traps.

Oil could be found in ancient times when it visibly stopped on surface. Finding it underground was only a matter of luck. Today, as a result of geological studies, it can be determined where oil can be found. In fact, the main goal is to find the trap systems described above. However, it cannot be said that there is oil in every trap system. Where there is oil,

there is always a trap. Geological studies are done by a method called seismic. In seismic surveys, sound waves are sent with vibrations underground and the return times of these sound waves are recorded with receivers in different places. The data collected in this way is made three-dimensional with the help of modeling. Different times and speeds help to understand the shape of the underground. Which formation structures are underground and at what depths are determined with the help of seismic. Seismic can be done in the sea as well as on land. Seismic ships are indispensable for this job. After the area with potential traps is determined by seismic, test drilling is done. Test drilling provides information on the capacity and efficiency of the well and reservoir. Considering that production efficiency will be achieved, the area is expanded for exploration activities and new drillings are made to determine the reservoir boundaries. If productivity cannot be achieved or oil cannot be found in the well, that area is abandoned. Oil wells are drilled by drilling. The target depth is the depth where the oil is located. Drilling is done by drilling a cylindrical hole underground with the help of diamond bits. Drilling rigs with a certain capacity are needed for drilling (Farndon, 2015).

The rig in the Figure 4 is a land drilling rig. On land, it is used to access underground reservoirs by drilling. The drill rig consists of power equipment, mud pumps, drill string equipment, drilling bits and living sheds.



Figure 4: Land Drilling Rig
(TPIC, 2023)

Similar to seismic surveys, drilling rigs can operate on land and offshore. Offshore drilling rigs operate on the platform and are transported by ship. Unlike land drilling, the casing pipe is lowered to the final depth of the sea to cut off the contact with the sea water in the sea. Rig capacities are generally higher in this situation.



Figure 5: Offshore Drillship
(TPAO, 2023)

The Society of Petroleum Engineers has grouped oil reservoirs into four groups according to their probability of being underground. These are proven reserves, unproven reserves, probable reserves and possible reserves. Proven reserves have 90%, probable reserves have 50%, possible reserves have 10% possibility of finding oil. Unproven reserves, geologically similar to proven reserves, are in the category of unproven reserves due to technical, economic or regulatory uncertainties (SPE, 1997).

1.4.1.1. Pricing of Petroleum

The oil price is determined in the market by considering the supply-demand balance. Factors that affect pricing are exploration and production costs of oil, scarcity rent, petroleum investments, energy intensity, speculations, geopolitical reasons, natural disasters, prices of alternative energy sources, value of US dollar and environmental factors (Solak, 2012).

The market conditions of crude oil and the factors that affect it are mentioned above. The market price is an important factor in determining the price of crude oil, but it is not sufficient. Transportation and insurance costs determine the final price of the oil. Oil pricing in Türkiye is made according to the Law No. 5015. It has been stated that the price in oil purchases and sales is based on the closest accessible free market. As the base crude oil in oil prices;

For 26 API and lighter oils → Arab Medium (31 API)

For 26 API and heavier oils → Arab Heavy (27,5 API)

30-day futures prices of these petroleum products are taken as basis. In case of a gravity difference between the base oil and domestic oil, 2 US cents are added or subtracted for each 0.1 API gravity difference to the price of the comparable oil. If the oil is lighter, the price will increase because it will be of good quality, while the heavy oil will cause the price to decrease. In addition, since two different gravity groups are taken as basis, it is stated in the law that the price of the low gravity group cannot exceed the price of the high gravity group. In addition to the oil quality, transportation and insurance costs are added to the price determination. The exchange rate is based on the monthly average US dollar value announced by the Central Bank of the Republic of Türkiye. Pricing is explained in Law No. 5015, which entered into force in 2003 (TBMM, 2003).

1.4.2. Natural Gas

Natural gas was discovered by humans thousands of years ago, when it leaked to the earth's surface and caught fire easily. Natural gas is a mixture of many different hydrocarbon groups. The most abundant hydrocarbon in this mixture is methane. Similar to oil, natural gas is also made up of fossil remains. In reservoirs where oil is found, it is located at the top due to the density difference. It can also only be found in gas reservoirs. Since natural gas is much lighter than oil, it comes naturally from the well to the Earth during production. After the cleaning and pressurization processes in the surface facilities, the natural gas coming to the Earth is supplied to the residences and industrial facilities by being given to the pipelines (EIA, 2023).



Figure 6: Tuz Gölü Underground Gas Storage Project
(BOTAŞ, 2022)

Apart from pipelines, natural gas can also be transported by natural gas LNG ships. LNG is the liquefied form of natural gas under a certain pressure and temperature. LNG is compressed 600 times its normal volume. At the same time, its temperature is reduced to -162 C. Today, the number of LNG ships has increased and spot natural gas market transactions have begun to be made in the world. LNG is very important to ensure natural gas supply security (Shell, 2023).



Figure 7: Ertuğrul Gazi FSRU Ship
(BOTAŞ, Ertuğrul Gazi FSRU Ship, 2021)

By purchasing an LNG ship, Türkiye aims to ensure an uninterrupted supply of natural gas. Considering the recent crisis between Russia and Europe, natural gas supply security is a critical issue for a country like Türkiye that imports almost all of its natural gas. Any political crisis with another country may cause a problem in natural gas supply (BOTAŞ, 2023). World total natural gas consumption between 1990 and 2019 are pictured in the Figure 8.

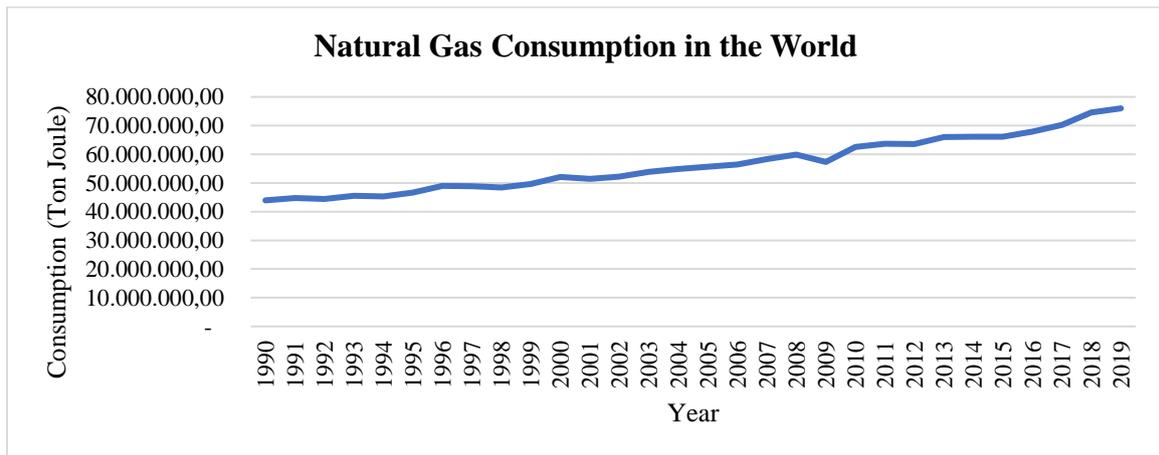


Figure 8: Natural Gas Consumption in the World
(IEA, Natural Gas Consumption, 2023)

The Figure 8 shows the world's total natural gas consumption in terms of heat units. The reason why it is shown as a unit of heat is that the natural gas coming from each source has different heating values. If the calculation was made in m³, the years in which the gases with low calorific value were used more would have been higher in m³. This would cause the graph to be misinterpreted. World natural gas consumption has been increasing linearly since 1990. The reasons for this can be shown as the increase in the World population and the increase in the usage areas of natural gas. In addition, the increase in production capacity, the greater need for natural gas with the development of technology, the replacement of coal as a heating medium by natural gas, the widespread use of natural gas in electricity generation have led to an increase in consumption. Also, the course of the monthly Henry Hub Natural Gas Spot price between 1997M1 to 2022M9 is illustrated in the Figure 9.

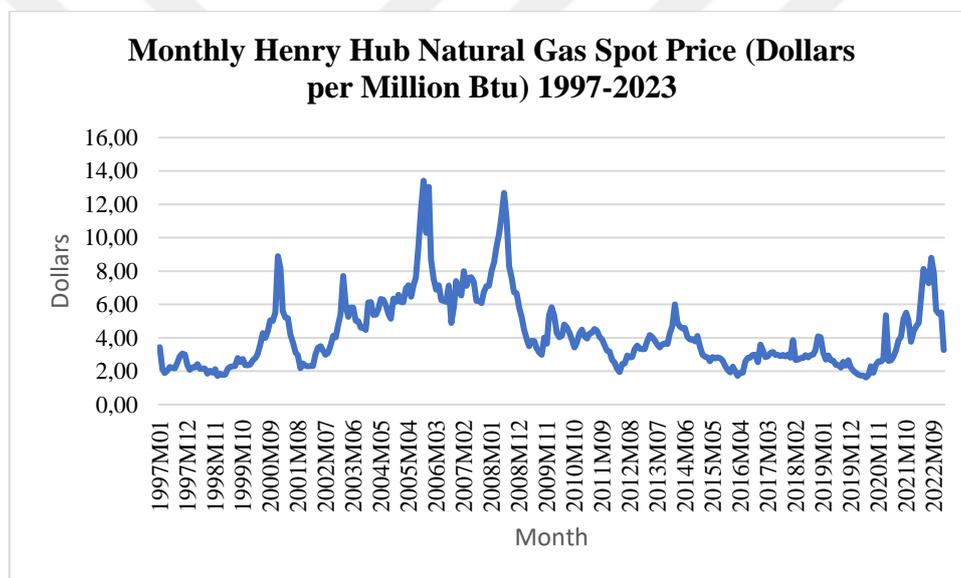


Figure 9: Monthly Henry Hub Natural Gas Spot Price
(EIA, Henry Hub Natural Gas Spot Price, 2023)

BTU (British Thermal Unit), defines the amount of heat required to raise the temperature of 1 lb of water 1 °F at 39,1 °F (BOTAŞ, Dictionary, 2023). Henry Hub is the distribution and pricing center for natural gas pipelines located in Erath, Louisiana.

$$1 \text{ BTU} = 1055 \text{ Joule}$$

The Figure 9 shows that natural gas prices are fluctuating. This situation is caused by worldwide political crises, epidemics, economic crises and wars. It is seen in the graph that natural gas prices, which peaked in 2008, decreased in 2009. This is an example of the

mortgage crisis that occurred in the United States, that is, the worldwide economic crisis. At the beginning of 2022, the Russia-Ukraine war started and it increased due to the entry of Russia into the war, which has an important position in the World in terms of natural gas supply. This situation can be given as an example to the political crises and wars in the World.

1.4.3. Coal

Coal, like oil and natural gas, is a fossil fuel consisting of the remains of living things. It was the driving force of the industrial revolution. At that time, it was used for heating houses. Coal has a critical importance in electricity generation and steelmaking, although oil and natural gas are substitutes in some areas today. Coal is formed from the remains of plants growing in tropical swamps. Plants died and were buried under marsh mud and were exposed to pressure and temperature changes. This process dried and hardened the plant residues. Over millions of years, the buried layers and the baked remains turned into solid black carbon. Whether the coals are close to the ground or not is an indicator of its quality. The closest coal to the ground is peat. It contains 60% carbon. As the depth of coal increases, the carbon ratio also increases. Brown lignite coal is slightly deeper than peat and contains 73% carbon. Bituminous coal, whose color is close to black, contains 85% carbon and is deeper. The deepest coal is black anthracite. It contains 90% carbon. The best bituminous and anthracite coal is found deep underground. First, a deep well is dug to reach the coal and locate it. Later, horizontal or slightly inclined tunnels are opened to enter the coal seam. From these tunnels, coal is cut and extracted with special equipment. Lignite coal is found at a depth close to the ground. These coals are usually extracted by removing the surface soil and materials with a large excavation machine. Since the carbon rate is low, the deep ones are not extracted for efficiency reasons (Farndon, 2015).

Coal is used to generate electricity at a rate of 73%, about 8% in the iron and steel industry, about 16% in other industrial sectors and about 3% for heating purposes in 2018. Today, coal mines are widely used to generate electricity. Although coal consumption has decreased for some years, it is in an increasing trend as seen in the Figure 10. However, the rate of

increase has decreased in recent years (Tamzok, 2019). The total World coal consumption is visualized in Figure 10.

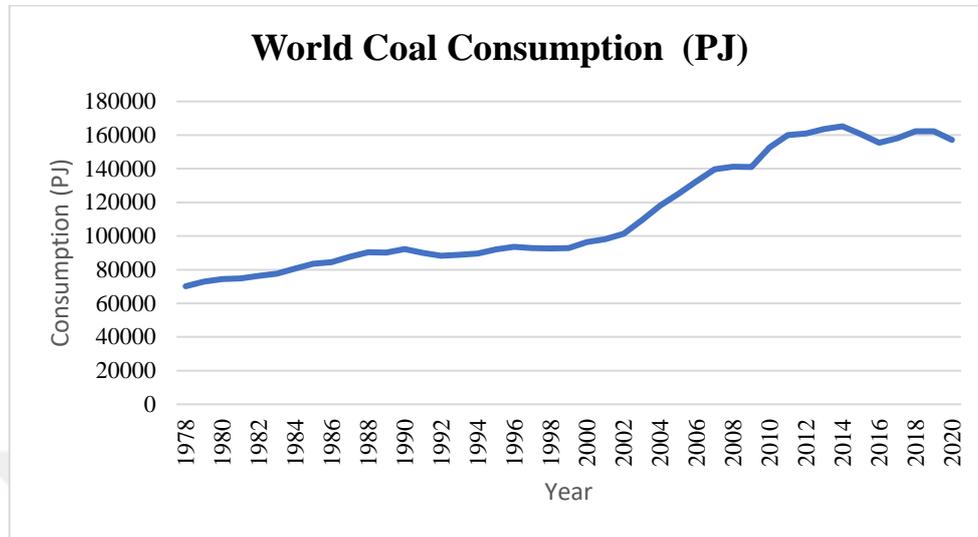


Figure 10: World Coal Consumption
(IEA, World Coal Consumption, 2023)

The Figure 10 clearly shows the effects of the 2009 crisis and the Covid-19 epidemic that emerged in 2020. In these years, there was a decrease in coal consumption. Apart from these effects, it is observed that coal consumption increased linearly until 2010. The reasons for this are the increase in production capacities, the increase in coal production in the World and the increase in the need for energy and naturally coal due to population growth. After 2010, it was observed that coal consumption remained stable. The orientation towards renewable energy and the use of natural gas instead of coal caused this period to progress steadily. As investments in renewable energy increase in the following period, demand for coal is expected to decline or remain steady.

1.4.4. Fuel Oil

According to the definition of Turkish Language Institution, fuel is a liquid as gasoline, kerosene, diesel etc. The resulting products are obtained from petroleum. Crude oil is processed in refineries to decompose into certain liquid fuels. This process is called refining (TDK, 2023).

Refining is the process done to make crude oil usable for different purposes. Different types of fuel are obtained for purposes such as automobiles, trucks, airplanes, domestic use, and industrial use. Refining processes are divided into five groups. These groups are distillation, cracking and reforming, treatment, blending and other processes, subsidiaries and other operations. After removing the salt in the crude oil, different products are obtained with the difference in boiling point by giving heat. This process is called distillation. During distillation, the gas separates from the liquid with the difference in density. Other liquid products decompose with the difference in boiling point. The reason for the boiling point difference is that the products contain different hydrocarbons and bonds. In the second process, cracking and reforming process, the sizes and structures of hydrocarbons are changed. In these stages, the steps of decomposition, unification, alteration and rearrangement are followed. The third process is treatment. The purpose of treatment is to prepare hydrocarbon varieties for further process. Hydrocarbons may contain some aromatics and naphthenes. Chemical solvent methods are used to separate them. In the fourth process, the blending process, the products obtained are blended with other products according to some standardized criteria. In this way, compliance with criteria such as octane level and vapor pressure value is ensured. The fifth process is light-ends recovery, sour-water stripping, solid waste and wastewater treatment, process water treatment and cooling, storage and transportation (API, 2023).

The resulting products are divided into three groups. These are petrochemicals, fuels and non-fuel products. Petrochemicals; hydrocarbons such as naphtha, gas oil, benzene, toluene. They are used in the production of plastic, synthetic rubber and synthetic fiber. Secondly, non-fuel products are oils, petroleum coke, bitumen, paraffin waxes, and solvents. Oils are used as engine and grease. It is produced in certain viscosity ranges. Petroleum coke is black and solid residues. It is used for purposes such as heating, electrode production and chemical production. Bitumen is a semi-solid product with high viscosity. It is used in asphalt construction. Finally, fuels; classified as liquefied petroleum gas (LPG), gasoline, jet fuels, kerosene, diesel and refinery gases (Beşergil, 2009).

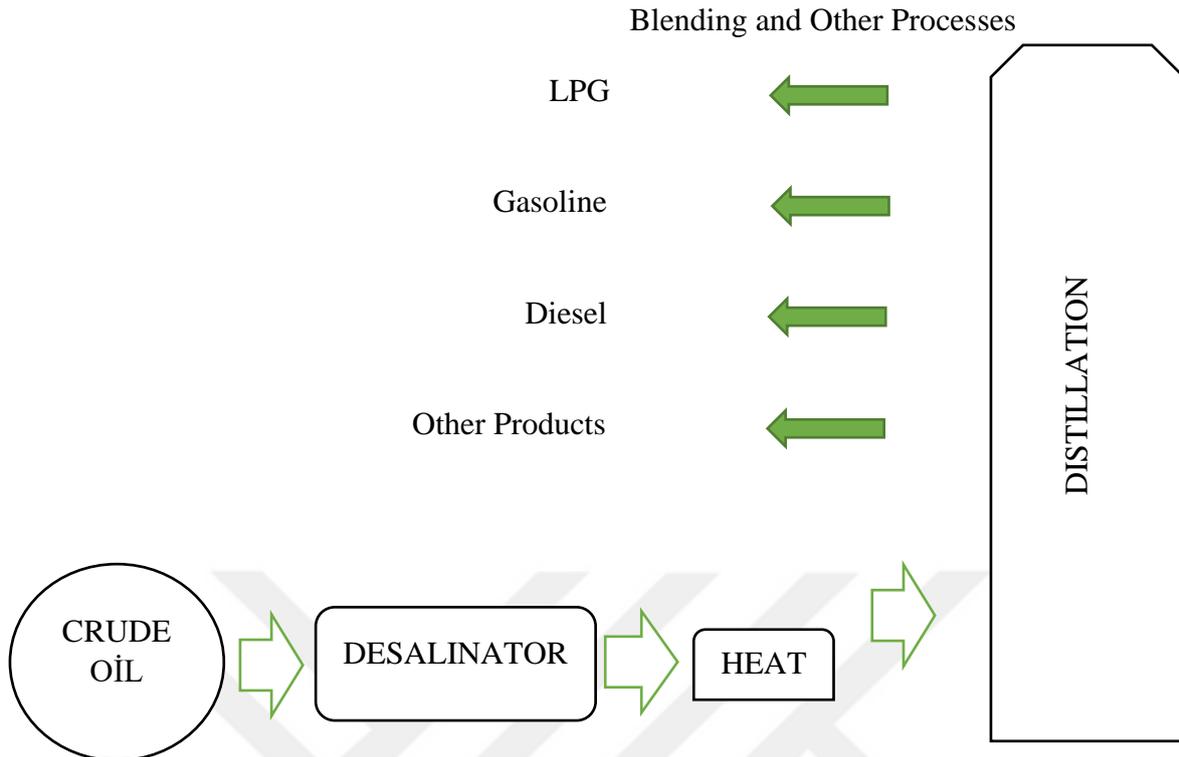


Figure 11: Refining Process

(Beşergil, 2009)

Boiling range of the products are:

LPG < 85 °F < Gasoline < 185 °F < Naphta < 350 °F < Kerosene, Jet Fuel < 450 °F < Diesel < 650 °F < Other Products

The lightest fractions which are LPG and gasoline rise to top of the distillation unit. Medium weight fractions which are kerosene and diesel stay in the body of unit. The other products that are the heaviest settle at the bottom of the unit (EIA, 2023).

1.4.4.1. Pricing of Fuel Oil

Data published in Platts European Market Scan in Europe and Türkiye are used for fuel pricing. Although the prices are published and determined on a daily basis, prices in Türkiye are not reevaluated daily, but are reevaluated according to the dollar exchange rate or the change in crude oil prices. There are five main headings for fuel oil pricing in Türkiye. Headings are followed as: (EPDK, 2022).

Product Price: Prices for diesel and gasoline are calculated in \$/ton per day at Platts European Market Scan. These prices are calculated using the indicative exchange rate published by the Central Bank and product density. In the short term, crude oil and fuel prices may move in opposite directions in the international market. Therefore, the price is determined directly by the market value of the product.

Wholesaler Margin: It is the margin added to the product price by the refinery and the distributor.

Revenue Share: It is the price added to hold the complementary part of the oil stock at the national level. The price for 2022 is 0.00716 TL per liter.

Distributor and Dealer Margin: It is the margin that includes all costs after the product is received from the refinery or distributor.

Total Tax: Special Consumption Tax and Value Added Tax. Determined by the Ministry of Treasury and Finance (EPDK, 2022).

According to the report published by EPDK monthly in 2022, diesel and gasoline prices are shown in the Table 4.

Table 4: Special Consumption Tax and Value Added Tax in Fuel Oil Prices

Type of Fuel Oil	SCT	VAT
Gasoline (95 Octane)	2,5265 TL/liter	18%
Diesel	2,0559 TL/liter	18%

(EPDK, 2022)

Value added tax base = product price + wholesaler margin + revenue share + distributor and dealer margin + SCT

According to the report published by EPDK in October 2022, diesel and gasoline prices are shown in the table below.

Table 5: All items in Fuel Oil Prices

Product	Product Price	Wholesaler margin	Revenue Share	Distributor and Dealer Margin	Total Tax	Final Price
Diesel	17,993	0,596	0,00716	1,613	6,064	26,274
Gasoline	12,759	0,442	0,00716	1,563	5,640	20,412

(EPDK, 2022)

Prices are determined according to the European Side of Istanbul. According to the report published by EPDK monthly between 2014 May and 2022 September, total tax and final price of gasoline are shown in the Figure 12.

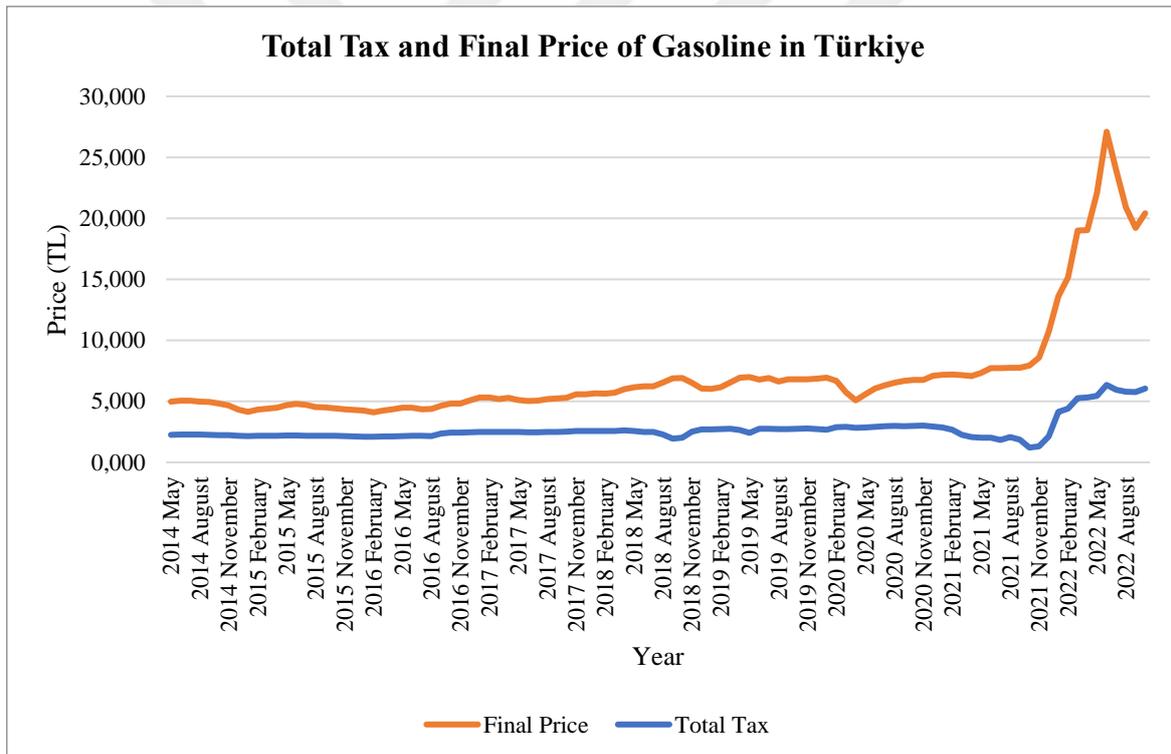


Figure 12: Total Tax and Final Price of Gasoline in Türkiye

(EPDK, 2022)

Figure 12 shows the final gasoline sales prices and the total tax amounts in gasoline prices from 2014 to the present in Türkiye. As can be seen, there is no sharp difference between the years 2014-2021. While there has been a serious fluctuation in final prices since January

2021, tax amounts have not increased that much. The reason for the increase in gasoline prices after 2021 is the increase in the exchange rate from 8 TL to 18 TL and the increase in crude oil prices from 80 \$ to 120 \$. Gasoline prices are directly proportional to the exchange rate and crude oil. Considering the effect of these two variables, it has been observed that the prices have increased approximately 3 times. The exchange rate reached its highest level in December 2021, and Brent oil in March 2022. The tripling of prices in the chart took place in May 2022. Therefore, it can be said that the effects of crude oil and exchange rate are reflected in gasoline prices after a few months. The percentage of total tax on final price in gasoline price is pictured in Figure 13.

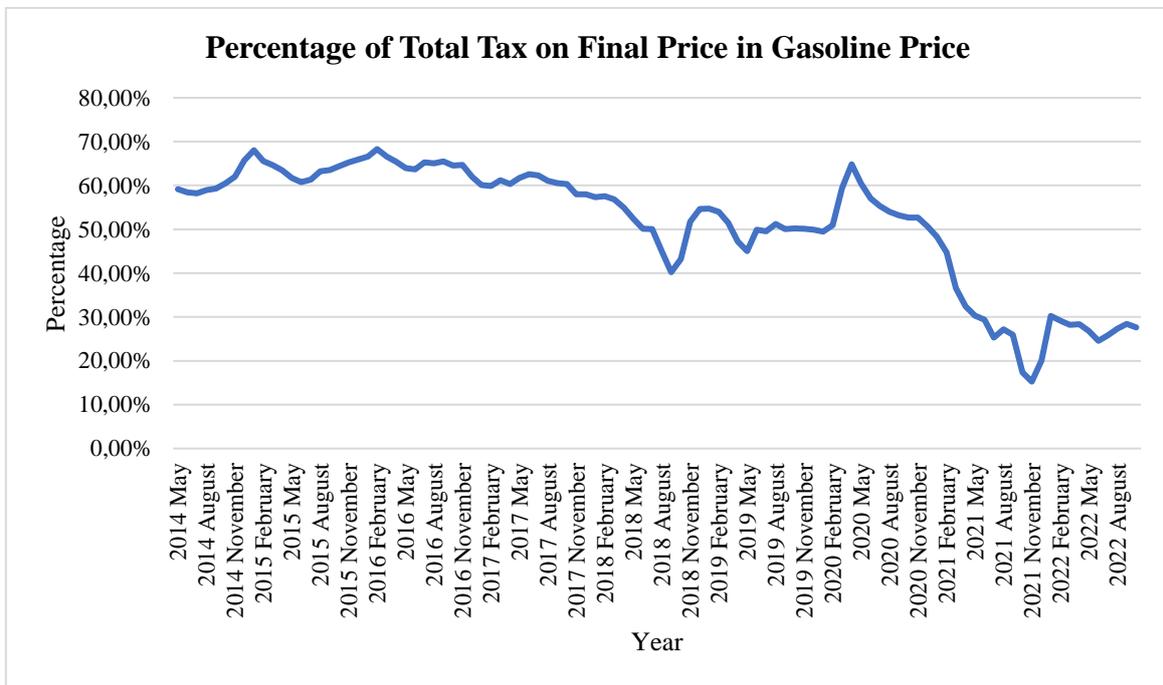


Figure 13: Percentage of Total Tax on Final Price in Gasoline Price

According to Figure 13, there has been a significant decrease in proportion since 2020 November. After 2021, the exchange rate and crude oil prices increased. It is seen that the tax rates in fuel have been reduced with the echelle mobile system, which is used to control fuel prices in Türkiye. According to the report published by EPDK monthly between 2014 May and 2022 September, total tax and final price of diesel are shown in the Figure 14.

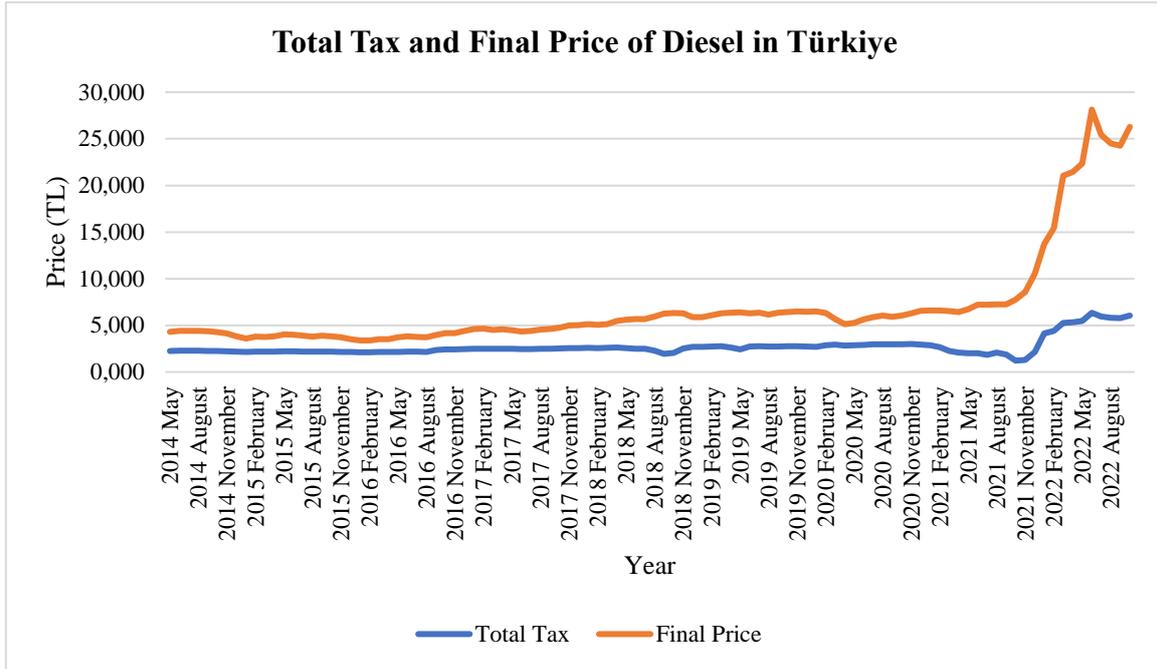


Figure 14: Total Tax and Final Price of Diesel in Türkiye
(EPDK, 2022)

Figure 14 shows the final diesel sales prices and the total tax amounts in diesel prices from 2014 to the present in Türkiye. As can be seen, there is no sharp difference between the years 2014-2021. While there has been a serious fluctuation in final prices since January 2021, tax amounts have not increased that much. The reason for the increase in diesel prices after 2021 is the increase in the exchange rate from 8 TL to 18 TL and the increase in crude oil prices from 80 \$ to 120 \$. Diesel prices are directly proportional to the exchange rate and crude oil. Considering the effect of these two variables, it has been observed that the prices have increased approximately 3 times. The exchange rate reached its highest level in December 2021, and brent oil in March 2022. The tripling of prices in the chart took place in May 2022. Therefore, it can be said that the effects of crude oil and exchange rate are reflected in diesel prices after a few months. The percentage of total tax on final price in diesel price is graphed in Figure 15.

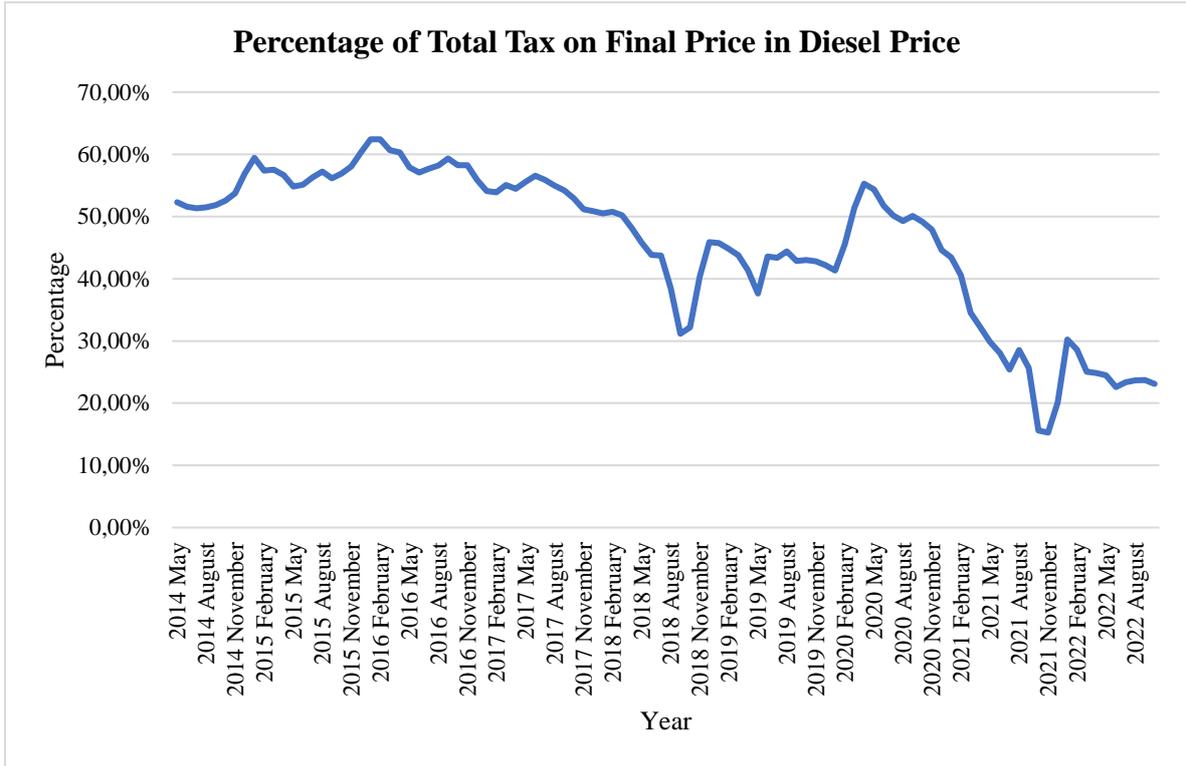


Figure 15: Percentage of Total Tax on Final Price in Diesel Price

According to Figure 15, there has been a significant decrease in proportion since 2020 November like gasoline price. The exchange rate and crude oil prices started to climb after 2021. The tax rates in diesel have been reduced with the echelle mobile system like fuel.

SECOND PART

INFLATION AND FOOD MARKET IN TURKIYE

2.1. Historical Course of Inflation in Türkiye

Inflation in Türkiye is generally high. The most important reasons for this can be shown as demand inflation caused by money supply and cost inflation caused by exchange rate, energy prices, monetary policy, public debt, rapid population growth, internal migration (Tunca, 1998).

Due to the policies that have changed periodically since the foundation of the Republic, it would be more accurate to make these effects and evaluations separately. These periods are CHP period (1923-1950), Democratic Party period (1950-1960), 1960-1969 period, 1970-1979 period, 1980-1989 period, 1990-2001 period, 2000-2013 period, 2013-2017 period and 2018-2021 period.

2.1.1. CHP Period (1923-1950)

During this period, the Ottoman Empire survived heavy wars and the Turkish Republic was newly established. The Ottoman Empire has recently followed a policy of increasing the money supply due to high war costs. After the establishment of the Republic of Türkiye, inflation was tried to be avoided by avoiding the high emission policy followed by the Ottoman Empire. Mustafa Kemal Atatürk saw maintaining the value of the Turkish lira, controlling inflation, and maintaining the budget balance as independence in the economy. In this period, market economy was applied until the Great Depression. After the Great

Depression, the principle of statism was started to be applied in order to minimize the effects of the crisis. After the crisis, the Central Bank was established and authorized for monetary policy. If the Atatürk period is evaluated in terms of inflation, low inflation rate was carried out with low money emission and tight monetary policy. In the post-Atatürk period, high inflation was observed due to the Second World War. Wealth tax law was enacted in 1942 to reduce the money supply due to increasing inflation (Akyıldız & Eroğlu, 2004). The inflation rate of Post- Atatürk period is pictured in Figure 16.

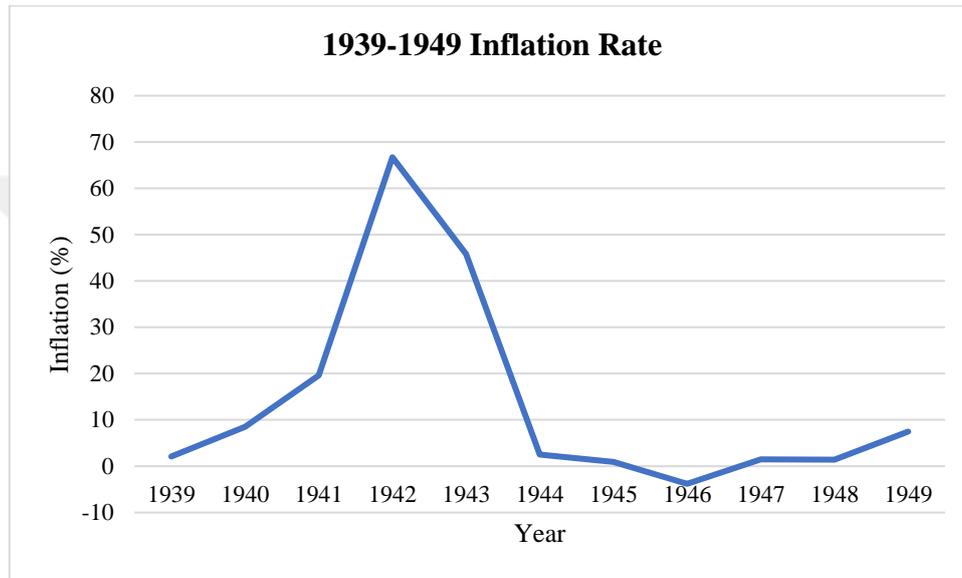


Figure 16: 1939-1949 Inflation Rate in Türkiye (TURKSTAT, Statistical Indicators 1923-2013, 2014).

According to Figure 16, inflation has started to increase since 1939. However, the sharp surge of inflation is observed in 1941. World War II is the most important reason for the increase in inflation in this period. After climbing inflation, the money supply reduction policies adopted in 1942. This policy enable to succeed in curbing the rise of inflation. During the 2nd World War, national protection law, wealth tax and land crop tax were put into effect in order to regulate economic and financial policies in Türkiye. The land crop tax is the other policy adopted by government prevented the increase in consumer prices (Dayıoğlu Erul & Buz, 2019).

2.1.2 Democratic Party Period (1950-1960)

During the Democratic Party period, the statism policy was abandoned and more liberal economic policies were implemented instead of statism. Imports were largely liberalized, mechanization in agriculture became widespread, low-interest loans and Marshall Aids from the United States were used. As a result of the abandonment of monetary tightening policies and the adoption of the expansionary monetary policies, the increase in inflation reappeared (Takım, 2012). The inflation rate in Democratic Party Period is visualized in Figure 17.

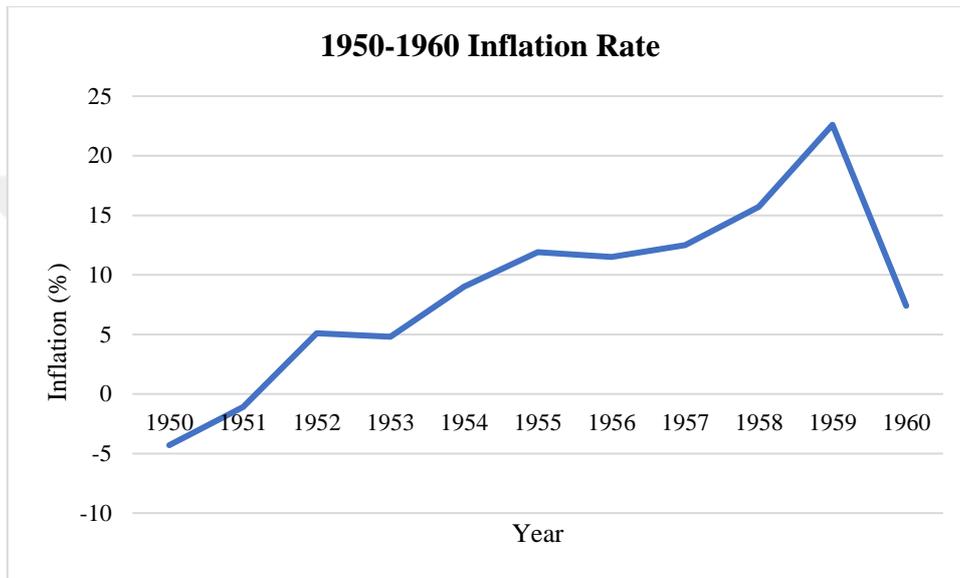


Figure 17: 1950-1960 Inflation Rate in Türkiye
(TURKSTAT, Statistical Indicators 1923-2013, 2014)

According to Figure 16, inflation remained low in the first years of the Democratic Party, and an increase has been observed since 1953. In 1958, a decrease was observed with the precautions taken regarding inflation. Due to the increase in the foreign debt deficit until 1958, Türkiye agreed on a stabilization program with the IMF in 1958. The main items of this program are devaluation, tight monetary and fiscal policy, postponement of foreign debts, liberalization of the prices of state-owned enterprises and liberalization of foreign trade (Taş, 2004). The propensity of inflation is upward in this period. Also the measures reduced inflation in the short run, but they were not succeed to control inflation in the long run in this period.

2.1.3. 1960 – 1969 Period

After the 1960 coup, the liberal policy is abandoned and the import substitution policy was adopted. The aim of this policy is to strengthen the Turkish industry and to produce domestic products instead of imported products. The import substitution policy succeeded in controlling inflation and kept it low in this period (Ertuna, 2014). The inflation rate of 1960-1969 period is graphed in Figure 18.

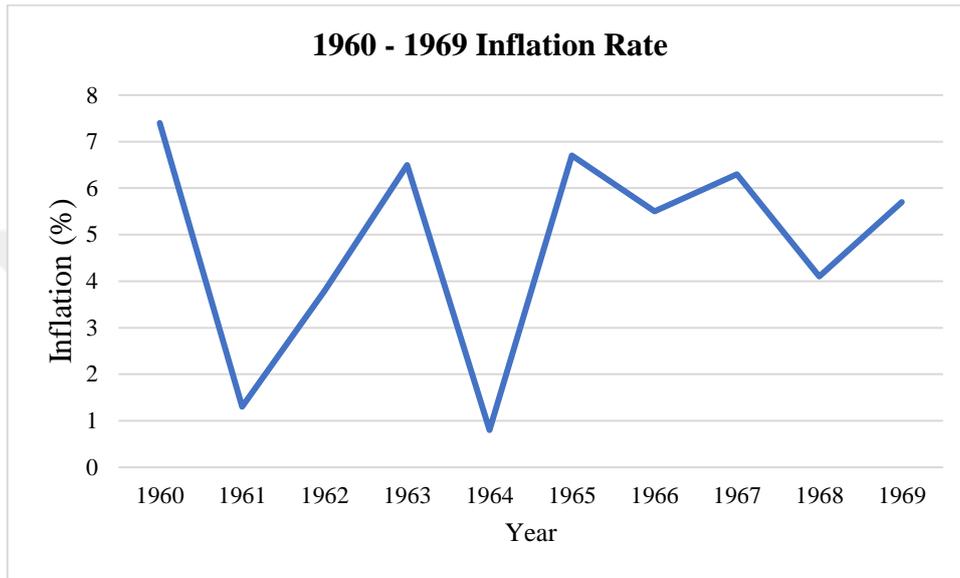


Figure 18: 1960-1969 Inflation Rate in Türkiye
(TURKSTAT, Statistical Indicators 1923-2013, 2014)

According to Figure 18, inflation was fluctuating in 1960-1969 period. Also, inflation remained at a low level of less than ten percent during this period. The reason for this is the establishment of the State Planning Organization and the preparation of five-year development plans. It is observed that following development plans have been successful in controlling inflation in this period (Eğilmez, 2020). After this period development plans adopted by government but development plans have never reached to success of inflation control like this period.

2.1.4. 1970 – 1979 Period

Coup attempts in the 1970s destabilized inflation and inflation jumped again from single digits to double digits. Therefore the Turkish economy was devalued on August 1970. With

this devaluation made to prevent external deficits, the dollar rate was increased to 15.1 TL. Although the increase in the exchange rate had a positive effect on foreign debts in the first place, it caused high inflation due to the political instability in 1971 and the oil crisis in the World in 1973. Oil crisis leads to increase the oil price in the Worldwide. Also oil price surge is observed in Türkiye in this period. Surge of oil prices leads to increase cost of goods. This situation has also led to rise in inflation in this period. Political events in the following years led to inefficient use of public resources and budget deficits (Eğilmez, 2020). The inflation rate of 1970- 1979 period is presented by Figure 19.

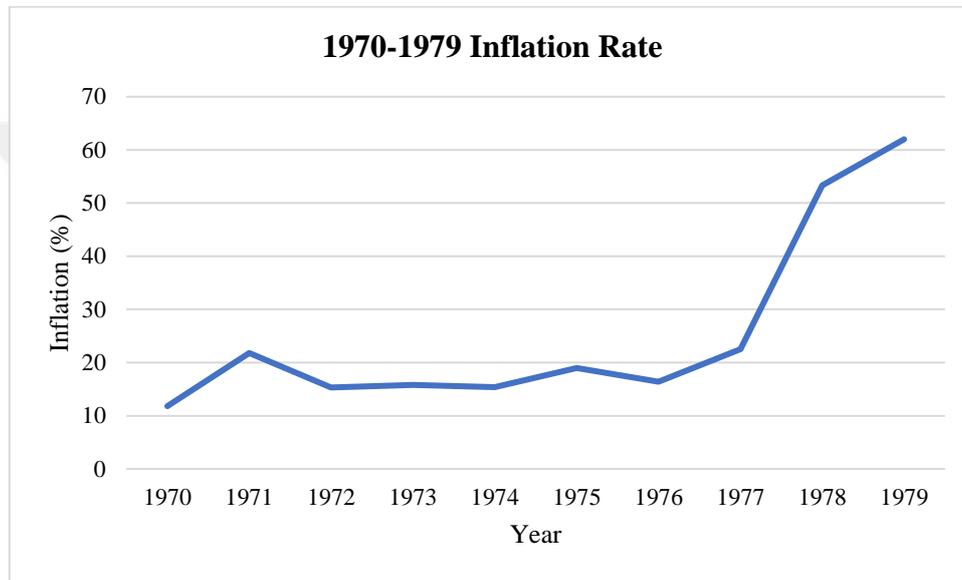


Figure 19: 1970-1979 Inflation Rate in Türkiye
(TURKSTAT, Statistical Indicators 1923-2013, 2014)

According to Figure 19, inflation, which has been above 10% since the early 1970s, increased to 60% after 1977. Political instability is the most important reason for this skyrocketing. From 1977 to 1980, the conflicts between the right and the left in the parliament were reflected to the public and the events reached the points that the state could not control. These terrorist incidents adversely affected the political, social and economic balances (Öner, 2022). As political conflicts spiraled out of control, so did inflation. Also, policy makers failed to implement an adequate monetary policy to control inflation in this period.

2.1.5. 1980 – 1989 Period

Turkey was integrated into the global market in this period that started with the January 24, 1980 decisions. There are two main views regarding the January 24 decisions. The first of these is to open Türkiye's doors to the outside World and catch up with the era. The second view is to abandon national industrial, commercial and agricultural policies by leaving Türkiye completely to foreign capital. With the January 24 decisions, a flexible exchange policy was adopted and the pressure on prices was removed. With the tight fiscal policy, a decrease in inflation was achieved in the first years, and then, with the effect of the populist policies followed, an increase was observed in inflation again (Öztürk, Nas, & İçöz, 2008). The inflation rate of 1980-1989 period is pictured in Figure 20.

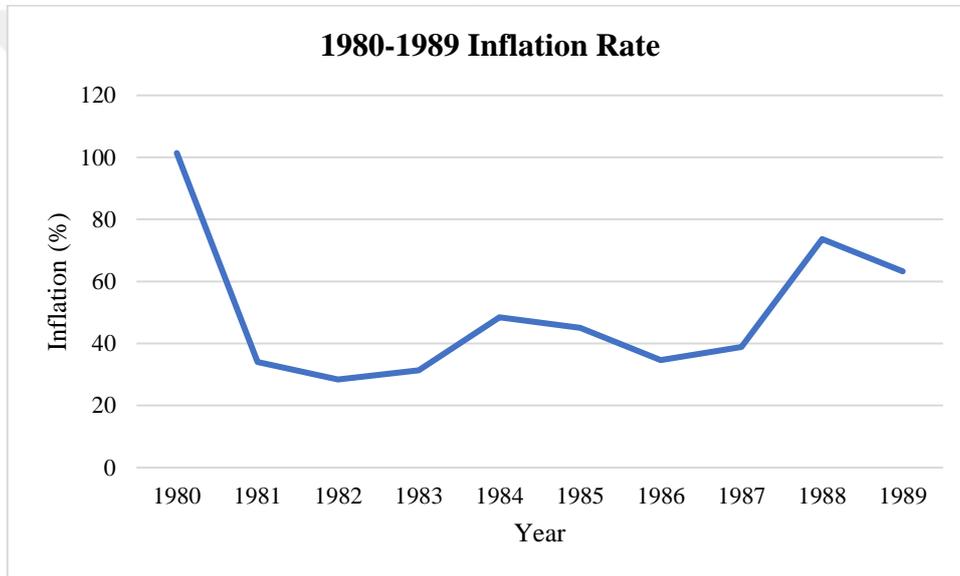


Figure 20: 1980-1989 Inflation Rate in Türkiye
(TURKSTAT, Statistical Indicators 1923-2013, 2014)

According to Figure 20, inflation is fluctuated in this period. While the trend of inflation was downward at the beginning of the period, everything was reversed and the trend of inflation was upward at the end of the period. Also, inflation over 100% in Türkiye in 1980, due to the high level of internal conflicts, turned into a downward trend after the coup and in the first period of the ANAP government. With the transition to a liberal economy policies and the measures taken, inflation was brought under control in a short time. However, it has risen again and reached 60% since 1987.

2.1.6. 1990 – 2001 Period

Turkish economy went through two major crises in this period. The first of these is the 1994 crisis. The government of the period was stubborn with the market, lowered the policy rate and got the inflation out of control. This led to an increase in public debt and a high current account deficit. On April 5, 1994, a decision was taken for the necessary measures in the economy. When the decisions taken in the Official Gazette No. 21896 are analyzed, the Turkish lira was devalued by 38 percent. Prices were increased by increasing taxes on many products from fuel products to monopoly products. Public personnel recruitment was frozen. There was a wage freeze in public personnel salaries. Many public institutions were privatized. A general analysis of the measures taken reveals that they were aimed at increasing public revenues and reducing public expenditures. These measures led to dismissals (Sayilgan, 1994).

The second crisis of this period occurred in 2001. Before 2001, as a result of the economic crisis of Asian countries in 1998, Türkiye 's exports decreased. Also, Marmara earthquake affected Turkish economy seriously in 1999. These two developments cause to deteriorate Türkiye economy. As a result of deterioration, inflation has increased and the economy has shrunk. In 1999, a stand-by agreement was signed with the IMF. Although the agreement had an impact on the arrival of foreign capital in the country, it could not break the negative economic expectations. In this period, fixed exchange rate, free interest system was applied. The fact that the banks, which have a large amount of treasury bills, could not pay them, caused the interest rates in the market to increase. In the following process, as a result of the political crisis that occurred in February 2001, the economy collapsed. Most banks went bankrupt in this crisis. The real sector was seriously damaged and many companies went bankrupt (Uygur, 2001). The inflation rate of 1990-2001 period is illustrated in Figure 21.

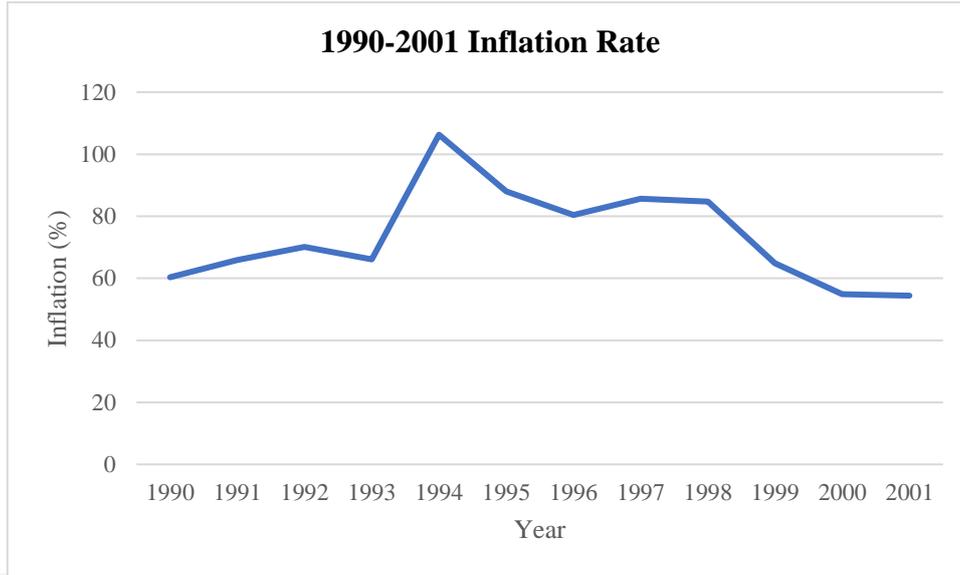


Figure 21: 1990-2001 Inflation Rate in Türkiye
(TURKSTAT, Statistical Indicators 1923-2013, 2014)

According to Figure 21, inflation was remained high in this period. The negative impact of the 1994 crisis on inflation is clearly understood from the Figure 21. Due to the increase in the money supply in 1993, inflation rose above 100% and started to decline again with the April 5 decisions. This period passed with political and economic instability in general. A total of 11 governments were established during this period, so economic stability and planning could not be achieved. In addition, the increase in money supply caused inflation to not fall below 50%. It is observed that the impact of low policy rate on inflation is more dominant than the impact of Asia crisis and Marmara Earthquake on inflation in this figure. We can say that wrong monetary policy implementations have a greater impact on inflation than rare events such as earthquakes.

2.1.7. 2002 – 2013 Period

During this period, inflation was successfully combated thanks to the policy changes brought about by the change in political power, tight fiscal policy and the IMF program. Inflation has dropped to single digits. In addition, Türkiye's initiation of full membership negotiations with the European Union in 2005 led to foreign direct investment, and the exchange rate remained low and stable for a long time. After a long time, residents' demand for foreign

exchange declined and the Turkish lira appreciated (Karagöl, 2013). The inflation rate of 2002-2013 period is presented by Figure 22.

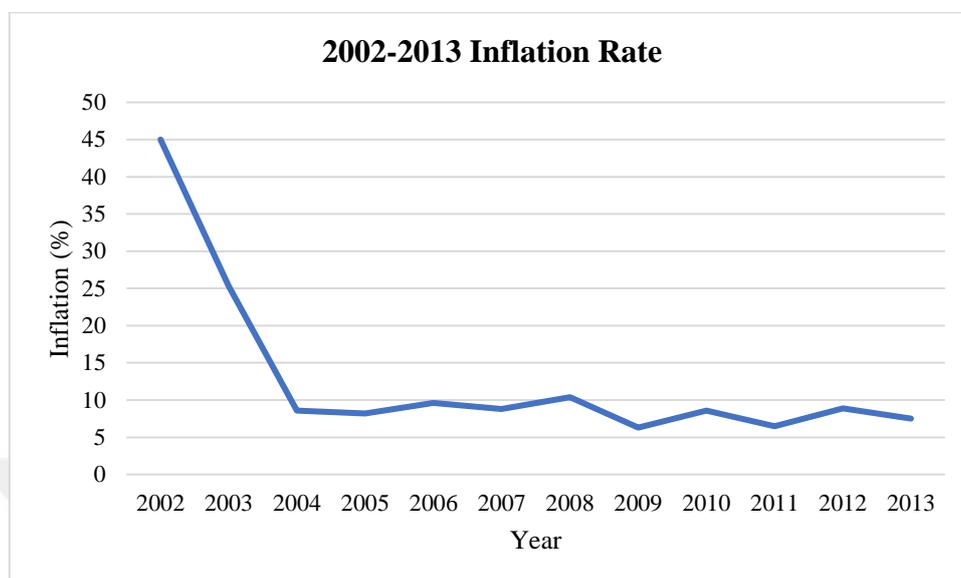


Figure 22: 2002-2013 Inflation Rate in Türkiye
(TURKSTAT, Statistical Indicators 1923-2013, 2014)

According to Figure 22, inflation, which was over 45% in 2002, dropped to single digits in 2004 and remained stable for 9 years. The right policies implemented during this period, the ability of the TCMB to take independent decisions and the inflow of foreign direct investments to Turkey helped to keep the exchange rate and inflation under control. Also, TCMB adopted inflation targeting policy in this period. That is, the primary aim of TCMB is to keep inflation under control. Therefore, TCMB pursued monetary policies aimed at bringing inflation closer to the targeted inflation rate and achieved its goal.

2.1.8. 2013 – 2017 Period

Due to the political events that started in Turkey in 2013, economic confidence in Turkey started to decline. In addition, with the United States starting to reduce the money supply, which it raised after the crisis in 2009, exchange rates started to increase in Türkiye as well as in all developing countries. Although not like the period between 2002 and 2013, Türkiye managed to keep inflation at a low level despite the political crises such as Gezi Park events,

December 17-25 plot attempt and July 15 coup attempts. The inflation rate of 2013-2017 period is graphed in Figure 23.

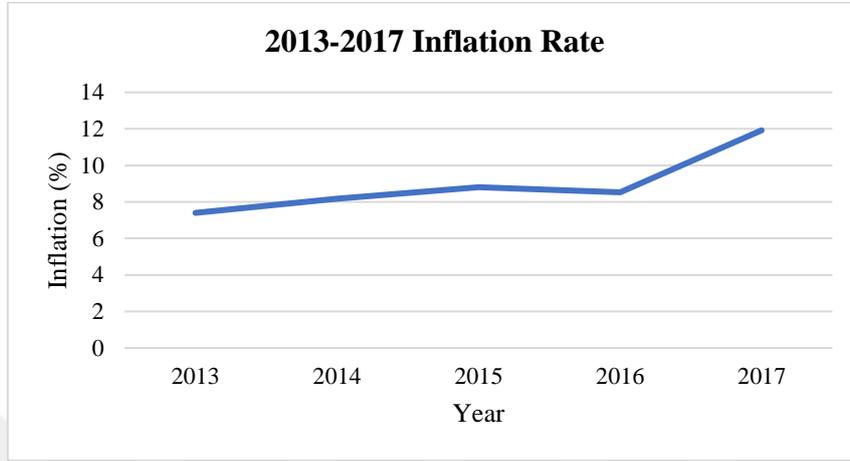


Figure 23: 2013-2017 Inflation Rate in Türkiye
(TURKSTAT, TURKSTAT Database, 2023)

According to Figure 23, inflation increased but not dramatically. The reason for this is the crude oil prices, which have been declining Worldwide since 2013. In addition, the United States' tight monetary policy is the reason. Despite the increase in the exchange rate in Türkiye, the decrease in oil prices prevented the increase in costs. Despite the political events, inflation remained under control and the wage-price spiral were not deteriorated in this period.

2.1.9. 2018 – 2022 Period

Türkiye went through a change in the form of government in 2018. In fact, the first elections for the new system, which was determined by the referendum held in 2017, were held in June 2018. The exchange rate, which had risen before the elections, continued to rise after the elections. As a result of the political crisis with the United States, the dollar exchange rate, which reached its highest level in its history for that year, started to decline again with the measures taken. However, the high inflation for 2018 could not be prevented. 2019 was spent with stagnant and positive real interest rates in order to reduce this high inflation. There was a decrease in demand due to the effect of the pandemic (Covid-19) in the Worldwide

since 2020. Although there was a decrease in demand and an increase in money supply, it did not reflect as a serious increase in inflation. While the year 2021 passed with anti-inflation policies for Türkiye until September, it started to rise with the policy rate decisions taken by the Central Bank after September, and completed the year as 36.08%. Interest rate decisions have led to the discussion of the independence of the Central Bank. In addition to this decision of the TCMB, the war between Russia and Ukraine exploited in February 2022. This war caused serious increases in oil and natural gas prices, causing inflation to rise independently of other effects (Eğilmez, 2022). The war also led to a global grain shortage and caused food prices to skyrocket. The inflation rate of 2018-2021 period is pictured in Figure 24.

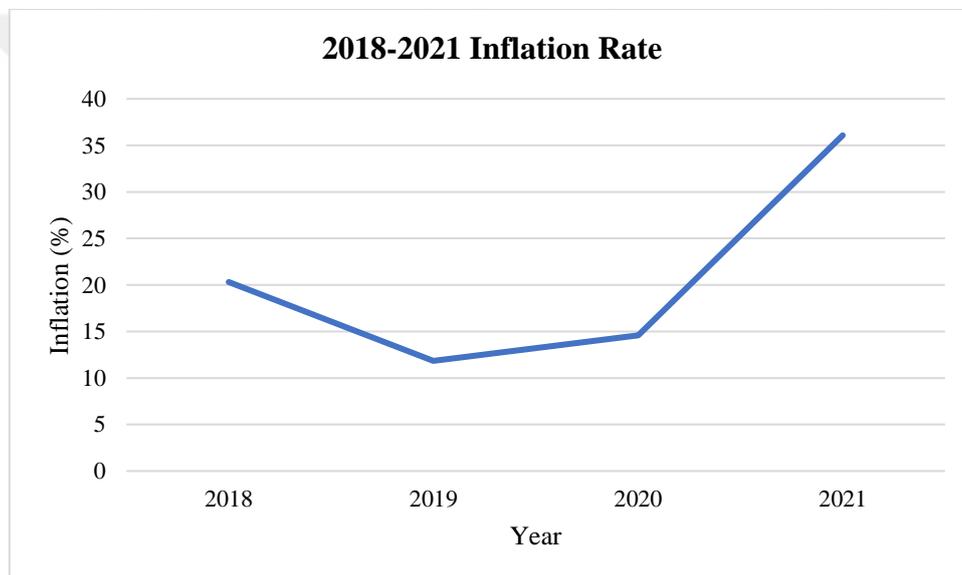


Figure 24: 2018-2021 Inflation Rate in Türkiye
(TURKSTAT, 2023)

According to Figure 24, inflation increased in 2018 due to political crisis with United States of America. Then it remained stable for two years. In 2020, Covid-19 did not affect inflation because there are both decrease in supply and demand in the beginning of pandemic. In addition to this, the central bank intervened in the market by selling foreign currency, and there was not much increase in inflation as the currency remained relatively stable in 2020. Inflation increased significantly due to the Central Bank's policy of lowering interest rates in 2021. The decrease in the interest rate caused an increase in the demand for foreign

currency. The increase in the exchange rate led to high costs for the producers and the inflation rose to 36% at the end of the year.

2.2. Food Market

When the structure of the food market is examined, it can be said that supply and demand have not changed much. In the production of food products, it is not possible to increase the supply between two harvest seasons. In addition, although it is desired to increase production with additional areas, this takes a long time. The producer will make production decisions for the next year according to the price of the product that year. Adherence to natural conditions in the production of food products is another factor that restricts supply. On the demand side, the income elasticity of food prices is low. In other words, an increase or decrease in income affects the demand for food to a small extent (Can, 2008). Shortly, the food market is less likely to be affected by shocks than other markets such as energy market and less likely to be out of balance between supply and demand. The food market consists of two components. These are food supply and food demand.

2.2.1. Food Supply

When the supply of agricultural products is examined periodically, the industrial revolution emerges as an important turning point. Before the industrial revolution, the food supply was based on self-sustaining agriculture. Food transport between cities was not common. With the machine technology that developed after the industrial revolution, logistics, irrigation systems and access to water became easier and mechanization in agriculture was achieved. In this way, many foodstuffs reached different cities and countries. However, in recent years, the increase in migration from rural areas to cities, the increase in population and urbanization of agricultural lands due to the growth of cities affect food supply negatively (Kapdan, 2022).

The factors affecting the food supply are the protectionist policies of countries, global warming and agricultural policies. First, two main events have occurred in recent years that have led to the protectionist policies of countries. These are the Covid-19 epidemic and the Russia-Ukraine war. Many countries that have problems in food supply have restricted their

exports according to their product needs. This has caused some countries to lose their markets. As a result of the increase in demand for vitamin C during the Covid-19 epidemic, Türkiye banned the export of lemons. After the effects of the Covid 19 pandemic passed, the demand for lemons in Türkiye decreased, and there was an excess domestic supply due to the loss of export markets. Secondly, global warming affects the amount of precipitation and the water-holding capacity of the soil, leading to a decline in agricultural productivity. Third, agricultural policies can be analyzed in terms of resources and agricultural land that governments allocate to agriculture. Increased food supply thanks to the incentives provided following the rise in food prices led to a decline in food prices, while food prices increased in years when incentives were reduced. In addition, agricultural lands are decreasing day by day. This leads to a decrease in food supply and therefore to increase food prices (Özçelik, 2023).

2.2.2. Food Demand

With the increasing population in the world, the demand for food is also increasing. There are concerns that this increasing demand will not be met due to limited resources such as land, water and labor. While the demand increases, the supply stays at the same level or increases less than the demand, which will cause inevitable price increases in food (Yelen, 2017).

The world population will reach 8.2 billion by 2030. However, different increases will be observed in each region. Africa's population will increase by 50% compared to 2010, while North America will increase by 16%. Developed countries' food demand will increase not in quantity but in quality. The quantity of demand will be stabilized in 2030. However, the increase in income level in developing countries will increase the demand for food. In underdeveloped countries, on the other hand, there is a direct proportional relationship between income level and food expenditures. Income elasticity of food demand decreases from less developed to developed countries (Lem, Bjorndal, & Lappo, 2014).

There are various studies to conduct the relationship between income and food consumption. A study conducted in the United States investigated the elasticity between food prices and demand between 1938 and 2007. In the study that analyzed 13 different food groups, the

price elasticity of all food groups was found to be less than 1. The results show that food prices are inelastic against demand (Andreyeva, Long, & Brownell, 2010).

2.3. Recent Trends in Food Prices

The increase in food products in recent years draws attention in Türkiye and in the World. In recent years, research on this subject has been increasing. Especially after the coronavirus pandemic, the importance of food was understood, and price jumps occurred as a result of the supply chain crises in food. In order to talk about food inflation, the increase in the consumer price index should be less than the increase in food and non-alcoholic beverages. In this case, the increase in food prices is higher than the average price growth of all other goods and services. Among the most important causes of food inflation Worldwide are the drought caused by global warming, the increase in demand for food products after the Covid 19 pandemic, and the increase in the World population. In Türkiye, besides these reasons, the increase in production costs stemming from the exchange rate draws attention. The global food index rose to 113 from 2016 to 2020. In Türkiye, food inflation has been consistently above consumer inflation since 2009 (Yavuz, 2021). It does not seem possible to find a solution without investigating the causes of food inflation, which has recently risen above consumer inflation both in Turkey and around the World.

Causes of food inflations are followed as: Input costs used for the production of food products, natural disasters and global climate change, logistics costs incurred when transporting products to other cities or countries, profit margins of intermediary firms or organizations in the chain of transportation from producer to consumer, unusual and malicious increases due to disaster and drought, country or regional security risks, namely war or terrorist incidents, deterioration in macroeconomic indicators, epidemics (Cavlak & Selvi, 2022).

Factors leading to food inflation can also be analyzed from the supply and demand side. The use of different energy sources, population growth, changes in consumer preferences and increase in expenditures are demand-side factors. Climate change and drought are supply-side factors. Apart from the supply and demand side effects, macroeconomic factors also

have an impact on food prices. These factors are the exchange rate, energy prices and economic growth in the country (Kutlu, 2021).

After the Ukraine and Russia War, as a result of the decrease in the production of two major grain producing countries, the world faced the possibility of food crisis and millions of people losing their lives due to lack of access to sufficient food. At this point, Türkiye assumed a critical task and signed the Grain Corridor Agreement with Ukraine, the United Nations and Russia. In this way, the grain produced in Ukraine will send safely from the Black Sea port to the countries to be exported through Türkiye (Acer, 2022).

The consumer price index and the food price index is graphed in Figure 25.

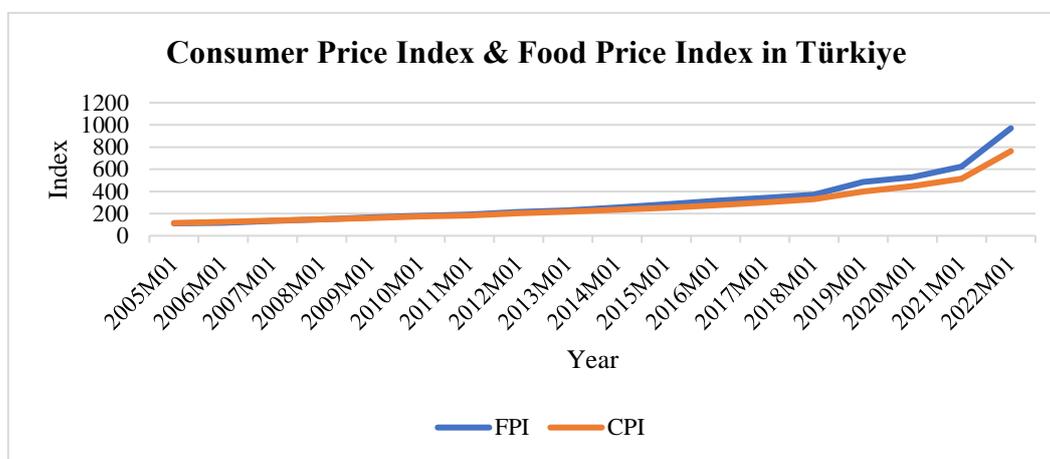


Figure 25: Consumer Price Index and Food Price Index in Türkiye 2005-2022
(TURKSTAT, 2023)

Figure 25 enables to compare food prices to consumer price index. According to Figure 25, the food price index followed a course parallel to the consumer price index during 2005-2009 period, but diverged from 2009 onwards. After 2009, the food price index increased more than the consumer price index.

While the World food index was 58 in 2003, it rose to 130 in 2011 and then decreased to 90 in 2016. As can be seen in the chart, in Türkiye, unlike the rest of the World, there has been a continuous increase since 2009. The reason for the separation after 2020 is the coronavirus epidemic. The increase from 2009 to 2020 is the decrease in the share of producers as a result of the increase in the share of the marketing sector and the decrease in the desire of the

producers to do agriculture (SETA, 2021). The food price index and consumer prices index of Europe is pictured in Figure 26.

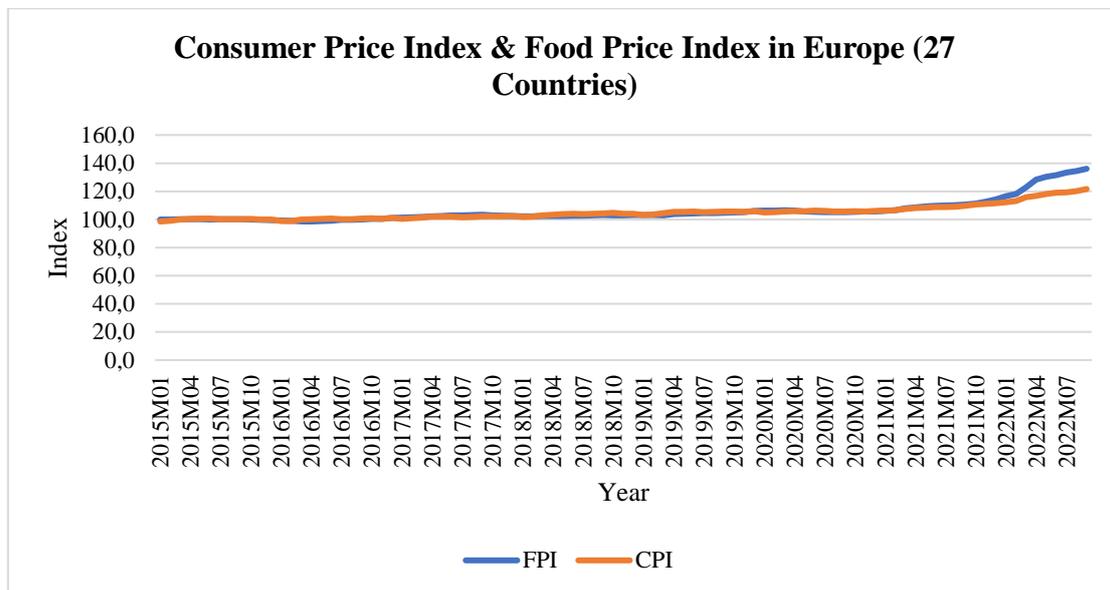


Figure 26: Consumer Price Index and Food Price Index in Europe (27 Countries) 2015-2022 (Eurostat, 2022)

Data from 27 member states of the European Union are used in the Figure 26. The base year was 2015. The food price index is shown with a blue line, and the consumer price index is shown with an orange line. According to Figure 26, the food price index is higher than the consumer price index as of October 2021. This means that food inflation is greater than consumer inflation. It can be mentioned that food inflation is more prominent than inflation. This makes it necessary to research on food inflation. Due to the Russian-Ukrainian war, there were problems in accessing some foods in Europe. The most important reason for this is the decrease in agricultural production due to the war in Ukraine. Assuming the demand is the same since there is no significant change in the population, this decrease in supply directly caused the increase in food inflation. This is clearly seen in the Figure 26.

THIRD PART

LITERATURE RESEARCH AND EMPIRICAL ANALYSIS

First, the literature on the relationship between fuel prices and food inflation will be introduced in this part. The differences of the research from the literature and its contributions to the literature will be presented. Then the method used in the research will be introduced. After introducing the method, the findings will be reported and interpreted.

3.1. Literature Research

There are many studies regarding the impact of fuel prices on food inflation. The main studies in the literature as follows:

Chen, Kuo, & Chen (2010) examined the relationship between wheat, soybean, corn and oil prices. Weekly global data from 1983 to 2010 were used. Structural breaks have been detected due to the volatility of oil prices. The 49th week of 1985 and the 3rd week of 2005 were determined as turning points and examined in a total of four periods. It was observed that the 1% increase in oil prices caused a significant increase in grain prices in three periods (1983w12-1985w48, 2005w3-2008w20 and 2008w21-2010w5).

Çelik & Akgül (2011) investigated the relationship between the consumer price index and fuel prices using monthly data between 2005 and 2010 in Türkiye. As a result of the ADF unit root test, it was seen that the variables contained unit root. According to the ADF test performed with first differences, the variables showed stationary characteristics. According to the Johansen-Jeselius cointegration test, it was observed that there was a long-term

relationship between the variables. As a result of the Granger causality test, it was seen that fuel prices caused inflation. As a result, it was analyzed that a 1% increase in fuel prices led to a 1.26% increase in inflation with a one-year delay.

Ali, Ramzan, Razi, & Bhatti (2012) investigated the effect of diesel prices on food inflation in Pakistan. Foods were selected as rice, maize, wheat, chicken and cooking oil and their price data were taken. The data were taken from 2001-2010. The obtained results showed that there is a positive relationship between diesel prices and food prices.

Irz, Niemi, & Liu (2013) examined the relationship between energy prices and food prices. Price indices between 1995-2010 were used in this study. VEC model was used to determine the short and long -term dynamics of food prices. According to the findings, energy and labor affect the food prices in the long term.

Niyimbanira (2013) examined the relationship between oil prices and inflation in South Africa. ADF unit root test and Johansen-Juselius cointegration test were applied. According to the findings, there is a long-term relationship between oil prices and inflation. In addition, Granger causality analysis was performed. As a result of this analysis, it was concluded that oil prices cause inflation. Policy makers in South Africa have been recommended to consider oil prices to keep inflation under control.

Kargı (2014) investigated the effect of oil prices on inflation and growth in Türkiye. Data were taken monthly between January 1998 and April 2013. ADF and PP unit root tests were applied to the data and it was seen that the variables were constant, in other words, they were available for long-term analysis. Engle-Granger Co- integration test was performed and it was concluded that there was a regression between the data. Granger causality test results show that there is a causality between oil imports and inflation and growth. The increase in oil consumption causes inflation and growth to increase.

Dillion & Barrett (2015) investigated whether oil prices affect food prices in East Africa. Maize and oil price indices were used for analysis. In addition, the effects of transportation costs on maize prices were examined in this study. Monthly price indices between 2000-2012 were used. Johansen Co -Integration Tests are used as an error correction model. According to the findings, an increase in oil prices leads to increase 0.26% of maize prices.

Ibrahim (2015) analyzed the relationship between oil and food prices in Malaysia. NARDL method was preferred in the study. Also, 1971-2012 annual data were used in the analysis. According to the findings, there is a short- and long-term relationship between oil and food prices.

Siok, Xue, & Yen (2015), divided countries into two groups considering their dependence on foreign oil. The pass-through equation is in ARDL format and the model is estimated using the pooled mean group method. As a result of unit root tests (LLC, IPS and Fisher ADF), the null hypothesis cannot be rejected at the 5% level for all variables. All variables were found to be stationary after the first derivative. The results of the panel cointegration tests (Pedroni residual test and Kao residual test) reject the null hypothesis. Test results showed that there is a long-term relationship between dependent and independent variables. According to the ARDL model results, oil prices do not have a long-term effect on inflation in the group of countries dependent on foreign oil which are Singapore, South Korea, Philippines, Greece, Belgium, Italy, Pakistan, India, Portugal, Spain. Also, oil prices have a long-term effect on inflation in the group of countries that are not dependent on foreign oil, in other words, exporting countries which are Norway, Denmark, United Kingdom, Canada, Mexico, Malaysia, Brazil, Venezuela, Ecuador, Bulgaria. As a result, it has been suggested to policy makers that they should consider the effect of oil prices on inflation.

Xuan & Chin (2015) investigated the effect of diesel prices on the consumer price index. The data were used in quarters from 2005-2013. According to the findings, retail diesel prices were more effective on inflation compared to subsidized diesel prices.

Abdlaziz, Rahim, & Adamu (2016) examined the effect of oil prices on food inflation in Indonesia. The data were taken in quarters between 1995 and 2014. NARDL method was selected in this study. According to the findings, there is short- and long-term cointegration between food and oil prices. Test results showed that 10% increase in oil prices resulted in a 3.6% increase in food prices.

Bala & Chin (2018) investigated the effect of oil prices on inflation in Nigeria, Libya, Algeria and Angola. In this study, three different oil prices were used as data: spot oil prices, OPEC basket oil price and the average of Brent, WTI, Dubai oil prices. 1995-2014 period annual data were preferred in this study. According to the ARDL analysis results, there is a

short- and long-term relationship between oil prices and inflation. In addition, food production has a negative relationship with inflation. Policy makers have been advised to encourage domestic production of food to reduce inflation.

Karacan & Yardım Kılıçkan (2018) investigated the effect of oil prices and exchange rate on inflation in Türkiye. 2006-2017 period annual data were used for analysis in the study. While calculating oil prices, Brent oil prices are used, inflation data is taken from TURKSTAT. According to VAR model results, oil prices have an effect on inflation. It has been commented that inflation in Türkiye is caused by costs and it has been suggested to policy makers to turn to renewable energy sources.

Koçak, Balan, & Albayrak (2018) investigated the relationship between oil prices and inflation in Türkiye. Data were taken monthly between January 2003 and February 2017. According to VAR model results, there is a long-term positive relationship between oil prices and inflation. In addition, it has been understood that oil prices are the cause of inflation with Granger causality analysis. As a result, oil prices have an impact on inflation, limited to 3%.

Bawa, Abdullahi, Tukur, Barda, & Adams (2020) examined the effect of oil price shocks on inflation in Nigeria. NARDL method was preferred in the study. Data consisting of quarterly slices between 1999 and 2018 were used. According to the findings, the increase in oil prices causes an increase in inflation. In addition, the increase in oil prices causes a further increase in food prices. The study advises the central bank of Nigeria to take measures to ensure that increases in oil prices do not lead to food inflation through monetary policy.

Dinçer & Karakuş (2020) examined the effect of oil prices on inflation in the G7 countries. Data were obtained from the World Bank between 1980-2018. Data were analyzed with Philips Perron, Kao cointegration and Dumitrescu Hurlin panel causality tests. According to the findings, there is a long-term relationship between oil prices and inflation. However, no causal relationship was found between the two variables in the findings. In this case, it was emphasized that focusing only on oil prices in inflation targeting is not the right approach.

Sarwar, Hussain, & Maqbool (2020) investigated the effect of oil prices on food price index and excluding food price index in Pakistan. The nonlinear ARDL (NARDL) model was preferred in the analysis of the study. Data are from quarters between 1990Q3 and 2019Q4.

Test results show that oil prices affect food and non-food price indices. Also, according to the findings there is a non-linear relationship between oil prices and food and non-food price indices. Although the increase in oil prices causes the food and non-food prices to increase the decrease in oil prices does not affect the food and non-food prices.

A brief review of the literature reveals that a studies such as Chen et al. (2010), Çelik & Akgül (2011), Ali et al. (2012), Irz et al. (2013) detect a positive effect of fuel prices on food inflation. Çelik & Akgül (2011), Kargı (2014), Karacan & Yardım Kılıçkan (2018), Koçak et al. (2018), Dinçer & Karakuş (2020) analyzed the impact of fuel prices on food inflation in Türkiye. So far, studies have neglected the structural break in the determination of the effect of fuel prices on food inflation in Türkiye. The research aims to fill the gap in the literature. Therefore, the Fourier method, which also takes into account soft breaks, is preferred in determining the impact of fuel oil on food inflation in Türkiye.

3.2. Unit Root Test

Unit root tests are tests to determine whether the time series is stationary or not. The mathematical formula of unit root test is followed as (Gujarati & Porter, 2009):

$$Y_t = \rho Y_{t-1} + u_t \quad -1 \leq \rho \leq 1$$

$$Y_t = Y_{t-1} + u_t \quad \text{if } \rho=1$$

In this condition Y_t is nonstationary. This is the main idea of this test.

Subtracting Y_{t-1} from both sides:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + u_t$$

$$\Delta Y_t = \delta Y_{t-1} + u_t$$

where $\delta = (\rho - 1)$ and, Δ is the first difference operator. Therefore $\delta = 0$.

$$Y_t = (Y_t - Y_{t-1}) = u_t$$

u_t is a white noise error term, it is stationary, in other words the first differences of a random walk time series are stationary (Gujarati & Porter, 2009).

3.2.1. Dickey and Fuller Test

Dickey and Fuller (1979) proposed this test to check whether the time series is stationary or not. It is the first test applied for unit root testing. Dickey Fuller (DF) unit root test detect whether the time series contains a unit root, that is, it is not stationary, or that it does not contain a unit root, that is, it is stationary in two different hypotheses (Dickey & Fuller, 1979).

$$Y_t = \rho Y_{t-1} + u_t$$

In a time series, Y_t represents the value of a variable in the current period, and Y_{t-1} represents the value of the same variable in the previous period. U_t is a white noise error term.

If the equation is written as $\delta = (\rho - 1)$;

$$Y_t - Y_{t-1} = \Delta Y_t = \delta Y_{t-1} + u_t$$

In this equation, the null hypothesis is expressed as $\phi = 0$. In this case, the first differences of the Y_t series are stationary. Dickey-Fuller test has three different forms which are;

Y_t is a random walk: $\Delta Y_t = \delta Y_{t-1} + u_t$

Y_t is a random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + u_t$

Y_t is a random walk with drift around a deterministic trend: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + u_t$

The hypotheses are as follows;

Null hypothesis: $H_0: \delta = 0$ means there is a unit root or the time series is nonstationary.

Alternative hypothesis: $H_1: \delta < 0$ means the time series is stationary (Dickey & Fuller, 1979).

3.2.2. The Augmented Dickey-Fuller Test (ADF)

Dickey-Fuller Test has three different forms which are random walk, random walk with drift and random walk with drift around a deterministic trend. In these three equations above, the term u_t is uncorrelated. Therefore Dickey and Fuller developed new test “Augmented Dickey Fuller Test” (Gujarati & Porter, 2009).

The ADF test is the estimation of this regression below.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=0}^m \alpha_i Y_{t-i} - I + \varepsilon_t$$

where ε_t is pure white noise error term,

$$\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2}),$$

$$\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3}).$$

As in the DF test, it is tested whether $\delta = 0$ in the ADF test. Also, the ADF and DF tests follow the same asymptotic distribution and therefore the same critical values can be used (Gujarati & Porter, 2009).

3.2.3. Philips – Perron Test

Philips – Perron test is an alternative of ADF test. The PP test estimates the DF regression in the first step. The following two regressions are used (Philips & Perron, 1988) :

$$y_t = \mu + \alpha \cdot y_{t-1} + u_t$$

$$y_t = \mu + \beta \cdot (t - (0.5).T) + \alpha \cdot y_{t-1} + u_t$$

where μ , α , β are the conventional least-squares regression coefficients.

T is sample size.

U_t is error term.

The hypotheses of the PP test are as follows;

H_0 $\rho = 0$ the time series is not stationary and it has a unit root.

H_1 $\rho < 0$ the time series is stationary and there is no unit root.

3.2.4. KPSS Test

The KPSS test was proposed by Kwiatkowski, Phillips, Schmidt, and Shin in order to ensure the deterministic trend in the series and make the series stationary. Regression used for testing;

$$Y_t = \delta x_t + u_t$$

where x_t is constant trend.

The test statistic is defined as:

$$LM = T^{-2} \sum_{i=1}^T s(t)^2 / f_0$$

where T is sample size,

s_t is cumulative residual function and it is shown as;

$$s(t) = \sum_{r=1}^t u_r$$

f_0 represents the estimator of the residual spectrum at zero frequency.

Unlike other tests, the main hypothesis in the KPSS test is that there is no unit root. The hypotheses are as follows;

$H_0: \sigma_u^2 = 0$ means the time series is stationary

$H_1: \sigma_u^2 > 0$ means there is a unit root or the time series is nonstationary (Yavuz, 2004).

3.2.5. Fourier KPSS Test

The Fourier KPSS test is presented as a more flexible model besides the results of sudden shocks. Regression used in the test (Becker, Enders, & Lee, 2006) :

$$y_t = X_t' \beta + Z_t' + r_t + \varepsilon_t$$

$$r_t = r_{t-1} + u_t$$

where ε_t is error term,

Z_t is a vector with $\left(\sin \frac{2\pi kt}{T}, \cos \frac{2\pi kt}{T} \right)$ and t is trend, T time period, k is frequency.

The test statistics used for level stationarity analysis;

$$y_t = \alpha_0 + \gamma_1 \sin \frac{2\pi kt}{T} + \gamma_2 \cos \frac{2\pi kt}{T} + e_t$$

The test statistic used for trend stationarity analysis is;

$$y_t = \alpha_0 + \beta_1 + \gamma_1 \sin \frac{2\pi kt}{T} + \gamma_2 \cos \frac{2\pi kt}{T} + e_t$$

If the data set does not contain a non-linear trend, the normal KPSS test is used for unit root analysis. In order to understand this, it is evaluated whether it is greater or less than the critical value by looking at the F test value (Becker, Enders, & Lee, 2006).

3.2.6. ADF – GLS Test

Elliot, Rosenberg and Stock suggested the ADF-GLS test. Regression used for testing (Ellioit, Rothenberg, & Stock, 1996);

$$\Delta Y_t = \alpha_0 Y_{t-1}^d + \alpha_1 Y_{t-2}^d + \dots \dots A_p Y_{t-p}^d + \text{error}$$

$H_0 : \alpha_0 = 0$ the null hypothesis is tested with DF. If the critical value is greater than the calculated test statistic, the null hypothesis is rejected (Ellioit, Rothenberg, & Stock, 1996).

3.2.7. Zivot – Andrews Test

Zivot – Andrews test is a unit root test with structural break. Unlike Perron’s test, in this test the break fraction (λ) is taken endogenous, not exogenous. The null hypothesis model is as follows (Zivot & Andrews, 1992) :

$$y_t = \mu + y_{t-1} + \varepsilon_t$$

Perron’s ADF test regressions are followed and the equations used in the test are (Zivot & Andrews, 1992):

Model A:

$$y_t = \mu^A + \Theta^A + DU_t(\lambda) + \beta^A t + \alpha^A y_{t-1} + \sum_{j=1}^k \varepsilon_t + \delta_j^A \Delta y_{t-j}$$

$$DU_t(\lambda) = 1 \text{ if } t > T \lambda$$

$$DU_t(\lambda) = 0 \text{ otherwise}$$

Model B:

$$y_t = \mu^B + \beta^B t + \gamma^B DT_t(\lambda) + \alpha^B y_{t-1} + \sum_{j=1}^k \varepsilon_t + \delta_j^B \Delta y_{t-j}$$

$$DT_t(\lambda) = t - T \lambda \text{ if } t > T \lambda$$

$$DT_t(\lambda) = 0 \text{ otherwise}$$

Model C:

$$y_t = \mu^C + \Theta^C DU_t(\lambda) + \beta^C t + \gamma^C DT_t(\lambda) + \alpha^C y_{t-1} + \sum_{j=1}^k \varepsilon_t + \delta_j^C \Delta y_{t-j}$$

3.2.8. Lee – Strazicich Test

In the Lee and Strazicich test, it is assumed that an endogenous single break occurs in the null and alternative hypotheses. In this test, the rejection of the null hypothesis does not mean that the unit root is rejected. In other words, the rejection of the null hypothesis means the rejection of the unit root without structural break. Data generating process as follows (Lee & Strazicich, 2004) :

$$y_t = \delta' Z_t + X_t$$

$$X_t = \beta X_{t-1} + \varepsilon_t,$$

where Z_t contains exogenous variables and for null hypothesis $\beta = 1$.

The test statistic is obtained by the following regression (Lee & Strazicich, 2004):

$$\Delta y_t = \delta' \Delta Z_t + \varphi S_{t-1} + u_t$$

$$\text{Null hypothesis } \varphi = 0$$

3.3. Method

The impact of fuel prices on food price is analyzed during 2005-2022 monthly data in Türkiye. For analysis, first of all, it will be checked whether the data is stationary with the help of unit root test. After detecting the data are stationary, a cointegration test will be performed to see if there is a long-term relationship between the data. If the existence of a long-term relationship is confirmed, the coefficients between the data will be found with the DOLS and FMOLS methods.

Fourier KPPS unit root test is preferred to check the stationary the data in this study. Also Fourier Shin co-integration test is used for detecting the long term relationship between fuel prices on food inflation. The purpose of applying tests with structural breaks instead of the traditional method is that abrupt transitions between data affect stationarity and long-term relationships. Multiple structural changes are estimated with the Fourier function. With the

Fourier function, it is not necessary to know the location and number of structural breaks. The Fourier Shin test based on the Fourier KPSS test and measures the long-term relationship between the variables. This test provides very robust results on the occurrence and number of structural changes. The Fourier Shin test is not like other tests in the literature, but accepts the existence of a long-term relationship in the basic hypothesis. This is the most important difference between similar tests (Kılıcı, 2019).

The cointegration test put forward by Shin (1994) is a test that gives results that there is a cointegration relationship between the data based on the KPSS stationarity test. In order to free the series from sudden transitions and long-term effects, Tsong et al. (2016) proposed adding the Fourier functions to Shin cointegration tests and developed a new method that ensures that it is not affected by structural breaks. The series are tested with the F test as in the FKPPS test. According to the F test value, it is decided whether Shin or FShin test will be applied (Pata, 2020).

If a variable undergoes certain changes due to the shocks it is exposed to and returns to its original state in a short time, it can be said that the shock has a temporary effect. In this case, traditional unit root tests give the result that the data set is stationary. On the contrary, if the shock to which the variable is exposed causes structural changes, traditional unit root tests give the result that the data set is not stationary. When structural break unit root tests are applied to the variables in this situation, it is seen that the data set is stationary (Çağlar & Mert, 2017).

In light of this information, unit root and cointegration tests will be applied with structural breaks. In this way, the relationship between fuel prices and food inflation will be examined, taking into account the structural changes.

3.4. Results and Discussions

Fuel prices and food price index monthly data between the years 2005-2022 from the Türkiye Statistics Office were used in the study. The stationarity of the data was tested with the help of the Fourier KPSS unit root test. The data used in the analysis are shown in the Figure 27. Gasoline prices, diesel prices and food price index is pictured in Figure 27.

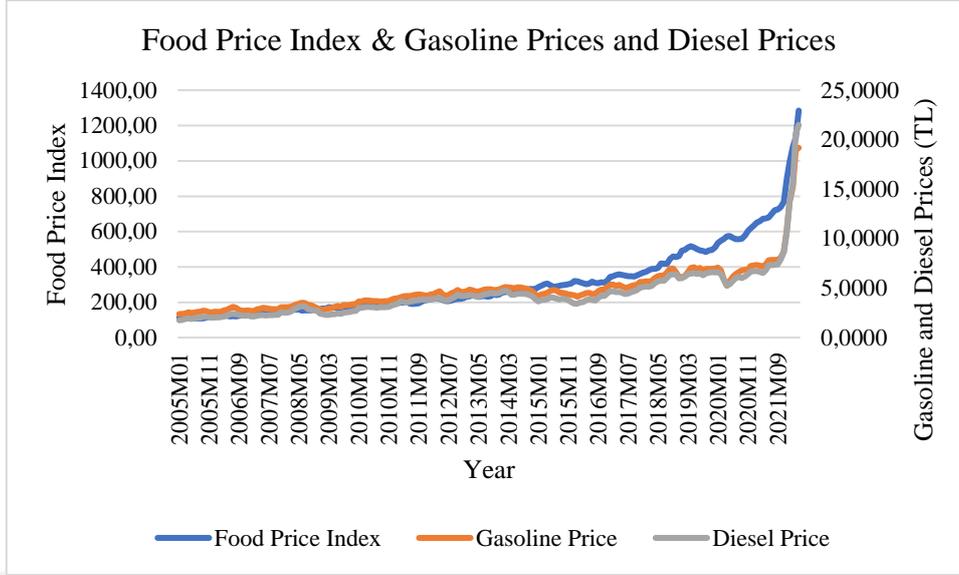


Figure 27: Food Price Index & Gasoline Prices and Diesel Prices
(TURKSTAT, 2023)

According to Figure 27, fuel prices and food price index show a close trend. Despite the low fuel prices due to the decrease in brent oil prices in the World between 2015 and 2020, it is observed that the food price index is high. This gap closed again at the beginning of 2022 with the increase in oil prices. After 2015, the food price indexes of 27 countries in Europe were also examined in the first part. It has been observed that the food price index has increased more than the consumer price index across Europe. This is also evident from this chart in Türkiye. Food price index generally differentiated positively from other variables. It is seen that the variables show a similar trend across the graph. For this reason, in order to determine whether there is a long-term relationship between the variables, it should be checked whether the variables are stationary or not. Fourier KPSS Test was performed for stationarity control and the results were obtained as follows. KPSS and Fourier KPSS test finding is reported in Table 6.

Table 6: FKPPS and KPSS Stationary Test Results of Variables (Fixed)

Variable	Level				
	Frequency	MİNSSR	FKPSS	KPSS	F Test
lgas	1	17.818	0.757	1.738	65.083
ldis	1	25.158	0.748	1.716	61.980
lfood	1	32.161	0.734	1.803	107.284
Variable	First Difference				
	Frequency	MİNSSR	FKPSS	KPSS	F Test
lgas	3	0.357	0.366	0.330	4.061
ldis	3	0.398	0.357	0.300	5.766
lfood	1	0.138	0.355	0.638	4.023

Note: Critical values for F test %1=6.730, %5=4.929, %10=4.133, Critical values for Fourier KPSS test where k=1 %1=0.270, %5=0.172, %10=0.132, Critical values for Fourier KPSS test k=3 %1=0.718, %5=0.448, %10=0.339, Critical values for KPSS test %1=0.216, %5=0.146, %10=0.119.

The natural logarithms of the variables were taken to detect the percentage effects. FKPPS test results will be evaluated since F test values are greater than critical values. According to the FKPPS test results, the null hypothesis was rejected at all three significance levels. In other words, the series is not stationary. Looking at the results of the first differences, it is detected that lgas and ldis are stationary at the 5% significance level. The variables become stationary when their first difference is taken. However, findings show that lfood is not stationary. After the unit root test of the variables was tested with the constant form, it was also tested with the trended form to check the validity of the findings. The findings of the KPSS and Fourier KPPS test is presented in Table 7.

Table 7: FKPPS and KPSS Stationarity Test Results of Variables (Fixed and Trended)

Variable	Level				
	Frequency	MİNSSR	FKPSS	KPSS	F Test
lgas	1	3.043	0.069	0.143	28.042
ldis	1	4.343	0.063	0.129	29.782
lfood	1	0.877	0.078	0.367	174.448
Variable	First Difference				
	Frequency	MİNSSR	FKPSS	KPSS	F Test
lgas	1	0.337	0.052	0.154	7.356
ldis	1	0.374	0.052	0.152	9.326
lfood	1	0.126	0.047	0.169	7.643

Note: Critical values for F test %1=6.730, %5=4.929, %10=4.133, Critical values for Fourier KPSS test %1=0.072, %5=0.055, %10=0.047, Critical values for KPSS test %1=0.739, %5=0.463, %10=0.347.

The natural logarithms of the variables were taken like as the Table 6. FKPSS test results will be evaluated since F test values are greater than critical values. According to the FKPSS test results, the null hypothesis was rejected for variables at the 5% significance level. In other words, the series is not stationary at the 5% significance level. Looking at the results of the first differences, it is seen that the series is stationary at the 5% significance level. The variables become stationary when their first difference is taken. After detecting the series are stationary at the first difference level, it is time to determine the existence of long term relationship between variables. Fourier Shin co-integration test is used to detect the existence of long term relationship between fuel prices and food inflation. We set two model to determine the impact of fuel prices on food inflation. The first model consists of two components, lgas and lfood. Also, second model consists of two components, ldis and lfood. The second model was constructed to check the accuracy of the analysis findings of the first model. The findings of the Fourier Shin co- integration test is reported in Table 8.

Table 8: Fourier Shin Co-Integration Test (lgas- lfood)

Frequency	Min SSR	FSHIN	SHIN	F-Test
1	2.040	0.123**	0.272	4.805**

*Note: Critical values in the FSHIN test are 0.124 for 5% and 0.198 for 1%,
Critical values for SHIN Test are %1=0.553, %5=0.314, %10=0.231,
Critical values for F test are %1=5.774, %5=4.066, %10=3.35.*

According to the F test results, the FSHIN test should be evaluated at the 5% significance level. The value obtained from FSHIN test results is below the critical value at the 1% significance level. This shows that there is a co-integration relationship between gasoline and food prices at 5% significance level. After determining the long term relationship between gasoline prices and food inflation, to test the existence long term relationship between diesel price and food inflation by using Fourier Shin co-integration test. Fourier Shin co- integration test finding is presented in Table 9.

Table 9: Fourier Shin Co-Integration Test (ldis- lfood)

Frekans	Min SSR	FSHIN	SHIN	F-Test
1	2.425	0.130	0.297	2.504

*Note: Critical values in the FSHIN test are 0.124 for 5% and 0.198 for 1%,
Critical values for SHIN Test are %1=0.553, %5=0.314, %10=0.231,
Critical values for F test are %1=5.774, %5=4.066, %10=3.35.*

According to the table 9, F test value is lower than the critical value of 1% significance level. SHIN Test results need to be evaluated. Shin test results shows that there is a co-integration relationship between gasoline and food prices at 5% significance level. This shows that there is long term relationship between diesel and food prices. Findings confirm the findings of the Table 8. Shortly, the existence of long term relationship between diesel prices and food inflation verify the existence of long term relationship between gasoline prices and food inflation.

After finding a co-integration relationship between the variables, DOLS and FMOLS models were applied to estimate the long-term coefficients. DOLS and FMOLS results are presented by Table 10.

Table 10: DOLS and FMOLS Results (l_{gas}-l_{food})

Variables	DOLS			FMOLS		
	Dependent variable: l _{food}			Dependent variable: l _{food}		
	Coefficient	t value	Standard Error	Coefficient	t value	Standard Error
l _{gas}	1.548***	20.162	0.076	1.465***	27.419	0.053
C	3.256***	32.153	0.101	3.367***	40.682	0.083
CC	0.048	1.251	0.038	0.039	1.421	0.028
SS	-0.081	-2.621	0.031	-0.095	-3.385	0.028

Note: ***, **, * represent the significance level of 1%, 5% and 10%, respectively.

According to the DOLS model, a 1% increase in gasoline prices causes a 1.548% increase in food prices. According to the FMOLS model, a 1% increase in gasoline prices causes a 1.465% percent increase in food prices. FMOLS results confirm the validity of DOLS results. It is observed that there is a positive relationship at 1% significance level in both model methods. In line with the results, we can say that the increase of gasoline prices is the one of the main factors of food inflation. From this point of view, one of the essential ways to prevent food inflation is to stop the increasing gasoline prices. Due to the foreign dependency on gasoline, it is hard to stop the price increase. For this reason, to control the increasing of exchange rate can be way of stopping the increasing gasoline prices. Also, orientation towards to renewable energies and to increase the capacity of renewable energy production is the other way of preventing the increase of gasoline prices and food inflation.

We tried to robust the estimation results of the long-run effect of gasoline prices on food inflation by comparing them with the estimation results of the long-run effect of diesel prices on food inflation. The long run effect of diesel prices on food inflation is presented with Table 11.

Table 11: DOLS and FMOLS Results (ldis-lfood)

Variables	DOLS			FMOLS		
	Dependent variable: lfood			Dependent variable: lfood		
	Coefficient	t value	Standard Error	Coefficient	t value	Standard Error
ldis	1.306***	15.101	0.086	1.239***	25.752	0.048
C	3.803***	39.822	0.096	3.882***	56.372	0.069
CC	0.075	1.878	0.040	0.068**	2.295	0.029
SS	-0.081	-2.503	0.033	-0.100***	-3.364	0.030

Note: ***, **, * represent the significance level of 1%, 5% and 10%, respectively.

According to the DOLS model test results, a 1% increase in diesel prices causes a 1.306% increase in food prices. Also FMOLS model test results show that 1% increase in diesel prices causes a 1.239% percent increase in food prices. It is seen that there is a positive relationship at 1% significance level in both model methods. According to the results, the increase in gasoline and diesel prices leads to an increase in food inflation. Since Türkiye is a foreign-dependent country for fossil fuels, it cannot set the prices itself. The factors that determine fuel prices are the exchange rate and oil production. The increase in oil production causes a decrease in oil prices Worldwide. The decrease in oil prices reduces the costs in countries such as Türkiye that are dependent on foreign energy, thereby reducing food inflation. Food inflation can be controlled when the exchange rate, which is another reason, is kept under control. In addition, electricity used in food production can be provided from renewable energy sources, thus reducing costs in the long time period. The role of the government in price setting, as explained in the second chapter, is in taxation. The total tax on fuel prices is more than half of the total price. If the government changes the taxation system and provides a reduction in taxes on fuel prices, food inflation can decrease.

FOURTH PART

CONCLUSIONS AND RECOMMENDATIONS

Food price indices have been increasing at a higher rate than consumer price indices around the World in recent days. This increase led to the emergence of the concept of food inflation. This rising trend is the same in Türkiye as in the rest of the World. When the reasons for this are examined, it is determined that one of the main reasons is fuel prices. For this reason, in this study, the relationship between food inflation and fuel prices was investigated. The data are monthly data covering the years 2005-2022. Fourier KPSS unit root test is preferred to determine series are stationary or not. Also, Fourier Shin co-integration test is used to detect the existence of long term relationship between fuel prices and food inflation. Fourier KPSS test and Fourier Shin co- integration test enables us to take into account the structural breaks for analyzing the impact of the fuel prices on food inflation. According to the Fourier KPSS test findings, series are stationary at the first difference level. Then, the long-term relationship between gasoline-food and diesel-food was investigated by applying the Fourier Shin test. It was concluded that there is a long-term relationship for both data sets. Finally, the coefficients of the long-run relationship between the variables were obtained by applying the DOLS and FMOLS models. According to DOLS model test results, a 1% increase in gasoline prices causes an increase of 1.548% in food prices, while a 1% increase in diesel prices causes an increase of 1.306% in food prices. In addition, according to FMOLS model test results, a 1% increase in gasoline prices causes food prices to increase by 1.465%, while a 1% increase in diesel prices causes a 1.239% increase in food prices. In the light of this information, it is seen that gasoline and diesel prices directly affect food prices and inflation.

In this study, it was observed that the increase in fuel prices was effective in the increase in food inflation. Lowering fuel prices helps to reduce food inflation. Fuel prices are affected by worldwide oil prices, exchange rates, and oil supply. During periods of high oil supply, fuel prices decrease. Since Türkiye is a country that cannot meet its own oil needs and cannot export it to other countries, it is not possible to control oil supply. In other words, oil supply and worldwide oil prices are external factors. Exchange rate can be controlled with the right monetary policies, taking into account the balance of imports and exports. It is directly related to the decisions of policy makers. Therefore, a stable exchange rate can prevent food inflation by ensuring that fuel prices are stable. In addition, the government has the taxation authority to set prices. When the monthly fuel pricing reports of EPDK are analyzed, it is seen that the tax rate in fuel prices in Türkiye is above 50%. If the government abandons this tax policy and charges less tax on fuel prices, a decrease in food inflation is achieved, assuming other variables are constant in other words *ceteris paribus*. As a result, this study findings highly recommends to policy maker decreasing the tax on fuel prices. Also, investment to renewable energy may be a solution to the control of the increasing impact of fuel prices on food inflation. Increased use of renewable energies may limit the increasing impact of fuel prices on the cost of goods and services. In addition to policy makers, it is recommended that researchers who plan to study this issue in the future examine the impact of fuel oil on food inflation in the context of the Russia-Ukraine war.

REFERENCES

- Abdlaziz, R., Rahim, K., & Adamu, P. (2016). Oil and Food Prices Co-integration Nexus for Indonesia: A Non-linear Autoregressive Distributed Lag Analysis. *International Journal of Energy Economics and Policy*, 82-87.
- Acer, Y. (2022). Rusya-Ukrayna Savaşının Gıda Arzına Etkileri Ve Tahıl Koridoru Anlaşması. *SETA*.
- Akyıldız, H., & Eroğlu, Ö. (2004). Türkiye Cumhuriyeti Dönemi Uygulanan İktisat Politikaları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi*, 9(1), 43-62.
- Ali, S., Ramzan, M., Razi, A., & Bhatti, A. (2012). Impact of oil prices On food inflation in Pakistan. *Interdisciplinary Journal of Contemporary Research Business*, 123-140.
- Andreyeva, T., Long, M. W., & Brownell, K. D. (2010). The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food. *Government, Politics, and Law*, 216-222.
- API. (2005). Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method. *Manual of Petroleum Measurement Standards*, 1-6.
- API. (2023). *Refinery Processes*. American Petroleum Institute: <https://www.api.org/oil-and-natural-gas/wells-to-consumer/fuels-and-refining/refineries/how-refinery-works/refinery-processes> adresinden alındı
- Atuk, O., & Sevinç, O. (2012). Enflasyona Katkı Hesaplamaları. *Ekonomi Notları - TCMB*.
- Bala, U., & Chin, L. (2018). Asymmetric Impacts of Oil Price on Inflation: An Empirical Study of African OPEC Member Countries. *MDPI Energies*, 1-21.
- Baumol, W. J., & Blinder, A. S. (1991). *Macroeconomics: Principles and Policy*.
- Bawa, S., Abdullahi, I., Tukur, D., Barda, S., & Adams, Y. (2020). Asymmetric Impact of Oil Price on Inflation in Nigeria. *CBN Journal of Applied Statistics*, 85-113.
- Becker, R., Enders, W., & Lee, J. (2006). A Stationarity Test in the Presence of an Unknown Number of Smooth Breaks. *Journal of Time Series Analysis*.
- Beşergil, B. (2009). *Rafineri Prosesleri*. Gazi Kitabevi.
- Birinci, Y. (1989). Enflasyon, Para Politikası ve Stratejileri. *47(1-4)*, 19-30.
- BOTAŞ. (2021). *Ertuğrul Gazi FSRU Ship*. Botaş Website: <http://www.botas.gov.tr> adresinden alındı
- BOTAŞ. (2022). *Tuz Gölü Natural Gas Storage Project*. BOTAŞ Official Web Site: <https://www.botas.gov.tr/Sayfa/devam-eden-onemli-projelerimiz/505> adresinden alındı
- BOTAŞ. (2023). <https://www.botas.gov.tr/> adresinden alındı
- BOTAŞ. (2023). *Dictionary*. BOTAŞ Official Web Site: <https://www.botas.gov.tr/Sozluk?Kelime=404> adresinden alındı

- Can, M. (2008). Dünya Gıda Fiyatlarının Yükselmesinin Piyasa Yapısıyla İlgisi. *Maliye Dergisi*, 89-107.
- Cavlak, N., & Selvi, M. S. (2022). Possible Causes Of Excessive Increase In Food Prices And The Impact Of Covid-19. *The Journal of Food*.
- Chaudhuri, U. R. (2011). *Fundamentals of Petroleum and Petrochemical Engineering*.
- Chen, S. T., Kuo, H.-I., & Chen, C. C. (2010). Modeling the relationship between the oil price and global food prices. *Applied Energy*, 2517-2525.
- Çağlar, A. E., & Mert, M. (2017). Environmental Kuznets Hypothesis and The Impact of Renewable Energy Consumption on Carbon Emmissions in Turkey: Cointegration with Structural Breaks Approach. *Yönetim ve Ekonomi*, 22-38.
- Çelik, T., & Akgül, B. (2011). Changes in Fuel Oil Prices in Turkey: An Estimation of Inflation Effect Using Var Analysis. *Journal of Economics and Business*, 11-21.
- Çepni, E. (2015). *Ekonomik ve Finansal Göstergeler Rehberi*.
- Dayıoğlu Erul, R., & Buz, F. (2019). Tax Policies in Turkey Applied in the Period of Second World War. *Ekonomi, İşletme ve Mali Araştırmaları Dergisi*.
- Dickey, D. A., & Fuller, W. A. (1979). *Distribution of the Estimators for Autoregressive Time Series With a Unit Root*.
- Dillion, B. M., & Barrett, C. B. (2015). Global Oil Prices and Local Food Prices: Evidence from East Africa.
- Dinçer, H., & Karakuş, H. (2020). Petrol Fiyatlarının Enflasyon Üzerindeki Etkisinin Belirlenmesi: G7 Ülkeleri Üzerine Ekonometrik Bir Analiz. *Uluslararası Hukuk ve Sosyal Bilim Araştırmaları Dergisi*, 1-12.
- ECB. (2023). *What is Inflation?* ECB Website: <https://www.ecb.europa.eu/> adresinden alındı
- Eğilmez, M. (2020). *Türkiye Ekonomisi*.
- Eğilmez, M. (2022). *Yapısal Reformlar ve Türkiye*.
- EIA. (2023). <https://www.eia.gov/energyexplained/natural-gas/> adresinden alındı
- EIA. (2023). *Henry Hub Natural Gas Spot Price*. EIA Website: <https://www.eia.gov/dnav/ng/hist/rngwhhdm.htm> adresinden alındı
- EIA. (2023). *Refining crude oil*. U.S. Energy Information Administration: <https://www.eia.gov/energyexplained/oil-and-petroleum-products/refining-crude-oil-the-refining-process.php> adresinden alındı
- Ellioit, G., Rothenberg, T. J., & Stock, J. H. (1996). Efficient Tests For An Autoregressive Unit Root.
- EPDK. (2022). *PETROL VE LPG PİYASASI FİYATLANDIRMA RAPORU EKİM 2022*.
- Ertuna, Ö. (2014). *1923'ten Bugüne Türkiye Ekonomisi ve 2023'e Doğru Hedefler*.
- Eurostat. (2022). *Eurostat Database*. <https://ec.europa.eu/eurostat/data/database> adresinden alındı

- Farndon, J. (2015). *Yakından Tanyın Petrol*. Tübitak.
- FED. (2023). *What is Inflation?* FED Website: <https://www.federalreserve.gov/> adresinden alındı
- Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics*.
- Ibrahim, M. (2015). Oil and food prices in Malaysia: a nonlinear ARDL analysis. *Agricultural and Food Economics*, 1-14.
- IEA. (2023). *Natural Gas Consumption*. International Energy Agency Website: <https://www.iea.org/data-and-statistics> adresinden alındı
- IEA. (2023). *World Coal Consumption*. International Energy Agency Web Site: <https://www.iea.org/data-and-statistics/charts/world-coal-consumption-1978-2020> adresinden alındı
- Irz, X., Niemi, J., & Liu, X. (2013). Determinants of food price inflation in Finland - The role of energy. *Energy Policy*, 656-663.
- Kapdan, E. (2022). Development Of Food Supply Of The Cities After The Industrial Revolution. *Paradoks Economics, Sociology and Policy Journal*, 133-148.
- Karacan, R., & Yardım Kılıçkan, Z. (2018). The Evaluation of Inflation in Turkey within the Aspects of Oil Prices and Exchange Rate. *Current Debates in Social Sciences*, 185-194.
- Karagöl, E. T. (2013). Ak Parti Dönemi Türkiye Ekonomisi.
- Kargı, B. (2014). The Effect of Oil Prices on Inflation and Growth: Time Series Analysis in Turkish Economy for 1988:01-2013:04 Period. *Int.J.Eco.Res.*, 29-36.
- Kaymaz, V. (2021). Covid-19 Inflation Basket. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Araştırma Makalesi Dergisi*, 735-753.
- Kılıcı, E. N. (2019). Analysis Of Impact Of Late Liquidity Windowrates On Lending Rates And Foreign Exchange Rates: Evidence From Turkey. *International Journal of Afro-Eurasian Research*, 14-26.
- Koçak, S., Balan, F., & Albayrak, B. (2018). Türkiye Ekonomisinde Petrol Fiyatları ve Enflasyon İlişkisi: Ampirik Analiz. *Journal of Life Economics*.
- Kutlu, Ş. Ş. (2021). Türkiye’de Gıda Enflasyonunun Belirleyicileri: Svar Modelinden Kanıtlar. *Ekev Akademi Dergisi*, 581-598.
- Law:5015. (2003, 12 23). Oil Market Law, Law No:5015. Official Newspaper.
- Lee, J., & Strazicich, M. C. (2004). Minimum LM Unit Root Test with One Structural Break.
- Lem, A., Bjorndal, T., & Lappo, A. (2014). Economic Analysis Of Supply And Demand For Food Up To 2030 – Special Focus On Fish And Fishery Products. *FAO Fisheries and Aquaculture Circular No. 1089*.
- Mazmanoğlu, A. (2012). İktisat ve işletmede istatistiksel anlamda indeksin önemi ve hesaplama teknikleri üzerine bir açıklama. *ABMYO Dergisi*, 26, 3-22.
- McEachern, W. A. (2006). *Economics, A Contemporary Introduction* (Cilt 7).

- Meral, P. S. (2005). Enflasyon ve Enflasyonun Okuma Alışkanlığına Etkisi. *Sosyal Bilimler Enstitüsü Dergisi*, 2(19), 309-324.
- Niyimbanira, F. (2013). An Investigation of the Relationship between Oil Prices and Inflation in South Africa. *Mediterranean Journal of Social Sciences*, 105-111.
- OSGU Geology Engineering Department. (2023). Eskişehir Osman Gazi University Geology Engineering Department Website: <https://jeoloji.ogu.edu.tr/Storage/Jeoloji/Uploads/petrol%C3%BCn-g%C3%B6%C3%A7%C3%BC.pdf> adresinden alındı
- Öner, A. (2022, 4 7). 1971-1980 Arası Türk Siyasetinin Genel Tablosu. TUIC Academy: <https://www.tuicakademi.org/1971-1980-arasi-turk-siyasetinin-genel-tablosu/> adresinden alındı
- Özçelik, O. (2023). Rusya-Ukrayna Savaşı Gölgesinde Dünyadaki Gıda Fiyatlarının Belirleyicileri: Fourier Bootstrap Ardl ve Fourier Bootstrap Toda-Yamamoto Yaklaşımlarından Kanıtlar. *Turkish Journal of Agricultural Economics*, 29-47.
- Öztürk, Ş., Nas, F., & İçöz, E. (2008). 24 Ocak Kararları, Neo-Liberal Politikalar ve Türkiye Tarımı. *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 1(2), 15-32.
- Pata, U. K. (2020). The Relationship between Education and Economic Growth in Turkey: Fourier-Shin Cointegration Test. *International Journal of Economics and Innovation*, 175-190.
- Peterson, W. C., & Estenson, P. S. (1992). *Income, Employment, Economic Growth*.
- Philips, P. C., & Perron, P. (1988). Testing for a Unit Root in Time Series Regression.
- Samuelson, P. A., & Nordhaus, W. D. (2010). *Economics* (Cilt 19).
- Sarwar, M. N., Hussain, H., & Maqbool, M. B. (2020). Pass through effects of oil price on food and non-food prices in Pakistan: A nonlinear ARDL approach. *Resources Policy*.
- Sayılğan, Ş. (1994). 5 Nisan Kararları ve Beklentiler. *Marmara Journal of Communications*(8), 213-217.
- Schlumberger. (2023). *API Gravity*. Schlumberger: <https://glossary.slb.com/> adresinden alındı
- SETA. (2021). *Türkiye'de Gıda Enflasyonu*.
- Shell. (2023). *LNG*. Shell Website: <https://www.shell.com.tr/> adresinden alındı
- Siok, K. S., Xue, Q. T., & Yen, N. W. (2015). A Comparative Study on the Effects of Oil Price Changes on Inflation. *Procedia Economics and Finance*, 630-636.
- Solak, A. O. (2012). Determinants of the Oil Prices. *International Journal of Alanya Faculty of Business*, 4(2), 117-124.
- SPE. (1997). *Petroleum Reserves Definitions*. Society of Petroleum Engineers: <https://www.spe.org/en/industry/petroleum-reserves-definitions/> adresinden alındı
- Takım, A. (2012). Demokrat Parti Döneminde Uygulanan Ekonomi Politikaları ve Sonuçları. *Ankara Üniversitesi SBF Dergisi*, 67(2), 157-187.

- Tamzok, N. (2019). *Dünya'da ve Türkiye'de Kömür*.
- Taş, M. (2004). Menderes Dönemi Ekonomi Politikası ve 1958 İstikrar Programı. *Mevzuat Dergisi*.
- TBMM. (2003). *Petroleum Market Law*. Petroleum Market Law,5015:
<https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5015&MevzuatTur=1&MevzuatTertip=5> adresinden alındı
- TCMB. (2004). Türkiye Cumhuriyet Merkez Bankası.
- TCMB. (2023). <https://www.tcmb.gov.tr/> adresinden alındı
- TCMB. (2023). *TCMB Causes of Inflation*. TCMB Official Website:
<https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Temel+Faaliyetler/Para+Politikasi/Fiyat+Istikrari+ve+Enflasyon/Neden> adresinden alındı
- TDK. (2023). *TDK*. <https://sozluk.gov.tr/> adresinden alındı
- TDK. (2023). *Turkish Language Institution*. Turkish Language Institution: <https://sozluk.gov.tr/> adresinden alındı
- TPAO. (2023). *TPAO Offshore Drilling Rigs*. TPAO Official Website: <https://www.tpao.gov.tr/> adresinden alındı
- TPIC. (2023). *TPIC Drilling Services*. TPIC Website: <https://www.tpic.com.tr/> adresinden alındı
- Tunca, Z. (1998). Türkiye'de Enflasyon. *İstanbul Üniversitesi İktisat Fakültesi Mecmuası*, 201-215.
- TURKSTAT. (2014). *Statistical Indicators 1923-2013*.
- TURKSTAT. (2022, 11 16). <https://data.tuik.gov.tr/> adresinden alındı
- TURKSTAT. (2023). <http://data.tuik.gov.tr> adresinden alındı
- TURKSTAT. (2023). TURKSTAT Database: <http://data.tuik.gov.tr> adresinden alındı
- Uygur, E. (2001). Krizden Krize Türkiye: 2000 Kasım ve 2001 Şubat Krizleri. *Türkiye Ekonomi Kurumu Tartışma Metni*.
- Xuan, P., & Chin, L. (2015). Pass-through effect of oil price into consumer price: An empirical study. *International Journal of Economics and Management*, 143-161.
- Yavuz, F. (2021). Türkiye'de Gıda Enflasyonu: Tarladan Çatala Sorunların Bir Göstergesi. *Siyaset Ekonomi ve Toplum Araştırmaları Vakfı*.
- Yavuz, N. Ç. (2004). Durağanlığın Belirlenmesinde KPSS ve ADF Testleri: İMKB Ulusal-100 Endeksi ile Bir Uygulama.
- Yelen, B. (2017). Agricultural Production And Food Demand In Türkiye. *Ph.D Thesis*.
- Zivot, E., & Andrews, D. W. (1992). Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis.

AKSARAY ÜNİVERSİTESİ TEZ DEĞERLENDİRME FORMU

Öğrencinin Adı Soyadı: Mesut GÜDÜKÇAM		EYET
Kapak		
1	Tez Başlığı tutanaktaki başlıkla aynı mı?	
2	Kapakdaki ay ve yıl savunmaya girilen tarihle tutarlı mı?	
3	Kapak format kılavuzdaki kapak formatına uygun mu?	
4	Kapakta yazılan tüm yazılar doğru olarak verilmiş mi?	
İçindekiler		
5	Sayfa numaraları tam verilmiş mi?	
6	Şekil, Çizelge vb. listeleri verilmiş mi? Sıralaması doğru mu?	
7	Özet, Abstract, Giriş, Sonuçlar vb. bölümler var mı?	
8	Yazım hataları kontrolü yapıldı mı?	
Giriş		
9	Hazırlanan tezin önemini anlatıyor mu?	
10	İkinci ve Üçüncü dereceden başlık içermemeli kuralına uyuldu mu?	
Özet/Abstract		
11	Kılavuza uygun mu?	
12	Ay ve yıl savunmaya girilen tarihle tutarlı mı?	
13	Özet; tek sayfa, tek aralık, tek paragraf kuralına uygun olarak yazıldı mı?	
14	Bilim kodu, sayfa adedi, anahtar kelimeler ve tez danışmanı yazıldı mı?	
Kaynakça		
15	Kaynakların tamamına metin içinde atıf yapıldı mı?	
16	Kaynak formatı Kılavuzdaki kaynak formatına uygun olarak hazırlanmış mı?	
17	Atıf formatı kılavuzdaki atıf formatına uygun mu?	
Atıf Yöntemi APA 6 <input type="checkbox"/> CMS <input type="checkbox"/> İSNAD <input type="checkbox"/>		
Genel Değerlendirme		
18	Etik Beyan açıklaması okundu, uyuldu ve imzalandı mı?	
19	Kabul/Onay sayfası kılavuzdaki formata uygun olarak düzenlenmiş mi?	
20	Kabul /Onay sayfasında belirtilen oy birliği/oy çokluğu seçeneklerinden uygun olanı savunmayla tutarlı olacak şekilde belirlenmiş mi?	
21	Sayfa kenar boşluklar ve sayfa numaraları kılavuzdaki formatına uygun mu?	
22	Paragraf boşlukları ve metin satır aralığı kılavuza uygun olacak şekilde düzenlenmiş mi?	
23	Başlık yazımları kılavuzdaki başlık formatlarına uygun mu?	
24	Yazı tipi ve boyutu kılavuzdaki yazı tipi ve boyutu formatına uygun mu?	
25	Şekil, Çizelge vb. açıklama ve numaralandırmaları kılavuzdaki formata uygun olarak yazılmış mı?	