Hacettepe University Graduate School Of Social Sciences

Department Of Economics

THE EFFECTS OF ENERGY PRICES ON INFLATION AND MONETARY POLICY: THE CASE OF TURKEY

Muhammed Taha ÇİÇEK

Master’s Thesis

Ankara, 2024

THE EFFECTS OF ENERGY PRICES ON INFLATION AND MONETARY POLICY: THE CASE OF TURKEY

Muhammed Taha ÇİÇEK

Hacettepe University Graduate School Of Social Sciences

Department Of Economics

Master’s Thesis

Ankara, 2024

ACCEPTANCE AND APPROVAL

The jury finds that Muhammed Taha ÇİÇEK has on the date of 22/01/2024 successfully passed the defense examination and approves his Master's Thesis titled "The Effects of Energy Prices on Inflation and Monetary Policy: The Case Of Turkey".

Prof. Dr. Başak DALGIÇ (Jury President)

Prof. Dr. Özge KANDEMİR KOCAASLAN (Main Adviser)

Dr. Alperen AĞCA

I agree that the signatures above belong to the faculty members listed.

Prof. Dr. Uğur ÖMÜRGÖNÜLŞEN

Graduate School Director

YAYIMLAMA VE FİKRİ MÜLKİYET HAKLARI BEYANI

Enstitü tarafından onaylanan lisansüstü tezimin/raporumun tamamını veya herhangi bir kısmını, basılı (kağıt) ve elektronik formatta arşivleme ve aşağıda verilen koşullarla kullanıma açma iznini Hacettepe Üniversitesine verdiğimi bildiririm. Bu izinle Üniversiteye verilen kullanım hakları dışındaki tüm fikri mülkiyet haklarım bende kalacak, tezimin tamamının ya da bir bölümünün gelecekteki çalışmalarda (makale, kitap, lisans ve patent vb.) kullanım hakları bana ait olacaktır.

Tezin kendi orijinal çalışmam olduğunu, başkalarının haklarını ihlal etmediğimi ve tezimin tek yetkili sahibi olduğumu beyan ve taahhüt ederim. Tezimde yer alan telif hakkı bulunan ve sahiplerinden yazılı izin alınarak kullanılması zorunlu metinlerin yazılı izin alınarak kullandığımı ve istenildiğinde suretlerini Üniversiteye teslim etmeyi taahhüt ederim.

Yükseköğretim Kurulu tarafından yayınlanan ***"Lisansüstü Tezlerin Elektronik Ortamda Toplanması, Düzenlenmesi ve Erişime Açılmasına İlişkin Yönerge"*** kapsamında tezim aşağıda belirtilen koşullar haricince YÖK Ulusal Tez Merkezi / H.Ü. Kütüphaneleri Açık Erişim Sisteminde erişime açılır.

- o Enstitü / Fakülte yönetim kurulu kararı ile tezimin erişime açılması mezuniyet tarihimden itibaren 2 yıl ertelenmiştir. (1)
- o Enstitü / Fakülte yönetim kurulunun gerekçeli kararı ile tezimin erişime açılması mezuniyet tarihimden itibaren ... ay ertelenmiştir. (2)
- o Tezimle ilgili gizlilik kararı verilmiştir. (3)

……/………/……

Muhammed Taha ÇİÇEK

i

[1] *"Lisansüstü Tezlerin Elektronik Ortamda Toplanması, Düzenlenmesi ve Erişime Açılmasına İlişkin Yönerge"*

(1) *Madde 6. 1. Lisansüstü tezle ilgili patent başvurusu yapılması veya patent alma sürecinin devam etmesi durumunda, tez* ***danışmanının*** *önerisi ve* ***enstitü anabilim dalının*** *uygun görüşü üzerine* ***enstitü*** *veya* ***fakülte yönetim kurulu*** *iki yıl süre ile tezin erişime açılmasının ertelenmesine karar verebilir.*

(2) *Madde 6. 2. Yeni teknik, materyal ve metotların kullanıldığı, henüz makaleye dönüşmemiş veya patent gibi yöntemlerle korunmamış ve internetten paylaşılması durumunda 3. şahıslara veya kurumlara haksız kazanç imkanı oluşturabilecek bilgi ve bulguları içeren tezler hakkında tez* ***danışmanının*** *önerisi ve* ***enstitü anabilim dalının*** *uygun görüşü üzerine* ***enstitü*** *veya* ***fakülte yönetim kurulunun*** *gerekçeli kararı ile altı ayı aşmamak üzere tezin erişime açılması engellenebilir.*

(3) *Madde 7. 1. Ulusal çıkarları veya güvenliği ilgilendiren, emniyet, istihbarat, savunma ve güvenlik, sağlık vb. konulara ilişkin lisansüstü tezlerle ilgili gizlilik kararı,* ***tezin yapıldığı kurum*** *tarafından verilir *. Kurum ve kuruluşlarla yapılan işbirliği protokolü çerçevesinde hazırlanan lisansüstü tezlere ilişkin gizlilik kararı ise,* ***ilgili kurum ve kuruluşun önerisi*** *ile* ***enstitü*** *veya* ***fakültenin*** *uygun görüşü üzerine* ***üniversite yönetim kurulu*** *tarafından verilir. Gizlilik kararı verilen tezler Yükseköğretim Kuruluna bildirilir.*
Madde 7.2. Gizlilik kararı verilen tezler gizlilik süresince enstitü veya fakülte tarafından gizlilik kuralları çerçevesinde muhafaza edilir, gizlilik kararının kaldırılması halinde Tez Otomasyon Sistemine yüklenir

***** *Tez* ***danışmanının*** *önerisi ve* ***enstitü anabilim dalının*** *uygun görüşü üzerine* ***enstitü*** *veya* ***fakülte yönetim kurulu tarafından karar verilir.***

ETİK BEYAN

Bu çalışmadaki bütün bilgi ve belgeleri akademik kurallar çerçevesinde elde ettiğimi, görsel, işitsel ve yazılı tüm bilgi ve sonuçları bilimsel ahlak kurallarına uygun olarak sunduğumu, kullandığım verilerde herhangi bir tahrifat yapmadığımı, yararlandığım kaynaklara bilimsel normlara uygun olarak atıfta bulunduğumu, tezimin kaynak gösterilen durumlar dışında özgün olduğunu, **Prof. Dr. Özge KANDEMİR KOCAASLAN** danışmanlığında tarafımdan üretildiğini ve Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü Tez Yazım Yönergesine göre yazıldığını beyan ederim.

Muhammed Taha ÇİÇEK

ACKNOWLEDGEMENTS

Tez çalışmamda bilgi ve tecrübelerinden yararlandığım saygıdeğer tez danışmanım Sayın Prof. Dr. Özge KANDEMİR KOCAASLAN hocama ve bana anlayış göstererek manen destek veren kıymetli eşim Hümeyra ÇİÇEK'e şükranlarımı sunarım.

ABSTRACT

ÇİÇEK, Muhammed Taha. *The Effects Of Energy Prices On Inflation And Monetary Policy: The Case Of Turkey*, Master's Thesis, Ankara, 2024.

The NARDL Bounds Test method was employed in the thesis study to examine the impact of energy prices on inflation in Türkiye during the period of 2012:01-2022:12. Furthermore, the study investigated the effects of energy prices on monetary policy using a modified Taylor rule for the period of 2006-2022, which coincided with the country's transition to the inflation targeting regime. While previous empirical studies in the economic literature typically focused on the international crude oil price, this study explored the effects on domestic inflation using two different models that incorporated the Market Clearing Price variable in addition to the aforementioned variable. The aim was to contribute to the existing economic literature. The study revealed that the pass-through effect from international oil prices to consumer prices is both asymmetrical and significant. These findings confirmed the effectiveness of the subsidy mechanisms implemented in domestic final energy prices in combating inflation. Additionally, it was found that the Market Clearing Price significantly influences inflation and exhibits symmetrical effects. However, from an econometric perspective, the impact of energy prices on monetary policy was found to be weak. Consequently, it is crucial for the public sector and economic decision makers to closely monitor the Market Clearing Price, as it is an important and influential variable.

Keywords

NARDL, Energy, Market Clearing Price, Inflation, Monetary Policy

ÖZET

ÇİÇEK, Muhammed Taha. *Enerji Fiyatlarının Enflasyon Ve Para Politikası Üzerindeki Etkileri: Türkiye Örneği*, Yüksek Lisans Tezi, Ankara, 2024.

Tez çalışmasında, 2012:01–2022:12 döneminde Türkiye'de enerji fiyatlarının enflasyon üzerindeki etkileri NARDL Sınır Testi ekonometrik yöntemiyle incelenmiştir. Ayrıca ülkede enflasyon hedeflemesi rejimine geçilen 2006-2022 dönemi için enerji fiyatlarının para politikası üzerindeki etkileri modifiye edilmiş Taylor kuralı ile incelenmiştir. İktisadi yazında ampirik çalışmalarda genellikle uluslararası ham petrol fiyatı kullanılırken bu çalışmada iktisadi yazına katkıda bulunulması amacıyla söz konusu değişkene ek olarak Piyasa Takas Fiyatı değişkeni esas alınarak iki ayrı modelde yurt içi enflasyon üzerindeki etkiler araştırılmıştır. Çalışma sonucunda uluslararası petrol fiyatlarından tüketici fiyatlarına geçişkenliğin asimetrik ve anlamlı olduğu ortaya konulmuştur. Bulgular, söz konusu dönemde yurt içi nihai enerji fiyatlarında uygulanan sübvansiyon mekanizmalarının enflasyonla mücadelede etkin olduğunu teyit etmiştir. Öte yandan, Piyasa Takas Fiyatı'nın enflasyon üzerinde simetrik ve anlamlı etkileri olduğu bulgusuna ulaşılmıştır. Enerji fiyatlarının para politikası üzerindeki etkilerinin ekonometrik olarak zayıf olduğu tespit edilmiştir. Piyasa Takas Fiyatı'nın kamu kesimi ve ekonomik karar alıcılar tarafından takip edilmesi gereken önemli ve etkili bir gösterge olduğu sonucuna varılmıştır.

Anahtar Sözcükler

NARDL, Enerji, Piyasa Takas Fiyatı, Enflasyon, Para Politikası

TABLE OF CONTENTS

ABBREVIATIONS

API : Argus/McCloskey's Coal Price Index

ARDL : Autoregressive Distributed Lag

BOTAŞ : Pipelines and Petroleum Transportation Joint Stock Company

BP : British Petroleum Company

CAPP : Central Appalachian

EMRA : Energy Market Regulatory Authority

ETKB : Ministry of Energy and Natural Resources

EXIST : Energy Exchange Istanbul

EU : European Union

FED : Federal Reserve

HH : Henry Hub

IAEA : International Atomic Energy Agency

IEA : International Energy Agency

IRENA : International Renewable Energy Agency

JKM : Japan Korea Marker

LNG : Liquefied Natural Gas

MAPEG : General Directorate of Mining and Petroleum Affairs

MCP : Market Clearing Price

MS-VAR : Markov Switching Vector Auto Regression

NARDL : Nonlinear Autoregressive Distributed Lag

NBP : National Balancing Point

OECD : The Organization for Economic Cooperation and Development

OPEC : The Organization of the Petroleum Exporting Countries

PSV : Punto di Scambio Virtuale

PVB : Punto Virtual de Balance

R & D : Research and Development

SCT : Special Consumption Tax

SVAR : Structural Vector Auto Regression

TEK : Turkish Electricity Authority

TPAO : Turkish Petroleum Joint Stock Partnership

TRF : Trading Region France

TTF : Title Transfer Facility

TÜİK : Turkish Statistical Institute

UN : United Nations

USA : United States of America

VAR : Vector Auto Regression

VOB : Virtualni Obchodni Bod

YEKDEM: Regulation on Certification and Support of Renewable Energy Resources

WTI : West Texas Intermediate

ZEE : Zeebrugge Hub

ZTP : Zeebrugge Trading Point

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

°C	: Centigrade
CO_2	: Carbon dioxide
EJ	: Exajoule
GW	: Gigawatt
Mbtu	: Million British Thermal Unit
MW	: Megawatt
MWh	: Megawatt hour
NO_x	: Nitrous oxide
SO_2	: Sulfur dioxide
PV	: Photovoltaic
TWh	:Terawatt hour
W	: Watt

INTRODUCTION

Effective and efficient use of energy, which is considered a production factor for sustainable growth and development in country economies, is of great importance. In the world where per capita energy consumption increases every year, it is seen that developing countries, like developed countries, are designing energy policies in line with sustainable growth targets.

Throughout its history, Türkiye has faced an energy deficit due to its reliance on imports to fulfill a significant portion of its energy requirements. Although the share of domestic resources in energy has been increased by taking important steps for localization and renewable energy policies in energy since the 2000s, the country remains a net energy importer as of 2023. Energy supply security, energy policies and energy prices are of particular importance for the Turkish economy, both in line with its geopolitical location adjacent to energy producing countries and sustainable growth targets.

The effects of price fluctuations on the overall level of domestic prices are of great concern to the public sector and other economic decision makers, as energy prices play a significant role in both household expenditures and manufacturing ındustry.

The task of ensuring price stability falls on central banks, and they pay particular attention to energy prices. In fact, they take energy prices into account when creating forecasts and expectations. This is because assessing the effects of energy prices on inflation is vital for central banks to implement successful monetary policies and macroprudential measures.

As far as researched, similar to the international economic literature, it has been observed that in econometric-based studies conducted in Türkiye on the pass-through of energy prices to consumer prices, the international crude oil price or, rarely, domestic fuel prices are taken as the basis as the energy reference price. However, in Türkiye, where the energy sector is significantly privatized and the energy markets are highly developed compared to similar countries, the use of only international oil prices as the energy reference price and the absence of studies on other reference prices are seen as a deficiency in the economic literature. Starting from this point, in this thesis study; In addition to the international oil price, it is aimed to contribute to the relevant literature by making the effects of the Market Clearing Price, which is the reference electrical energy price formed as a result of matching supply and demand in the day-ahead electricity markets, on inflation a research topic. Furthermore, the potential impacts of energy prices on monetary policy were examined with econometric analysis and their significance was investigated.

The initial section of the thesis encompasses an elucidation of the definition and significance of energy. It delves into the origins that cater to the global energy supply, the evolution of energy markets over time, and the historical trajectory of international energy prices and the mechanisms behind their formation. Subsequently, the thesis incorporates a comprehensive account of the progression of energy resources, energy markets, and the establishment and progression of domestic energy prices in Türkiye throughout its historical evolution.

The subsequent section of the study focused on analyzing the impact of energy prices on macroeconomic indicators, particularly inflation, as explored in the economic literature. This involved categorizing and examining both international studies and research conducted in Türkiye on the relationship between energy prices, inflation, monetary policy, and macroeconomics. Ultimately, the chapter concluded with a comprehensive assessment of the literature's trajectory, coverage, and findings.

The third section of the research paper provides comprehensive details regarding the scope, methodology, and research data employed in the study. Two separate econometric models were utilized to examine the influence of international oil prices and the Market Clearing Price on domestic inflation. The findings derived from these models were meticulously analyzed and interpreted. Moreover, the study also investigated the position of energy prices in the monetary policy response through the modified Taylor rule.

The final phase of the research involved a comparative analysis of the economic literature findings and the conclusions derived from the thesis study in the conclusion and evaluation section. In light of the thesis study's outcomes, recommendations were put forth for economic decision makers.

CHAPTER 1

ENERGY MARKETS AND THE FORMATION OF ENERGY PRICES

1.1. DEFINITION AND IMPORTANCE OF ENERGY

Humans have basic needs such as nutrition, shelter and warmth to survive. The emergence of the concept of energy is related to the provision of these basic needs. The dictionary meaning of energy in physics is "the power that exists in matter and emerges in the form of heat and light". Heat is obtained from the combustion process, where carbon and hydrogen in the substance combine with oxygen and release heat. Providing energy as heat or power mechanically or electrically is the main reason for burning fuels. The term energy, when used correctly, refers only to heat and power, but is also used by many in its non-inclusive definition to include fuels. (OECD/IEA, 2004, p.17).

In its most basic definition, energy is the available ability of an object to do work. Since the beginning of history, people have created energy using the power of their muscles or other animals. Throughout history, people have benefited from various forms of energy stored in nature in different forms. Before the Industrial Revolution, societies used basic energy transformations such as currents and wind, which relied on solar radiation as well as muscle power. After the Industrial Revolution of the 18th century, energy sources based on muscle power and solar radiation were replaced in a very short time by fossil energy sources such as coal and oil. (Pratt et al., 2014).

To understand the definition of energy, it is necessary to explain from what sources it is obtained. The world's primary energy sources include fossil fuels, natural nuclear resources and renewable energy sources such as solar, wind, hydroelectric, geothermal and biomass. The reason why fossil fuels such as oil, natural gas and coal, and nuclear fuels such as uranium and deuterium are scientifically considered renewable energy sources is that they have the ability to renew themselves on a geological time scale, then have been there for millions of years. However, in the energy literature, fossil and nuclear fuels are considered non-renewable energy sources because they cannot be renewed within predictable periods. Renewable energy sources are hydroelectric power generation, solar thermal energy, direct conversion of solar energy to electrical energy (photovoltaic energy), wind energy, solar energy capture in biomass, ocean thermal energy conversion, wave energy, geothermal energy and tidal energy. With the exception of geothermal and tidal energy, all other renewable energy sources are based on solar radiation. (Bent et al., 2002).

As societies continue their industrialization process and become richer, and transition from traditional energy sources such as wood and peat to commercial energy sources such as fossil-based, nuclear and renewable, it is predicted that energy supply will maintain its importance and energy demand will increase continuously in the 21st century, as in the previous century.

The growth rate of energy demand moves together with the growth rate of the world economy. As a matter of fact, electricity, heating and transportation make the modern world work. Therefore, the size of future energy demand also depends on how large the economy becomes with the efficiency with which we can produce goods and services (Koppelaar and Middelkoop, 2017, p.63).

Looking at energy demand and importance from another perspective, globally, a significant portion of the world's population, by some estimates more than two billion people, still lacks access to several basic energy services; including electricity, clean and safe food cooking devices, and adequate means of transportation (Ahuja and Tatsutani, 2009). By the end of 2021, 770 million people live without access to electricity, mostly in African and developing Asian countries. Between 2013 and 2019, an average of 100 million people had access to electricity for the first time, and a significant drop was recorded in the world population without access to electricity in those years (IEA, 2021, p.175). In this respect, it is necessary to state that the energy supply directed to underdeveloped countries to ensure their access to basic needs will also have an important place within the global energy framework.

One dimension that makes energy crucial in international politics is the issue of energy supply security, which arises as a result of countries not being able to meet their energy needs with their own resources and having to procure them from abroad. Substantially, country economies need energy resources in an uninterrupted and stable manner in order to have sustainable growth. Delivering the minimum amount of energy safely to those who demand energy stands out as a condition for the security of the state and society. In this respect, energy supply security can be defined as the uninterrupted availability of energy resources at an affordable cost (Furtana, 2020).

1.2. GLOBAL ENERGY MARKET

In order to understand the global energy outlook; energy markets, energy supply and energy prices, it is necessary to examine energy resources by classifying them according to their usability and convertibility, as seen in Table 1.1.

TABLE 1.1 CLASSIFICATION OF ENERGY SOURCES

Usability			**Convertibility**	
Non-renewable		Renewable	Primary	Secondary
Fossil Derived	Nuclear	Hydraulic	Coal	Electric
Coal	Uranium	Solar	Oil	Gasoline
Petroleum	Torium	Biomass	Natural gas	Diesel
Natural gas		Wind	Nuclear	Secondary Coal
		Geothermal	Hydraulic	Coke, Petrocoke
		Wave, Tide	Solar	Air gas
		Hydrogen	Biomass	Liquefied petroleum gas (LPG)
			Wind	
			Geothermal	
			Wave, Tide	
			Hydrogen	

Source: Koç and Kaya, 2015

It is referred to as a non-renewable energy source due to the projected depletion of fossil and nuclear energy sources in the foreseeable future. It is accepted that renewable energy sources will continue to provide energy to people in the future.

Primary energy refers to energy resources that are consumed directly as they exist in nature, without any processing. On the other hand, secondary energy sources include forms of energy that are converted from primary energy sources, produced and then put into use.

TABLE 1.2 DISTRIBUTION OF TOTAL ENERGY SUPPLY IN THE WORLD BY RESOURCES

Source	1973	1990	2005	2019
Petroleum	46,4%	37,0%	35,0%	30,9%
Natural gas	16,1%	19,0%	20,5%	23,2%
Coal	24,6%	25,4%	26,1%	26,8%
Biomass	10,1%	10,0%	9,3%	9,4%
Nuclear	0,9%	6,0%	6,3%	5,0%
Hydraulic	1,8%	2,1%	2,2%	2,5%
Other	0,1%	0,4%	0,6%	2,2%

Source: IEA, 2023

According to the data of the International Energy Agency, while global energy supply was 254 exajoules in 1973, it reached 606 exajoules as of 2019. During the relevant period, it is observed that the share of oil has decreased significantly over the years, while the share of natural gas has increased steadily. It is seen that the share of nuclear energy increased until the 2000s, but then entered a downward trend.

As seen in Table 1.2, as of 2019, 85.9% of the global primary energy supply is provided by non-renewable energy sources. Especially since the 2010s, commitments have been made and agreements have been signed by many governments at many international organization meetings to increase energy supply from renewable sources. The Paris Agreement, signed by United Nations member countries within the scope of the United Nations Framework Convention on Climate Change in 2015, has a long-term goal of keeping the global average temperature well below 2°C compared to before the industrial revolution and even aiming to limit it to 1.5°C. Within the scope of this agreement, the importance of the transition to clean and renewable energy has been emphasized on a global scale.

According to BP's 2022 Energy Outlook Report, it is estimated that the share of renewable resources in primary energy supply in 2050 will be 35% in the pessimistic scenario and 65% in the optimistic scenario (BP Energy Outlook, 2022).

1.2.1. Global Oil Markets

The oil obtained from the well opened by an entrepreneur named Edwin Drake in the Oil Creek region of the USA in August 1859 is considered the first oil well opened in the world and, in a sense, the discovery of industrial oil. It was not foreseen that this product, which was used primarily for lighting purposes after its discovery, would become the largest energy source of the 20th century and would be used in many areas such as transportation, industry and heating (Yergin, 2003).

According to OPEC data, as of the end of 2022, there are 1.56 trillion barrels of proven oil reserves in the world. Considering that there is a final oil consumption of approximately 36 billion barrels in 2022 alone, it can be predicted that if the current consumption trend continues and new proven reserves cannot be reached, oil will run out in the 2060s and will no longer be an energy source.

However, oil, which continues to be the most important energy source for world economies as of the 2020s, also maintains its importance in terms of trade volume. As shown in Table 1.3, as of 2021, approximately 55% of global oil is exported by the top 5 net exporting countries. On the other hand, there is a similar outlook in the countries that are net importers, and China, India, the USA, Japan and Korea, which are in the top 5, undertake approximately 60% of global oil imports.

.

TABLE 1.3 OIL TRADE SHARE BY COUNTRY (2021)

Net Exporter	Million tons	Total Export Share (%)	Net Importer	Million tons	Total Import Share (%)
Saudi Arabia	352	17,2	China	505	24,4
Russia	269	13,2	Indıa	227	11,0
Iraq	195	9,5	USA	202	9,8
Canada	154	7,5	Japan	149	7,2
United Arab Emirates	148	7,2	Korea	145	7,0
Other	924	45,2	Other	841	40,6
Total	**2.042**	**100,0**	**Total**	**2.069**	**100,0**

Source: IEA, 2023

The oil industry has sectors such as R&D, collection, processing, transportation and storage. As the demand for oil has skyrocketed since the beginning of the 20th century, oil has become an important resource subject to foreign trade. As a matter of fact, until the 1950s, there was an oil market in which American and British companies formed an oligopoly. Standard Oil, Shell, Anglo-Persian, Gulf, Texaco, Socal and Mobil companies, called the seven sisters, controlled approximately 90 percent of the world's crude oil production outside the United States, the Soviet bloc and China as of 1952. They were also marketing 75 percent of refined products. The oligopoly in question owned two-thirds of the world's tanker fleet and controlled almost all major oil pipelines, including international transportation (Issawi, 1978).

However, following the establishment of the Organization of Petroleum Exporting Countries, the door to a new era was opened in the global oil market. Founded by the heads of the delegations of Iran, Iraq, Kuwait, Saudi Arabia and Venezuela, who met in Baghdad on September 14, 1960, OPEC became a leader in a few years, controlling 85% of the world's oil exports and providing privileges to oligopolistic companies.

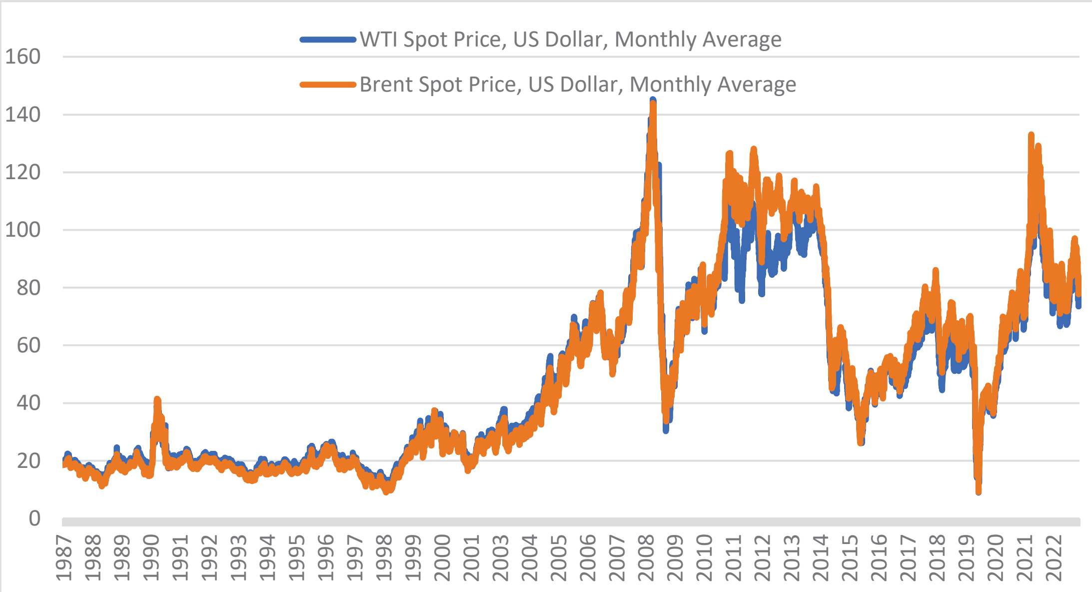
In 1973, the USA and the Soviet Union participated in the Yom Kippur War, which started on October 6, between Israel and Arab States led by Egypt and Syria, in a mutually supportive position. The Arab States could not achieve a decisive victory in the war and therefore decided to use the oil as a weapon. A series of market decisions were taken under the leadership of Saudi Arabia; First, price increases were made, then it was decided to impose an oil sales embargo on the USA, the Netherlands and Denmark. In the following months, oil-producing Arab States decided to cut production by 25%. Iraq, on the other hand, nationalized the US oil wells located in the north of the country. Even though OPEC did not make these decisions, OPEC's influence and dominance over the market continued to strengthen after 1973, especially due to the fact that the USA met 70% of its oil imports from OPEC countries in those years. With the transition to the free market mechanism in 1986 and oil becoming a product traded in both spot and derivative markets, OPEC's effectiveness began to decline reasonably (Arihan, 2021; Solak, 2012).

Notwithstanding crude oil is considered a standard product, there are 170 types of crude oil in the market that continue to be produced. The reference oils that dominate the market are Brent Blend, WTI and Dubai Fateh oils. Brent is traded on the Intercontinental Exchange; WTI is on the US New York Mercantile Exchange; Dubai Fateh is traded on the stock exchange called Dubai Mercantile Exchanges (Bayraç, 2005; Solak, 2012).

Today, the oil market is still in a position of incomplete competition that has not become a competitive market. Because OPEC controls the oil supply and has an impact on market prices with its guidance, especially its statements that signals an increase or cut in production. (Lin and Tamvakis, 2010).

According to Hamilton (2009, p.196), OPEC is not a cartel in the strict sense, because member countries sometimes do not act in accordance with the statements and often exceed their production quotas. However, it can still be alleged that one of the most effective factors on the general trend of prices are OPEC decisions.

FIGURE 1.1 OIL PRICES IN THE WORLD (1987-2023)



Source: EIA, 2023

Figure 1.1 shows the development of reference oil prices between 1987 and 2023, reflecting the period when the free market mechanism was implemented and oil became a commodity traded on the stock exchange. Here, it can be seen that WTI and Brent oil prices generally move very close to each other, although there are periods when the price gap widens. Although oil prices are formed within the supply-demand mechanism, we can see how sensitive they are to world macroeconomic and political developments from the sharp price movements during the 1990 Gulf War, the 2008 global economic crisis and the 2020 Covid-19 epidemic.

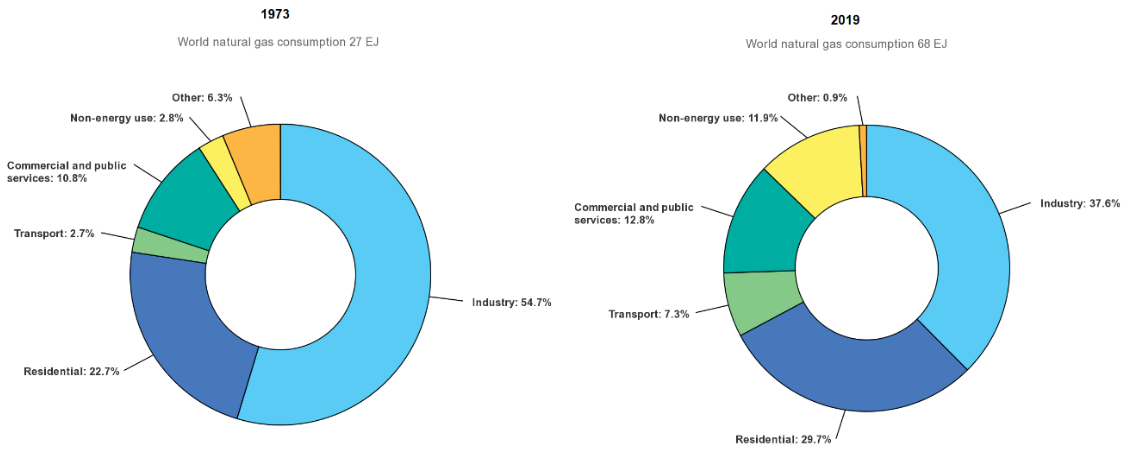
In summary; the factors could be ordered that determine oil prices as oil demand, oil supply and transactions in derivative markets. While the main driver of oil demand is global macroeconomic activity, OPEC, non-OPEC producer countries and the course of proven reserves are effective in oil supply.

1.2.2. Global Natural Gas Markets

It is known that the discovery of natural gas dates back to 2000 BC in China. However, for hundreds of years, natural gas, rather than being a fuel or energy source, was accepted as a religious image, especially in Iran, Ancient Greece and India, and temples were built around the fire of the gas leaking from the surface. (Speight, 2018).

The main development that enabled the industrialization of natural gas and its use as an energy source was the gas pipelines and storage facilities built in the 19th century for the widespread use of coal gas. Gas, which was first used for city lighting, was later used for cooking and heating in homes, and then in industry. Coal gas began to be widely used in many important metropolitan cities in the late 19th century and the early years of the 20th century (Abbott, 2016, p.47-48). However, at the beginning of the 20th century, natural gas, which produced twice as much energy as coal gas, did not contain toxic carbon monoxide, soot and sulfur, and was considered a clean energy source in those years, began to rapidly replace coal gas. The first natural gas well opened in the USA in 1821 was rapidly included in the industrialization process, and in the 1880s, gas companies began to transmit long distances through natural gas pipelines (Abbott, 2016 p.128). In Europe, the modern use of natural gas began after the discovery of the Groningen field in the Netherlands in 1959. As a matter of fact, when the United Kingdom and Norway reached reserves of similar sizes in the North Sea in the 1960s, this accelerated the spread of natural gas in Europe (Stern, 2003). In the Soviet Union, the first large-scale natural gas transmission line connecting Moscow and the Saratov gas field, 800 km away, was commissioned in 1946, and after this year, the use of natural gas began to spread throughout the country (Högselius, 2013, p.13-14).

FIGURE 1.2 USAGE AREAS OF NATURAL GAS CONSUMPTION IN THE WORLD



Source: IEA, 2022

As shown in Figure 1.2, the industrial use share of natural gas decreased rapidly from 1973 to 2019, and its share decreased from 54.7% to 37.6%. On the other hand, residential natural gas usage increased from 22.7% to 29.7% worldwide, and from 2.7% to 7.3% in transportation. Another important point is that the non-energy use of natural gas, which is an energy source, has increased over the years, reaching 11.9% from 2.8% from 1973 to 2019. A significant portion of non-energy uses consist of fertilizer and methyl alcohol production.

Today, the natural gas industry, which has many sub-sectors, is important in the global energy market and is production, transmission and export activities.

TABLE 1.4 NATURAL GAS RESERVES AND PRODUCTION SHARE BY COUNTRY, 2020

Country With Reserves	Trillion cubic meters	Total Share (%)	Country of Manufacture	Billion cubic meters	Total Share (%)
Russia	37,4	19,9	USA	915,9	23,7
Iran	32,1	17,1	Russia	637,3	16,5
Qatar	24,7	13,1	Iran	249,5	6,5
Turkmenistan	13,6	7,2	China	194	5,0
USA	12,6	6,7	Qatar	174,9	4,5
Other	67,7	36,0	Oher	1689,9	43,8
Total	**188,1**	**100**	**Total**	**3.861,5**	**100**

Source: BP Stats Review, 2023

When Table 1.4 is examined, it can be seen that while the total amount of proven natural gas reserves globally as of the end of 2020 is 188 trillion cubic meters, approximately 20% of this belongs to Russia, 17% to Iran and 13% to Qatar. However, when we look at the production amounts, it is striking that the USA, which has only 6.7% of the reserves, produces 23.7% of the world's natural gas production. The most important reason for this is that the annual natural gas consumption of the USA as of 2020 is 831.9 billion cubic meters (BP Stats Review, 2023). In other words, considering that the ratio of the natural gas it consumes to its production is 91%, it is evaluated that the USA quickly extracts its reserves, a significant portion of which is in the form of shale gas, both because of its technological possibilities and to keep the production at high levels in order to avoid having to procure this energy source from abroad.

While only natural gas pipelines were used in international trade until 1959, natural gas trade began to gain a different dimension with the start of transporting the form in which natural gas was cooled and turned into liquid by sea via ships in order to facilitate storage and transmission activities through LNG.

The volume of natural gas can be reduced by 1/600 and storage can be done using much less space thanks to LNG. The first commercial LNG facility in the world was established for storage in the US state of Ohio in 1941. LNG was first transported by ship in 1959, named Methane Pioneer, which sailed from the Louisiana coast of the USA to England (Noble, 2009).

TABLE 1.5 NATURAL GAS TRADE SHARE BY COUNTRY, 2022

Exporter	Billion cubic meters (Pipeline)	Billion cubic meters (LNG)	Exports, Billion cubic meters	Share (%)
USA	82,7	104,3	187	14,8
Russia	125,3	40,2	165,5	13,1
Qatar	20,1	114,1	134,2	10,6
Norway	116,8	3,7	120,5	9,6
Australia	0	112,3	112,3	8,9
Other	373,5	167,8	541,3	42,9
Total	**718,4**	**542,4**	**1.260,8**	**100,0**
Importer	**Billion cubic meters (Pipeline)**	**Billion cubic meters (LNG)**	**Imports, Billion cubic meters**	**Share (%)**
China	58,4	93,2	151,6	12,0
Germany	124,5	0	124,5	9,9
Japan	0	98,3	98,3	7,8
USA	82,1	0,7	82,8	6,6
Other	453,4	350,2	803,6	63,7
Total	**718,4**	**542,4**	**1.260,80**	**100,0**

Source: BP Stats Review, 2023

Although Russia also has a significant amount of exports in the LNG market, it can be seen in Table 1.5 that Russia has realized approximately 13% of global exports as of 2022, mostly through pipeline exports. Russia, which ranks 2nd in oil exports, also ranked second in natural gas exports in 2022. While approximately 68% of Russia's exports via pipeline reach Europe, approximately 50% of its exports via LNG reach Europe. On the other hand, Qatar and Australia as important LNG exporters; while 71% of Qatar's exports are to Asia Pacific and 25% to European countries, almost all of Australia's exports are to Asia Pacific countries due to its proximity advantage.

As of the end of 2022, 53% of the world's natural gas trade via pipelines was towards Europe, and approximately 69% of the LNG trade was towards Asia Pacific countries. Over the years, the share of LNG in international trade has skyrocketed considerably due to the economic growth experienced by China, a net importer, since the 2000s and the increasing natural gas needs of Japan as an island.

Until the 1970s, natural gas and refined petroleum products were considered substitute energy sources, especially in the US industry and electric power generation. Industry and electrical power generation plants used whichever energy source was more cost-effective, and there was a conversion between natural gas and fuel products from time to time. As a result of this situation, natural gas price movements have generally followed crude oil price movements. In fact, the 1 in 10 rule, also known as the rule of Thumb, was proposed based on these simultaneous price movement. According to the rule, while the price of a barrel of WTI crude oil is, for example, 100 US dollars, the price of 1 Mbtu of natural gas should be 10 dollars. While this ratio was more or less maintained until the 1990s, with the increase in demand for natural gas after the 1990s, this ratio evolved in favor of natural gas (Brown and Yücel, 2008).

Global prices in the natural gas market are different and more complex than the oil market. Facilities established for coal gas before the 1960s could be modernized and converted to natural gas systems at low cost. However, with the discovery of the Groningen fields in the Netherlands, pricing in the natural gas market began to pose a problem in international trade (Heather, 2015, p.10). Since cost-based pricing would mean a possible loss of income for the Netherlands, which has acquired new reserves, and would disrupt the balance in the current oil market, a pricing strategy slightly below rival fuel prices was preferred. Thanks to this pricing strategy, the market share of natural gas in Europe began to rise rapidly and dependence on natural gas as an energy source continued to increase over the years. As a matter of fact, the emergence of imports from the Soviet Union and North Africa to Europe following the increasing need for natural gas has brought the need for long-distance pipelines, storage and distribution systems to the agenda (Abbott, 2016, p.135). This is how long-term gas contracts came to the fore.

Pipeline projects have begun to be commissioned in exchange for contracts between the parties that contain a "take or pay" clause for at least 25-30 years and where the price of gas is generally determined by taking international oil prices as a reference. In these contracts, buyers bear the volume and usage risks, while the seller bears the price risk. On the other hand, one of the important reasons why countries that undertake volume risks have increased their investments in natural gas as an energy source and become more dependent on natural gas has been these long-term contracts. (Heather, 2015, p.10).

Today, when talking about global natural gas prices, it is not possible to talk about the existence of reference prices that are close to each other as in the oil market. In order to create an internationally accepted reference price; An organized market, sufficient liquidity and pricing guided by the supply-demand balance in all maturities are needed. Although the prices formed at Henry Hub, where physical deliveries are made in the US state of Louisiana, have a supply-demand balance mechanism and sufficient liquidity, they do not dominate the international market. Likewise, although NBP in the United Kingdom and TTF in the Netherlands are considered important market prices for Europe, there are other organized market centers similar to them (Mazighi, 2005; Hulshof et al., 2016).

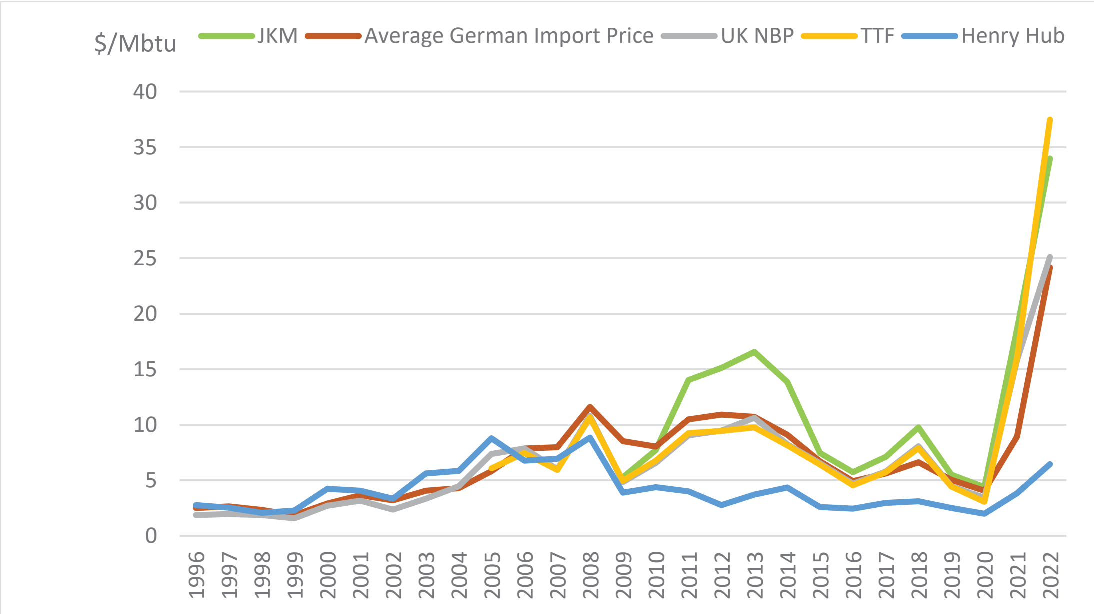
Among the European gas distribution centers that have become operational as of the end of 2020, the Dutch TTF and the British NBP, which are called mature; the four active centres, namely Italian PSV, German NCG and GPL and Austrian VTP; and the five weak centers are French TRF, Spanish PVB, Belgian ZEE and ZTP and Czech VOB (Heather, 2021).

In the Asian market, Japan Korea Marker is used as a reference price. It is a reference value published by the Platts organization and reflects the average spot LNG prices imported by Japan and Korea, which have to use LNG due to being island. (Alimet al., 2018).

Even though it is not possible to talk about a global reference price in the natural gas market, it can be evaluated that the market dynamics roughly consist of the prices agreed upon through long-term LNG and pipeline agreements and the prices formed in natural gas trading centers. At this point, we see that the pricing mechanism, which has been in the form of indexing to the oil price since the 1960s, has been replaced, at least partially, by the pricing formed in natural gas trading centers (Theisen, 2014; Zhang et al., 2018).

International energy markets have been experiencing an increasing trend of financialization since the 2008 global financial crisis. Therefore, we have entered an era in which energy prices such as oil and natural gas are more likely to behave like financial assets. In this respect, the possibility of speculation and asset bubbles in international energy markets emerge and a fragile energy market could be observed (Zhang et al., 2018).

FIGURE 1.3 REFERENCE NATURAL GAS PRICES IN GLOBAL MARKETS (1996-2022)



Source: BP Stats Review, 2023

When the reference prices in international markets are examined, it is seen that the reference spot natural gas prices in Europe are significantly above the US spot natural gas price, especially after 2008 until 2021. As shown in Figure 1.3, Henry Hub prices fluctuated between 2-4 $/Mbtu on an annual average during this period, while NBP, TTF and German import prices generally followed a course between 5-10 $/Mbtu.

At first glance, one might think that the US spot price HH fell by diverging from other reference prices after the 2008 global financial crisis, however the dramatic change here is related to the significant increase in supply. Since 2010, shale gas production has started to accelerate in the northern regions of the USA and a natural gas supply has been higher than expected over the years. In this way, LNG imports of the USA have decreased considerably and LNG exports have started from the country, thus, over time, price decreases have occurred in Henry Hub prices much higher than anticipated until 2020. (Stern, 2014, p.44).

The US's shale gas production developed so rapidly after 2008 that the general increasing trend in reference natural gas prices in the European and Asian markets, apart from the US after 1996, was broken and there was no significant jump in prices until the 2021 global epidemic. While US shale gas production was 36.6 billion cubic meters in 2007, it reached 740.5 billion cubic meters as of 2020, exceeding 80% of the total US natural gas production (US Shale Gas Production, 2021).

The striking example of shale gas in the natural gas market has once again proven that discoveries and technologies in the energy sector might have a crucial impact and significance on the course of the markets.

1.2.3. Global Coal Markets

The use of coal in the world dates back to before the Industrial Revolution. This energy source, known to have been used by the Chinese before Christ, has been one of the dominant energy sources globally for hundreds of years. On the other hand, in 1709, Abraham Darby discovered how to smelt iron ore using coke, a purified form of coal. After this discovery, the industrial revolution began with the use of coal in industry, especially in Manchester, England, and coal mining rapidly became important and developed (Fernihough and O'Rourke, 2014).

With technological developments in coal mining, coal with higher energy density began to be widely used. With Watt's invention of the steam engine in 1769, coal began to be used in the iron and steel industry, steam engines and residential heating since the 18th century. The progress of human civilization accelerated the development of the coal industry, and coal surpassed wood for the first time in the 1780s to have the largest share as the primary energy source. In 1875, a power plant producing electricity from coal was established for the first time in France, and the production of electricity from coal, which is the area where coal will be used the most in the future, started (Zou et al., 2016).

Coal, which maintained its place as the most important energy source from the industrial revolution until the 20th century, continues to be the second most used energy source with a share of 28.2% in primary energy, according to the data of the International Energy Agency as of the end of 2022. (IEA, 2023).

Although it is known that its use in homes, especially for heating purposes, has serious harm to human health, coal continues to be a widely used energy source today. According to Finkelman et al. (2002, p.427), in addition to the carbon dioxide it releases into nature, some of the coals undergo mineralization, resulting in the enrichment of potentially toxic elements such as arsenic, fluorine, mercury, antimony and thallium.

On the other hand, despite the objections of international environmental and energy organizations due to environmental concerns, it is claimed that the use of coal as an energy source can be achieved in a cleaner way with clean coal technologies. Thanks to these technologies, the possible negative effects of harmful gases such as CO_2, SO_2 and NO_x during the coal burning process can be reduced (Çıraklı, 2019).

TABLE 1.6 COAL PRODUCTION AND INTERNATIONAL TRADE SHARE BY COUNTRY (2022)

Coal Producing Country	Million tons	Total Production Share (%)	Net Exporting Country	Total Export Share (%)	Net Importing Country	Total Import Share (%)
China	4.560	51,8%	Indonesia	28,3	China	18
India	911	10,3%	Australia	25,8	India	15,4
Indonesia	564	7%	Russia	16,5	Japan	14,8
USA	540	6,1%	USA	6,9	Korea	10,3
Australia	443	5%	South Africa	5,4	Taiwan	5
Other	1.785	20%	Other	17,1	Other	36,5
Total	**7.575**	**100,0**	**Total**	**100,0**	**Total**	**100,0**

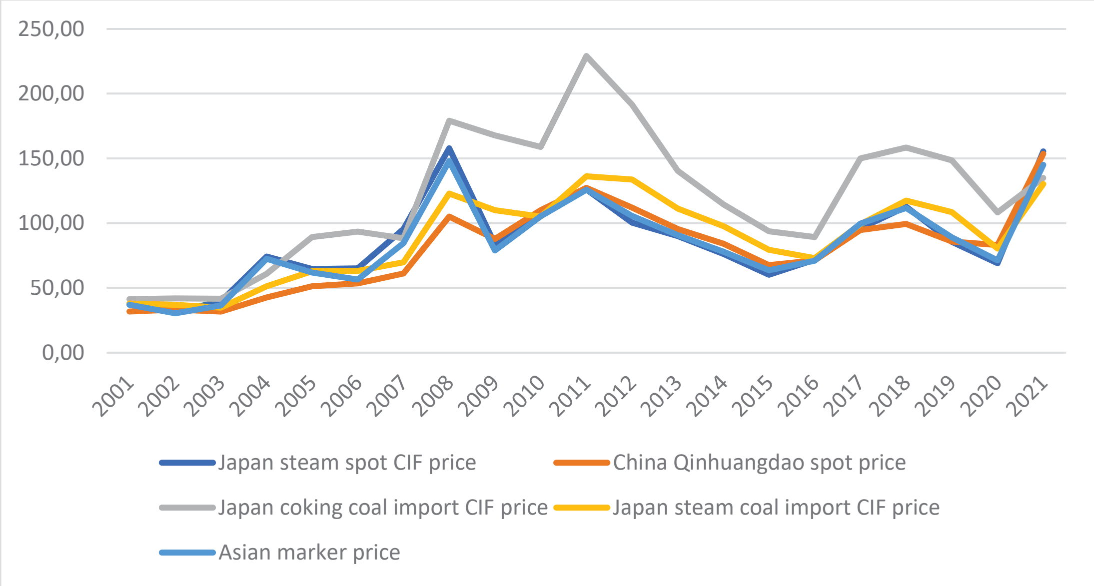
Source: IEA, 2023

As seen in Table 1.6, China is the dominant country in the global coal market and although it accounts for 52% of total production as of the end of 2022, it also continues to account for approximately 18% of total imports. On the other hand, Indonesia and Australia stand out as important countries in the world coal trade, each with a share of above 25% in exports.

The fact that 35.4% of global electrical energy production was produced from coal as of the end of 2022 and that China, which has the largest share in global total energy consumption, is the largest coal producer and consumer, makes coal prices important in the international energy market.

Coal is a non-standard commodity and therefore its price varies depending on its calorific value, purity level and production region. The higher the carbon content and purity, the higher its value. Coal, whose price was based on long-term contracts until the 1980s, has become a commodity for which various reference spot prices are formed and which is also traded on the stock exchange as a derivative product, with the development of financial markets. The most important reference prices stand out as API2 in Europe, API4 in South Africa, Newcastle Index and API5 in Australia, CAPP in the USA and API8 in the People's Republic of China (Li et al., 2010; Sribna et al., 2019).

FIGURE 1.4 INTERNATIONAL COAL PRICES (US DOLLAR PER TON, ANNUAL AVERAGE)



Source: BP Stats Review, 2023

Looking at Figure 1.4, which shows the course of coal prices between 2001 and 2021, it is observed that although they generally tend in a similar direction, some reference prices, especially Japanese coke, have differed considerably. It is observed that, like many commodities during the 2008 global financial crisis, coal prices followed a fluctuating course and, although they tended to increase, they stabilized in the following years, and entered a similar upward trend after the Covid-19 epidemic of 2020.

1.2.4. Nuclear Energy in the World

In 1945, the nuclear bombs dropped by the USA on the Japanese cities of Hiroshima and Nagasaki, which went down in history as the move that ended World War II. Proving that this huge energy release was provided by the nucleus was very important news for humanity. As a matter of fact, in 1955, the United Nations International Conference was held in Genoa, Italy, on the peaceful use of atomic energy, and it was announced to the public that information was provided on the possible industrial use of the energy produced by the fission of uranium and thorium. (Hubbert, 1956, p.28).

Although its use for military purposes has been on the agenda since its discovery, nuclear energy continues to be used in agriculture, health, industry and many areas as well as electricity production.

The development of electricity generation from nuclear energy has been quite rapid compared to the development of other fossil fuels. Of course, the rapid impact of World War II is an undeniable phenomenon. The size of the first nuclear energy reactor, established in Chicago, USA in December 1942, was measured as only 200 W. While the size of the pilot nuclear energy reactor established in the state of Tennessee in October 1944 was 1 MW, the size of the reactor established in Washington in September 1944 was 200 MW. The measure has increased a thousandfold in approximately two years. (Bodansky, 2003).

Unlike non-renewable energy sources such as oil, natural gas and coal, if used correctly and safely, nuclear energy produces almost no greenhouse gas emissions and causes very low environmental pollution compared to its alternatives. However, the risks it poses and the fact that its cost has historically been higher than alternative energy sources are considered to be effective in the fact that the share of nuclear energy in the primary energy supply has not reached double digits (Hultman, 2011, p.397-398).

TABLE 1.7 NUCLEAR POWER PRODUCTION BY COUNTRY

Producing Country	1973 (EJ)	1990 (EJ)	2005 (EJ)	2022 (EJ)	Nuclear Share in Country Production, 2022 (%)	Share in Global Production, 2022 (%)
USA	0,90	6,20	8,14	7,31	**17,9**	**30,3**
China	-	-	0,53	3,76	**4,7**	**15,6**
France	0,15	3,21	4,47	2,65	**63**	**11**
Russia	0,15	1,21	1,48	2,01	**19,1**	**8,4**
Korea	-	0,54	1,45	1,59	**28,4**	**6,6**
Ukraine	-	0,78	0,88	0,56	**55**	**2,3**
Germany	0,12	1,56	1,61	0,31	**6**	**1,3**
Japan	0,10	1,99	2,90	0,47	**5**	**1,9**
Spain	0,07	0,55	0,57	0,53	**19,9**	**2,2**
Other	0,58	3,70	4,65	4,94	**1,77**	**20,5**
World	**2,08**	**20,43**	**27,39**	**24,13**	**9,2**	**100**

Source: BP Stats Review, 2023

Following an accident that occurred during a test at the Chernobyl Nuclear Power Plant operating in the city of Pripyat in the Soviet Union in 1986, large-scale radioactive leaks occurred, and this accident was recorded as the largest nuclear disaster of the 20th century. The impact of this accident, which claimed thousands of lives and directly or indirectly damaged the health of millions of people, continues to this day. (Cardis and Hatch, 2011).

Looking at the nuclear energy producing countries in Table 1.7, it can be seen that nuclear energy production has slowed down significantly in recent years, especially in European countries, as Europe is the region most affected by this disaster. Although it is known that Chernobyl is not the only factor in this slowdown, it is also notable that Japan scaled back nuclear energy production following the leak at the Fukushima nuclear power plant in 2011. On the other hand, it is noteworthy that China, whose energy needs have increased significantly over the years, was in second place in the global share of nuclear energy production in 2022, a resource that it did not use in 1990.

According to the data of the International Atomic Energy Agency, as of 2021, 9.8% of the electricity produced in the world is provided by 437 nuclear energy reactors with a total installed power of 389.5 GW. In addition, it is known that 56 reactors with a capacity of 58 GW are under construction. As of 2021, more than 50% of the total electricity produced in France, Ukraine, Slovakia and Belgium continues to be provided by nuclear energy. While this rate is 19.6% in the USA, which is the largest energy consumer in the world, it is 19.2% in the Russian Federation and 5% in China (IAEA, 2022).

The Russia-Ukraine War, which started with Russia's invasion of Ukraine's Donetsk and Luhansk regions in February 2022, has caused significant changes in the energy policies of developed countries. As of May 30, 2022, in addition to some of the sanctions previously announced, EU countries announced that an embargo would be imposed on the import of oil and petroleum products from Russia for 6 months, and the energy supply crisis came to the fore in Europe upon the response to stop the natural gas supply from Russia (Martin and Di Mauro, 2022).

The Glasgow Climate Pact aims to reduce carbon dioxide emissions by 45% compared to 2010 levels by 2030; Although it was signed by UN member states, many countries have announced measures that conflict with environmental decisions due to increased energy supply risks or energy costs following the Russia-Ukraine war in 2022. In this context, Germany, for example, put decommissioned thermal power plants into operation and postponed the decommissioning of two nuclear power plants that had been decided to close. (Nature, 2022).

France will invest 50 billion Euros and commission 6 new nuclear reactors by 2028; The United Kingdom will install a 24 GW capacity nuclear power plant by 2050, providing 25% of electricity production this way; Poland, the Republic of Korea and Canada announced that they would start small modular reactor projects. Japan, which decided to close its nuclear power plants after 2011, announced that new nuclear reactor projects would be started by 2022, citing energy supply security. (Nuclear Power and Secure Energy Transitions, 2022).

TABLE 1.8 LEVELIZED COST OF ENERGY (2023)

Power Plant	USD/MWh price
Nuclear	180
Coal	117
Geothermal	82
Gas Combined Cycle	70
Solar PV	60
Wind-Onshore	50

Source: Lazard, 2023

To understand how costly nuclear energy is by 2023, it is necessary to compare it with the cost of electricity produced from alternative electrical energy sources. Levelized cost of energy expresses the unit price in US Dollars/MWh, calculated by dividing the costs incurred for energy production at an annual frequency by the amount of energy produced for that year. Table 1.8, calculated according to this methodology, shows that nuclear energy is produced at a higher cost than other fossil fuel and renewable energy sources, with a unit price of 180 USD/MWh for 2023.

1.2.5. Renewable Energy in the World

The first use of renewable energy dates back to when humans started burning wood for lighting and heating. Wood, considered a renewable energy source, was in the most important position throughout human history until the discovery and use of fossil energy resources. Today, wood has become an energy source under the classification of biomass or traditional biomass. (Herzog et al., 2001).

Renewable energy sources have many advantages and potential compared to many alternatives. Relatively low operating costs, low carbon emissions and the advantage they provide in energy supply security are among the factors that make renewable energy sources attractive. Solar, wind, biomass, hydropower, wave energy and geothermal energy are the leading renewable energy sources. (De Vries et al., 2007; Halkos and Gkampoura, 2020).

TABLE 1.9 THE SHARE OF RENEWABLE ENERGY SOURCES IN ELECTRICITY PRODUCTION IN THE WORLD

Source (TWh)	2010	2015	2022	Share ın Global Production, 2022 (%)
Hydropower	3.443,3	3.902,6	4.378	**15,1**
Wind	342,6	839,8	2.125	**7,3**
Solar	32,2	250,6	1.291	**4,4**
Biomass	369,1	519,0	687	**2,3**
Other	70,2	91,2	118	**0,4**
Total	**4.257,4**	**5.603,2**	**8.599,0**	**29,6**

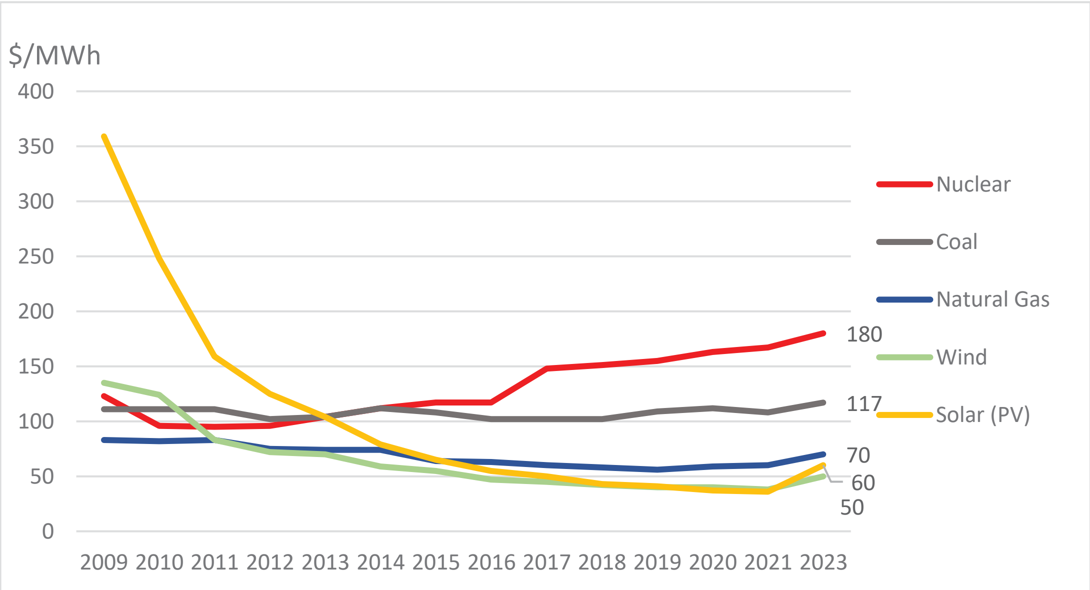
Source: IEA, 2023

While the contribution of sources other than hydropower to global electricity production in 2010 and before as renewable energy sources was about 3%, as shown in Table 1.9, in 2022 it was mainly wind energy with a share of 7.3% and solar energy with a share of 4.4 %. By adding the historically high share of 15.1%

of hydropower to the contribution from power plants, 29.6% of all electricity generated worldwide is now generated from renewable energy sources.

It is estimated by international organizations that the primary world energy supply, which was 606 exajoules as of 2019, will reach a point in the range of 800-1000 exajoules by 2050. Although hydropower appears to be dominant among renewable energy sources in the current outlook, it is predicted that wind and solar will reach or even exceed the share of hydropower over time. However, it is stated by some energy researchers that there are also some limitations. For instance, while the economic life of a hydroelectric power plant is on average 100 years, the 20-25-year lifespan of wind and PV solar power plants stands out as a limiting factor. Another point; It is also considered that some photovoltaic cells, permanent magnets in wind turbines and some other renewable technologies such as fuel cells are produced using rapidly depleting mineral resources and that the drop in these minerals may cause problems in the future in terms of both sustainability and cost (Moriarty and Honnery, 2012; Qazi et al., 2019).

FIGURE 1.5 LEVELIZED COST OF ENERGY BY SOURCE (2009-2021)



Source: Lazard, 2023

The reason for the exponential increase in electricity production from solar and wind energy between 2009 and 2023 is actually twofold. As shown in

Figure 1.5, the global average unit costs of energy produced from photovoltaic solar panels and wind were higher than all other alternative sources in 2009, but by 2023 they have become the most cost-effective electricity generation sources. Although their economic lifespan is shorter than alternatives, the decline in investment costs, especially as the demand for these technologies increases, thanks to economies of scale, has further increased the demand for these technologies over the years.

Although renewable energy technologies are rapidly replacing old technologies in the world, according to the data of the International Renewable Energy Agency, renewable energy transformation must be accelerated in order to achieve the 1.5°C increase target in the Paris Climate Agreement by 2050. While the annual investment in renewable energy in 2022 was 499 million USD, it should be increased above 1 trillion USD, while the annual solar power capacity addition is 191 GW and offshore wind is 75 GW, it should be increased to 615 GW and 335 GW, respectively. It is argued that meeting the targets necessitates the production of 90% of the output from renewable energy sources. (IRENA, 2023).

1.3. ENERGY MARKET IN TÜRKİYE

In order to understand the current situation of the energy market in Türkiye, it is necessary to examine in which direction the primary energy supply has changed from past to present.

TABLE 1.10 DISTRIBUTION OF PRIMARY ENERGY SUPPLY IN TÜRKİYE BY RESOURCES

Energy Source	**1972**	**2000**	**2022**
Petroleum	47,9%	41,0%	28,6%
Coal	22,9%	30,5%	26,7%
Natural gas	0,0%	15,7%	27,5%
Biofuel	27,8%	8,2%	2,9%
Hydropower	1,2%	3,4%	3,6%
Geothermal	0,2%	0,9%	7,3%
Wind	0,0%	0,0%	1,9%
Solar	0,0%	0,3%	1,5%
Total	**22,4 MTEP**	**79,1 MTEP**	**157,8 MTEP**

Source: National Energy Balance Sheet, ETKB

Looking at the distribution of primary energy supply by resources, it can be seen in Table 1.10 that the transformation in Türkiye is compatible with the transformation in the world and there is even a positive divergence with regard to the share of renewable energy.

Oil, biofuel and coal in 1972; while it constitutes almost the entire supply of primary energy, it is seen that by 2022, the share of oil decreased from 47.9% to 28.6%, coal increased slightly to 26.7%, and biofuel decreased significantly and was replaced by natural gas with a share of 27.5%. It is observed that the share of biofuel was high in the 1970s, especially due to the use of wood and its derivatives for heating purposes, and that was replaced by natural gas over time. On the other hand, the sum of hydropower, geothermal, wind and solar resources will reach 14.3% in 2022, while it was 1.2% in 1972; It is noteworthy that these resources, which are cleaner and more environmentally friendly compared to alternatives, have a significant share in the energy supply.

As of 2022, Türkiye relies heavily on imports for its oil, coal, and natural gas, which serve as the primary sources of energy. Given their significance as essential inputs in industrial production, the prices of goods and services can be directly influenced by the availability and cost of oil, natural gas, coal, and electricity. Consequently, it becomes imperative to establish regulations and oversight for energy markets, particularly those characterized as natural monopolies, such as the electricity and natural gas sectors. Without proper regulation, there is a risk of unjust income transfer from buyers to monopolistic companies. Furthermore, it is worth highlighting that the regulation of energy markets is crucial for ensuring national security, given the vital role of energy supply in this regard. (İnançlı et al., 2020; Sarıtürk, 2008).

In Türkiye, the Electricity Market Law No. 4628 established the Energy Market Regulatory Authority in 2001 as a regulatory and supervisory body with administrative and financial autonomy. Later, with the new regulations of 2001 and 2005, the natural gas, petroleum and liquid oil markets were also included in the mandate of the institution. (Sobacı, 2005).

1.3.1. Electricity Market in Türkiye

The first known electricity production in Türkiye was realized in 1902 in the Tarsus district of Mersin province, through a dynamo connected to the mill. The first electricity generation plant was a thermal power plant using coal as an energy source, which started production in 1914 in the Silahtarağa district of Istanbul (Sarıtürk, 2008, p.136).

Even though significant privileges were granted to domestic and foreign private capital in the field of electricity production in the first years of the Republic between 1923 and 1930, after 1930, the state's approach to assume a central role in the economy was also reflected in the electricity market, and in 1935, foreign capital and privileged electricity enterprises were nationalized. Although there was a market in which privileges were given to domestic capital companies again between 1950 and 1960, the Ministry of Energy and Natural Resources was established in 1963, and the privatization period has been suspended for a while.the Turkish Electricity Authority was established as a privileged monopoly responsible for electricity production, transmission, distribution and trade in 1970. With the law no. 3096 enacted in 1984, organizations other than TEK were again allowed to carry out activities related to the production, distribution, transmission and supply of electricity. Following the establishment of EMRA in 2001, the Electric Energy Sector Reform and Privatization Strategy Document was announced to the public in 2004 and it was declared that the electricity distribution activity would be completely privatized by the end of 2006 (Doğru, 2010; Sarıtürk, 2008; Selçuk and Togay, 2018).

As a result of these steps, a structural reform was achieved by ensuring significant privatization of the production and distribution activities of the electricity market in Türkiye. The Balancing and Settlement regulation published in 2004 aimed to facilitate real-time balancing in the market and respond to the needs of market participants. Later, the Energy Markets Management Joint Stock Company, which became operational in 2015, was given tasks such as operating organized wholesale markets, developing an energy exchange, operating the standardized electricity contracts (i.e. capital market instruments) market and derivative markets where derivatives based on electrical energy and/or capacity are bought and sold (Çetintaş and Bicil, 2015; Salman, 2008; Selçuk and Togay, 2018).

As a result of the reforms, the public share in licensed electricity production, which was around 70% in 2000, decreased to 15% as of 2022, and production activity has been largely privatized. Almost all of the unlicensed electricity generation facilities, which account for 3.9% of the total electricity production as of 2022, are private capital enterprises (Electricity Market Report, 2022; Selçuk and Togay, 2018, p.175).

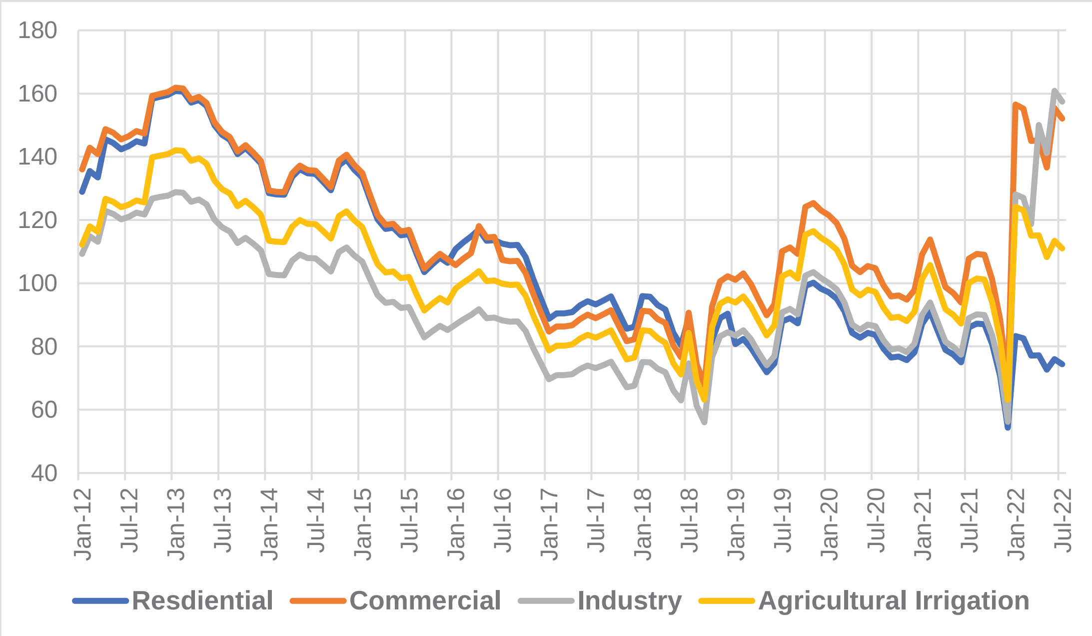
34.8% of the electricity produced in 2022 is coal, 21.8% natural gas, 20.7% hydropower, 10.8% wind, 4.8% solar, 3.4% geothermal, 2.8% was produced from biomass energy source. Approximately 42.5% of the total electricity production was provided by renewable energy sources (Electricity Market Report, 2022).

Looking at the domestic production rate of electrical energy resources in Türkiye as of 2022, 57.3% was produced from domestic energy resources, while 42.7% was obtained from imported sources, especially natural gas and coal (National Energy Balance Sheet, ETKB).

According to the current Electricity Market Law No. 4628, consumers whose annual consumption is above a certain threshold level are defined as "eligible consumers" and these consumers are given the option of appointing their suppliers through bilateral agreements. All other consumers are subject to the national tariff, which is calculated by EMRA according to the place and purpose of consumption and is generally announced on a quarterly basis. The final consumer price includes energy cost, distribution fee, various funds and taxes. In the calculation of electricity tariffs, the Market Clearing Price formed in the Total Electricity Market operated by EXIST is accepted as an important reference along with many other factors and is included in the calculations. Electricity prices in the market may follow a fluctuating course within the framework of the supply and demand mechanism. Factors causing these fluctuations; pandemic, restrictions in resource supply, exchange rate volatility, seasonality and differences in final consumer use (Akyüz and Akgül, 2020; Voyvoda and Voyvoda, 2019).

FIGURE 1.6 ELECTRICITY TARIFF PRICES FOR CONSUMER GROUPS EXCLUDING TAXES

(US Dollar / MWh, 2012-2022)



Source: Tariff Based on Electricity Bills, 2022

By examining Figure 1.6, it is detected that the electricity tariff price applied to industry in Türkiye between 2012 and 2019 was kept lower than the residential and commercial prices, which were very close to each other. However, between 2019 and 2022, it is seen that residential and industrial tariff prices are close to each other and the commercial price is slightly above them. On the other hand, it is evaluated that the tariff price applied to industrial and commercial establishments, starting from the beginning of the year 2022, will differ significantly from the residential price and follow an upward movement. It can be evaluated that prices in all three consumer groups decreased gradually in terms of US Dollars/MWh between 2013 and 2019, but subsequently, in the 2019-2022 period, significant subsidy mechanisms were operated in the prices applied to residences, and the increases reflected in industry and commerce were not reflected in residences.

Since the national tariff mechanism is implemented in the Turkish electricity market, there is a cross-subsidy application both between regions and between consumer groups. The main purpose of the subsidy between regions is to eliminate cost differences between regions. On the other hand, cross subsidies can be applied between consumer groups due to various factors such as the profile of consumer groups, consumption amounts, support of production, and protection of households (Karaoğlu, 2020).

1.3.2. Oil Market in Türkiye

The first oil exploration activity on Turkish soil was carried out in the rural areas of Iskenderun in 1887 by the Grand Vizier of the Ottoman Empire, Kamil Pasha. Like many activities to be carried out until the Republic period, no results were obtained from this first search activity. Petroleum exploration activities, which were carried out by Mineral Research and Exploration, a public institution, between 1935 and 1952, were transferred to Turkish Petroleum Joint Stock Company in 1952. Oil were discovered in various parts of the country, approximately 95% of which was in the southeastern region, and oil was extracted for the first time from the well named Raman-8 in 1948. Later, with the Petroleum Law No. 6326, which came into force in 1954, private enterprises with domestic and foreign capital were facilitated the opportunity to obtain oil exploration licenses. While the total crude oil production in the country was 178.6 thousand tons in 1955 and all of it was extracted by TPAO. By 1970 1.06 million tons was produced by TPAO and 2.47 million tons by the private sector, the majority of which was foreign capital, 3.5 million tons of crude oil production has been reached (Binici, 1971; Sekin, 1998; Yurtoğlu, 2017).

While 3.58 million tons of crude oil was produced in Türkiye in 2022; A total of 47.4 million tons of petroleum products were imported, 33.5 million tons of which were crude oil, and the export of products processed in refineries was 12.7 million tons. Of the 29.5 million tons of petroleum products sold domestically in 2022, 24.5 million tons are diesel products. In addition, bunker sales, expressed as fuel sold to vehicles at airports and ports, amounted to 3.7 million tons in 2022 (Petroleum Market Report, 2022).

It is known that the amount of crude oil produced in Türkiye from the beginning of the first crude oil production until the end of 2022 reached 168.8 million tons and the remaining proven producible crude oil reserve is 70.8 million tons (MAPEG Petroleum Statistics, 2022).

In light of these data, it is clear that crude oil imports will remain considerable for the country's energy supply security in the medium term. As seen in Table 1.11, the amount of oil imports from Iraq, Russia and Kazakhstan corresponds to approximately 76% of total imports.

TABLE 1.11 TÜRKIYE'S OIL IMPORT AMOUNT BY COUNTRY IN 2022 (CRUDE OIL AND OIL PRODUCTS)

Country	Import (million tons)	Share (%)
Russia	19,32	40,7
Iraq	12,51	26,4
Kazakhistan	4,27	9,0
Saudi Arabia	2,24	4,7
Nigeria	1,9	4,0
Israel	1,2	2,5
Italy	1,1	2,3
Libya	0,9	1,9
Other	5,82	8,4
Total	**47,42**	**100**

Source: Petroleum Market Report, 2022

In the Petroleum Market Law No. 5015, which is in force in Türkiye, petroleum market activities are listed as import, export, refining, processing, storage, transmission, bunker delivery, transportation, distribution and dealership. Likewise, as stated in the aforementioned law, prices related to market activities carried out within the scope of refinery and distributor licenses in Türkiye are reported to EMRA as ceiling prices prepared by license holders, taking into account the nearest accessible world free market formation.

As an indicator, the items in the price formation of diesel fuel, which is the most sold final petroleum product in the country, can be examined. For 2022, 66.7% of the final price of the diesel product consists of the cost of the product, 24.4% consists of tax and revenue share, and 8.8% consists of the gross profit of wholesalers, distributors and dealers (Petroleum Market Report, 2022).

Differences between cost items of products in the oil market may vary from year to year. Many factors, especially public tax rate adjustments, crude oil price, exchange rate fluctuations, and subsidy adjustments, have an impact on domestic oil market prices.

1.3.3. Natural Gas Market in Türkiye

The discovery of natural gas as an energy source in Türkiye took place in the borders of Kırklareli province in 1970. Until 1986, a total of 0.75 billion cubic meters of natural gas was produced in the country and all of it was consumed in industry and commerce within the country. Since air pollution has reached extreme levels in metropolitan cities, especially due to the use of low-quality lignite in household heating, a long-term natural gas purchase-sale agreement was signed with the Soviet Union in 1986, with the aim of increasing the use of natural gas, which is a cleaner and environmentally friendly energy source compared to coal, in domestic heating, business and industry. The agreement was signed and after this date, natural gas imports and consumption in the country increased at an exponential rate. Pipelines and Petroleum Transportation Joint Stock Company (BOTAŞ), which was established in 1974 to operate in the oil market, was equipped with the authority to import, transmit and determine the sales price of natural gas after 1986. Natural gas, which was first offered for domestic and commercial use in Ankara in 1988, was quickly made available to both domestic, commercial and industrial use with transmission and distribution lines built all over the country. (Engin, 2010; Yardımcı, 2011).

As of 2022, while the amount of natural gas produced domestically was 0.38 billion cubic meters, 54.6 billion cubic meters of natural gas were imported. While 27,8% of total imports were provided as LNG, 65.4% of LNG purchases were made by BOTAŞ based on long-term contracts and 34.6% consisted of spot LNG purchases. It is worth examining from which countries the natural gas, almost all of which is obtained through imports, is supplied from, in terms of geopolitics and energy supply security. 39.5% of 2022 imports come from the Russian Federation, 17.2% from Iran, and 15.9% from Azerbaijan via pipelines; 9.62% was provided from Algeria through a long-term LNG agreement, and 10.3% was provided as spot LNG from the USA. (Natural Gas Market Report, 2022).

Due to its location in the Northern Hemisphere, residential natural gas demand in Türkiye increases significantly, especially during the winter months, and supply-demand imbalances may occur due to the increase in demand in the same period in neighboring countries that meet a significant part of its imports. For this reason, the importance of storage facilities in the natural gas sector has increased and storage investments have begun to be seen as strategically important. As of 2022, the country's natural gas storage capacity is 5.6 billion cubic meters, including underground storage facilities with a capacity of 4.64 billion cubic meters, as well as LNG terminals with a capacity of 0.96 billion cubic meters (Şener and Sözen, 2016; Naural Gas Market Report, 2022).

Another important issue in terms of the country's natural gas market and energy supply is proven reserves. In the 2000s, the budget allocated to natural gas exploration and production activities by TPAO was increased and a significant amount of investment was made in land and sea exploration. While Türkiye's proven natural gas reserve until 2020 was 3.1 billion cubic meters only in the onshore field, 405 billion cubic meters of gas fields were discovered in the Tuna-1 field in the Western Black Sea in 2020 and 135 billion cubic meters of gas fields were discovered in the Amasra-1 well in the Black Sea in 2021. By the end of the year, proven natural gas reserves reached 543 billion cubic meters. It is planned to produce 10 million cubic meters of natural gas per day from the gas fields in the Black Sea by the end of 2023, and 40 million cubic meters of natural gas per day when the full project capacity is reached. If full capacity is reached, natural gas production is expected to reach approximately 14 billion cubic meters annually and provide a significant support to natural gas supply (TPAO Oil and Natural Gas Sector Report, 2021).

While transmission activities in the natural gas market are carried out by BOTAŞ, distribution activities are carried out by the private sector in 80 provinces of the country except Istanbul as of the end of 2023. Prices charged to final consumers consist of the sum of the system usage fee and taxes added to the natural gas sales price applied by BOTAŞ to distribution companies within the framework of the methodologies published by EMRA. EMRA calculates system usage fees separately for each natural gas distribution region, considering the expenses and investments of distribution companies. As in the electricity market, pricing is determined on the basis of consumer groups in the natural gas market, but there is not any cross-subsidy between distribution regions; final consumers in each distribution region are subject to the tariffs calculated for that region.

The price of natural gas in international markets, pipeline contract prices and exchange rates, as well as infrastructure amount of investment in the region, transmission and distribution operating expenses are the determining factors on the natural gas prices applied to final consumers due to the regional tariff application.

1.3.4. Renewable Energy In Türkiye

Interest in renewable energy, which is also called green energy and is considered environmentally friendly compared to its counterparts, has started to increase significantly in Türkiye, particularly since 2013.

Türkiye's renewable energy history began with a small water dynamo in Tarsus in 1902, and today hydroelectric power plants, which have the largest share in renewable energy production, are prominent. Hydroelectric power plants, which were commissioned in the second half of the 20th century and continue to operate in Atatürk, Karakaya, Keban and Ilısu dams with an installed capacity of over 1000 MW, contribute to the country's electricity The Renewable Energy National Action Plan, published in 2009, gave the first signal of the support and incentives that the public sector would provide to the private sector in this context, with the target of increasing the renewable share in total electricity production to 30% by 2023. With the Regulation on Support, it is aimed to accelerate renewable energy investments by giving 10-year purchase guarantee commitments at the exchange rate, in different amounts depending on the type of electrical energy to be produced. (Sinan, 2021, p.192-194; Topal, 2019, p.24-25). In this context, in 2010 and later, EMRA's introduction of unlicensed production activities in electricity production from solar energy up to a certain capacity (first 500 KW, then 1 MW and 5 MW respectively) also accelerated investments in solar energy. (Şeker, 2016, p.825).

TABLE 1.12 DISTRIBUTION OF TURKIYE'S INSTALLED CAPACITY BY ENERGY SOURCE (2011-2022)

Source	Installed Capacity in 2011 (MW)	Share in Installed Capacity in 2011 (%)	Installed Capacity in 2022 (MW)	Share in Installed Capacity in 2022 (%)
Hydropower	17.137	32,4	31.571	30,4
Wind	1.729	3,3	11.396	11,0
Solar	-	0,0	9.425	9,1
Biomass	126	0,2	2.354	2,3
Geothermal	114	0,2	1.691	1,7
Coal	12.550	23,7	21.099	20,3
Natural gas	19.477	36,8	25.959	25,0
Other	1.778	3,4	314	0,3
Total	**52.911**	**100,0**	**103.809**	**100,0**

Source: TEİAŞ Generation-Transmission Statistics

When Table 1.12 is analyzed, it is seen that a significant amount of investment was realized in renewable energy, especially solar and wind, between 2011 and 2022. By examining at the course of the share in installed power, it is observed that the wind-based installed power increased from 3.3% to 11% and the solar-based installed power increased to 9.1%. The share of renewable energy power plants in the total installed power has made a significant progress, increasing from 36% in 2011 when YEKDEM came into force to 55% by 2022. With the support of YEKDEM and various public incentives, the 2023 targets included in the National Energy Action Plan in 2009 have been exceeded.

.

CHAPTER 2

LITERATURE REVIEW

2.1. STUDIES ON MACROECONOMIC EFFECTS OF ENERGY PRICES IN INTERNATIONAL LITERATURE

In the international literature, until the oil crisis in 1973, it was evaluated that energy prices, or the oil price, which was seen as the most important energy source in that period, fell within the scope of microeconomics and was not a variable important enough to be considered as a macro variable. However, after the oil crisis of 1973 and its aftermath, it was understood that crude oil prices had significant effects on many macroeconomic indicators, especially long-term growth rates for developed countries (Mork, 1994, s.15).

It has been observed that, as far as possible, the majority of the studies are based on the prices of oil in international markets as the energy reference price. It is considered that the reason for this is that oil continues to rank first among the world's primary energy supply sources, even though its share has gradually decreased since the 1970s.

The history of international empirical studies investigating the effects of energy prices on macroeconomic indicators dates back to the 1980s. Theoretical studies that suggest that oil prices have significant effects on economic activity, such as Rasche and Tatom (1981) and Darby (1982), corresponding to the aftermath of the oil price shocks in the 1970s, have appeared in the literature. However, the first empirical study on this subject is considered to be Hamilton's (1983) study, in which he reached significant findings between the crude oil price and US real economic indicators.

2.1.1. Early Period (1983-1997)

In Hamilton's (1983) study, it was found that all but one of the recessions that occurred in the United States after the Second World War occurred after upward shocks in oil prices, with delays of approximately three quarters. In the study conducted between 1948 and 1980 using VAR models and Granger causality tests; The year 1973 was considered the midpoint due to the oil sales embargoes that OPEC started to impose on the USA and many other countries, and was divided into two periods as 1948-1972 and 1973-1980. Real output, unemployment rate, domestic prices, wages, import prices and money supply variables were used in the model. The study concluded that upward shocks in oil prices reduced real output and that this effect was stronger in the period until 1973. Additionally, Hamilton (1983) suggested in his study that these periodic changes may result from inflation expectations, monetary policy responses and changes in the oil price determination regime.

A significant number of studies, such as Burbidge and Harrison (1984), Gisser and Goodwin (1986), Mork (1989), Rotemberg and Woodford (1996), Leduc and Sill (2004), Blanchard and Gali (2007) reached results that support Hamilton’s (1983) basic findings.

By using VAR models, Bubidge and Harrison (1984) investigated the effects of changes in oil prices between 1961 and 1982 on the macroeconomic indicators of developed countries such as the USA, the UK, Germany, Japan and Canada. As the independent variable in the study; industrial production, short-term interest rate, money supply, wages and consumer prices were used. It was concluded that oil price increase shocks increased wages and inflation in all of the countries in question. The impact of crude oil prices on consumer prices in the UK is relatively high and the impact on wages is relatively low; It was found that the impact on wages and consumer prices was relatively lower in Japan and Germany.

In the study conducted by Gisser and Goodwin (1986), Granger causality tests were used on the economic effects of oil price shocks for the period 1961-1982. It stands out as a study that also examines Hamilton's (1983) approach to 1973 as a period of structural break. The study concluded that positive oil price shocks have a decreasing effect on real output and an increasing effect on consumer prices. The study puts forward the thesis that oil prices may have an impact on general prices through channels other than the cost channel, which is valid until proven otherwise; It was found that there was no structural break in 1973, and that oil prices in the US economy had similar and significant effects on the macroeconomy in the 25 years in question.

Although it is accepted in the research of Mork (1989) that oil prices and macroeconomic activity have an inverse relationship, which is the main finding of Hamilton (1983), it is also claimed that this relationship is not linear, and even the theoretical framework of this is also included in the study of Hamilton (1988). was banished. In the study, the model and variables used by Hamilton (1983) between 1949 and 1989 were preserved, the data range was expanded and the negative oil price shock experienced in 1985 was included in the scope of the research. The study found that the rate of positive impact of real output from decreases in oil prices has an effect close to zero compared to the decreasing effect of oil prices on real output. Mork's (1989) findings have an important place in the literature as they suggest that oil prices have non-linear effects.

There are many notable studies in particular, support Mork (1989)'s non-linear relationship thesis such as Ferderer (1996), Hamilton (1996), Huntington (1998), Davis and Haltiwanger (2001), Balke et al. (2002), Hamilton and Herrera (2004).

Although Hooker (1996)'s study found similar findings as Hamilton (1983) for the 1948-1972 period, it was concluded that oil prices had no effect on macroeconomic indicators in the 1973-1994 period. It was stated that a non-linear relationship could not be reached in the study using the Granger causality test. Also, from the same year, Darrat et al.'s (1996) study with VAR models with 6 variables (crude oil consumption, real oil price, industrial production, money supply, budget deficit, short-term interest rates) found that the effect of oil prices on the macroeconomy disappeared over time.

On studies suggesting that the effect of oil prices on the US economy has disappeared, Hamilton's (1996) study suggests that this effect has not weakened since 1983, on the contrary, it has continued to strengthen. Hamilton (1996) reached these conclusions by using net oil price data obtained by comparing each quarter's oil price with the maximum values observed in the previous four quarters, instead of the original oil price data. He also emphasized that the 1990-1991 recession was caused by increased oil prices due to Iraq's 1990 invasion of Kuwait.

2.1.2. The Phenomenon Of Monetary Policy Response

Based on VAR model predictions, Bernanke et al.'s (1997) study, as one of the first studies to approach the subject from the perspective of monetary policy, investigated the cumulative effect of increases in oil prices on real output, including both the direct effect of higher oil prices and the effect associated with the monetary policy response to higher oil prices. Bernanke et al. (1997) found that the 1974-75 economic recession could not be explained by the oil shock, allowing for an endogenous monetary policy response. On the other hand, according to empirical results, the decline in production in the 1979-81 period can be explained by the oil shock and the subsequent monetary policy response. However, it was concluded that the ongoing decline in economic activity after this point was due to the tightening of monetary policy, independent of oil prices. Another important finding of Bernanke et al. (1997) is that, in principle, the economic recession-inducing consequences of an oil price shock can be prevented at the expense of higher inflation simply by keeping the policy interest rate constant. According to the results obtained by Bernanke et al. (2004), which can be seen as an expanded version of the previous study, with VAR model predictions using the data suggested by Hamilton (1996), a 10% increase in oil prices will result in a 1.5% increase in the FED's policy interest rate and a 0.7% decrease in real output.

In the 2000s, both studies supporting the theses of Bernanke et al. (1997) emphasizing the importance of the monetary policy response and studies reaching opposing conclusions were encountered.

Leduc and Sill (2004) found that monetary policy responses following oil price shocks explained up to two-thirds of real output changes in the post-1987 period, which they defined as the post-Volcker period. In the analysis made by Barsky and Kilian (2001); It has been concluded that the stagflation experienced in the 1970s occurred due to the FED's expansionary monetary policies and that the oil supply shock had no effect, and that real oil prices would not enter a continuous increasing trend unless opposite policies were implemented in OECD countries in general.

In their study, Carlstrom and Fuerst (2006) argued that, contrary to the findings of Bernanke et al. (1997), within the framework of the Lucas criticism, the decreases in real output are not related to the monetary policy response to oil prices and are entirely due to oil prices. Hamilton and Herrera (2004) stated that Bernanke et al. (1997) used 7-month lags in the VAR model specification, but that there was a lag well below that used in the literature for oil shocks. Hamilton and Herrera (2004) in their model predictions; using lagged specifications of 12 months or more, concluded that even if tightening monetary policy was implemented, it would not have a preventive effect on the economic recession experienced in the 1970s and 1980s. Kilian and Lewis (2011) predicted nonlinear VAR specification models and found that the monetary policy response to oil prices had no effect on US real output indicators and inflation.

With an outlook of literature discovering out of US economy; such as China as one of the largest energy consumer globally since the early beginning of 2000’s. Using a systemic dynamic factor model, Ou et al. (2012) examine how China's macroeconomy reacts to global oil price shocks. They discover that as oil prices increase, various price indices, manufacturing output, consumption, and interest rates increase, whereas stock prices drop. Due to repeated reforms in China's oil pricing system, Du et al. (2010) note that the model has a systemic split, and the effects of the oil price shock on China's macroeconomic variables are non-linear and those irregular answers, on the other hand, are statistically unmeaningful. By conducting a medium-scale DSGE model with Bayesian method, Wang and Zhu (2015) showed that nominal rigidities will minimize the effects of energy price shocks, and interest rate rules can determine the extent of those effects.

In order to fulfill a robust contribution, the works focus on emerging markets both net energy importer and exporter are another significant perspective to be taken into account. Razmi et al. (2005) examined Indonesia, Malaysia, Thailand and Philippines empirically with a VAR analysis to compare the efficient monetary transmission channel for oil price shock to determine how resilient the country is strong against the oil price shocks via the monetary transmission mechanism. Researchers make a conclusion that interest rates in Indonesia, stock prices in Malaysia and Thailand, and domestic credit in the Philippines can all help monetary authorities mitigate the impact of an oil price shock on economic activity. Dogrul and Soytaş (2010) applied Toda–Yamamoto procedure to investigate the causality between unemployment and input prices as energy and capital for Türkiye for the period 2005:01–2009:08. Their results showed that Oil shocks primarily operate through traditional aggregate channels, spreading rises in oil prices to Türkiye's labor market as suggested by previous literature. By the side of monetary policy view, Filis and Chatziantoniou (2014) contradicts with the previous arguments by using a structural VAR method to distinguish between net oil importing and net oil-exporting countries. Sum up, their findings show that oil price changes have a substantial impact on inflation in both net oil-exporting and net oil-importing countries. Moreover, they discover that the reaction of interest rates to an oil price shock is highly dependent on each country's monetary policy framework.

Russia is another case due to the fact that this market is both emerging and a net oil exporter. Alekhina and Yoshino (2019) examines the relation between the Russian Federation's key macroeconomic indicators, monetary policy, and global oil prices by applying a VAR approach and monthly time-series data from January 1993 to December 2016. Their results indicate that the impact of the oil price fluctuations on the macroeconomic variables are more effective for the period 2000-2016 than 1993-1999. Another significant finding is that the Taylor rule accurately defines the Russian Federation's post-financial-crisis monetary policy.

In another significant research; Brazil, India, South Africa and Türkiye is investigated in terms of response of monetary policy to energy market shocks by

Nazlıoğlu et al. (2019) with conventional VAR and Fourier Toda–Yamamoto method. Nazlıoğlu et al. (2019) found out that oil price shocks influence the currencies of Indonesia and South Africa, interest rates in Brazil and India, and inflation in South Africa and Türkiye, according to the causality approach of gradual/smooth changes. Their results also fortified the idea that the oil market has an effect on these countries' monetary policy across a variety of channels.

2.1.3. Findings Regarding The Weakening In Pass-Through In The 2000s

In the model estimated by adding 4-period lags at quarterly frequency to Bernanke et al.'s (1997) model within the framework of Hooker's (2002) Philips curve, which investigates the pass-through of oil prices to inflation in the US economy between 1955 and 2000; It was concluded that there was a significant pass-through until 1981, but after 1981, the pass-through dropped to an almost non-existent level, although the possible reasons could not be proven with empirical findings. The findings in Hooker's (2002) article are consistent with Taylor's (1999) view that the decrease in pass-through results from the transition to a low inflation period after the monetary policy change.

In the article by Leblanc and Chinn (2004), the effects of oil prices on inflation in the USA, Japan, England, France and Germany were investigated. Unemployment, interest rate and crude oil prices were used as independent variables in 3 different short-term Philips curve models: Base Model, Hamilton's Net Price Model and Asymmetric Effects Model. According to the results obtained; It has been stated that a 10% upward oil price shock has an effect on inflation of 0.7% in the USA and the United Kingdom, 0.3% in Germany, 0.1% in France and 1.5% in Japan. Findings in the study; in developed European economies, in the 1970s, thanks to the power of labor unions over governments and employers, oil price shocks had an increasing effect on wages and a wage-inflation spiral was entered. It supports the assessment that the pass-through of oil price shocks to inflation has weakened with the liberalization of European economies and the increase in the competitive environment.

In an empirical study conducted by De Gregorio et al. (2007) on data from 9 developed and 3 developing countries' economies, it was concluded that the pass-through of oil prices to inflation in VAR models with 24-month sliding windows in the majority of 12 countries decreased significantly in the 30 years until 2005.

Possible reasons for the decrease in pass-through are attributed by De Gregorio et al. (2007) to the low inflation environment and the fact that the shocks experienced in the said period were aggregate demand shocks, unlike the oil supply shocks that occurred in previous periods. Consistent with the claim made in this article; In the studies of Blanchard and Gali (2007), Kilian (2009) and Valcarcel and Wohar (2013), the phenomenon of demand shock was suggested as the reason for the weakening in pass-through.

As far as the studies on developed economies, especially the USA, were available in the 2000s, most of them found that the inflation pass-through of crude oil prices decreased over time, but no consensus was found in the literature on the reasons for this decrease. For instance; while Bachmeir and Cha (2011) put forward the increase in energy efficiency as a reason, Blanchard and Riggi (2013) evaluated that the decrease in the rigidity of real wages reduces pass-through.

In the empirical study conducted by Conflitti and Luciani (2019) for the USA and the EU region using dynamic factor models and VAR with 1974-2016 data, the decline in pass-through was explained by defining a component called "idiosyncratic" and separated from general macroeconomic effects. With this new component phenomenon, Conflitti and Luciani (2019) concluded that the share of the general price level being driven by "idiosyncratic" dynamics has increased over the years, and therefore oil price volatilities have a limited but permanent effect on inflation.

In the empirical study conducted by Castro et al. (2017) for the Eurozone between 1996 and 2014, it was suggested to separate energy and non-energy prices and use harmonized price indices as an alternative to an analysis on aggregate prices. As a matter of fact, after the decomposition, it was concluded that crude oil prices in the Eurozone have a very direct effect on energy prices, but their effect on non-energy prices is weak.

2.1.4. Literature On Emerging Economies

It has been observed that early empirical studies on developing countries included, as far as possible, analyzes on the effects of crude oil price shocks on capital markets. After the 2008 global financial crisis, it is observed that empirical studies investigating the effects of crude oil prices on macroeconomy and inflation, covering developing countries, appeared in the economic literature.

In his article, Maghyereh (2004) examined the relationship between oil price shocks and stock market returns in 22 developing countries between 1998 and 2004 and concluded that there was no significant relationship in the analysis using VAR models. Wang et al. (2013) in their study with non-linear VAR models between 1999 and 2011; they concluded that the findings of Maghyereh (2004) are valid for net oil importing countries, but that demand-driven increases in oil prices in net oil exporting countries have an upward and significant effect on stock market returns. In the study of Aloui et al. (2012) for 25 developing countries using the method called sliding correlations; it has been reached that emerging markets are more sensitive to oil price shocks than developed markets and that there is a positive relationship with stock returns during bull market periods when the capital markets of oil-exporting emerging countries are on the rise.

Berument et al. (2010) conducted an empirical study with 3-variable (real exchange rate, inflation, real output) SVAR models for 16 Middle Eastern and North African countries, some of which are emerging economies; it has been found that there is a positive relationship between real output and oil price increases in oil exporting countries, regardless of whether the shock is demand or supply side. On the other hand, it is a significant finding of the study that supply-side oil price increases have a negative effect on real output for oil importing countries, while demand-side increases have a positive effect on real output.

The econometric study conducted by Tang et al. (2010) specifically for the Chinese economy is considered to be important in context of China's strict implementation of its control policy on energy prices. In the study, short and long term were analyzed with SVAR models between 1998-2008; It has been concluded that oil price increases have a negative effect on output and investments and that this effect is more permanent than the effect on inflation. It has been suggested by Tang et al. (2010) that the permanent negative effect on investments is caused by controls on energy prices and energy subsidies in China, which promote industrial production and over-capacity of scarce resources.

An empirical study was conducted with VAR models within the framework of the Philips curve by Mandal et al. (2012) in India, a market where domestic prices of oil and oil derivative products are controlled. The findings in the article show that crude oil price increases have a high impact on domestic inflation and industrial production. Another considerable finding in the study is that Mandal et al. (2012) suggests that in a scenario where there are no price controls, the crude oil price will show full pass-through to domestic prices.

In their econometric study based on SVAR models, Sakashita and Yoshizaki (2016) investigated the effects of WTI crude oil price on industrial production and inflation in 5 developing countries, namely the USA, Brazil, Chile, India, Mexico and Russia. In the study, it is alleged that surprise supply shocks in oil prices do not have a long-term effect on industrial production in emerging economies other than Russia, and the reason for this is that Russia differentiates in terms of high export share in the oil market. It was also concluded that transmission mechanisms differ significantly between the USA and developing countries. Findings have been found that while shocks that increase aggregate demand cause a rise in inflation in the USA, they reduce the general price level in Brazil, India and Mexico.

To present a general review of the literature on developing countries; as observed in developed country studies, there are studies showing that energy price shocks, whether supply or demand, may have different effects on the general price level and real output. In addition, controls on domestic energy prices and the size of energy subsidies can also be decisive on the reaction of inflation to external shocks. Another considerable point is that it has been revealed in the economic literature that the economies of net oil exporting countries and net oil importing countries are affected by oil price shocks to different extents and in different directions.

2.2. LITERATURE EXAMINING THE EFFECTS OF ENERGY PRICES ON TÜRKİYE

2.2.1. Early Period Studies On Türkiye

As far as is available, the first empirical study investigating the effects of energy prices on inflation in Türkiye is the study of Kibritçioğlu and Kibritçioğlu (1999). As a result of the econometric analysis conducted with VAR models, it was found that the direct effect of crude oil price changes on inflation was negligible. In the study covering the years 1961-1997; Kibritçioğlu and Kibritçioğlu (1999) suggested that the main determinant of inflation could be the exchange rate, especially after 1986, as the country's economy set off less dependent on oil, and oil prices could only have indirect effects on the current account balance.

The study conducted by Berument and Taşçı (2002) by renovating the calculations of Kibritçioğlu and Kibritçioğlu (1999) using the 1990 TÜİK input-output tables over various scenarios, pointed out a new finding. Although no meaningful conclusion can be reached regarding the direct effect, it has been found that if all income items such as wages and interest, profit and rent are indexed according to oil price changes, indexing a 20% shock can increase the general level of prices by 11.1% and this effect will be permanent. It has also been emphasized that the establishment of the indexing behavior for the Turkish economy may cause hyperinflation.

2.2.2. Studies On Macroeconomic Indicators For Türkiye

In the article by Sarı and Soytaş (2006), it was claimed that the impact of oil price shocks on Türkiye's macroeconomic indicators was studied for the first time. In the study where the effects on real returns of stocks were investigated for the period 1987-2004, it was concluded that oil price shocks did not have a direct effect on the macroeconomy. Sarı and Soytaş (2006) evaluated that the fact that tax rates are very high in domestic fuel prices and the changes in international oil prices are dampened by changes in tax rates prevent pass-through.

On the impact of crude oil price changes on the manufacturing industry sub-sectors, Torul and Alper (2010) argued that the oil price did not have a significant effect on total industrial production, which is a macroeconomic indicator, in line with the findings of Sarı and Soytaş (2006) for the period 1991-2007. On the other hand, it was uncovered in the paper that domestic fuel price increases have negative effects on the production of many manufacturing industry sub-sectors.

Güney and Hasanov (2013) delved into the effects of oil price shocks on both variables using inflation and output gap variables in their study using Hamilton (1996)'s asymmetric model and Granger causality tests for the period 1990-2012. In econometric analysis; It has been evaluated that oil price increase shocks reduce real output, but have no effect on real output in periods when oil prices decrease, a similar situation occurs in the inflation variable, and oil prices have asymmetric effects on economic growth and inflation. Güney and Hasanov (2013) alleged that high taxes on domestic fuel prices, as pointed out by Sarı and Soytaş (2006), may be a factor in the formation of this asymmetry.

Kandemir Kocaaslan (2021) examined the impact of international oil price changes on real output and investments in Türkiye during the 1998-2019 period with the SVAR method developed by Kilian and Vigfusson (2001). As a result of the impulse response analysis in the research, it was discovered that industrial production and investments react more to positive shocks than to negative shocks and that oil price shocks have asymmetric effects on the macroeconomy. Kandemir Kocaaslan (2021); He stated that investments and industrial production in the country were negatively affected by the upsurge in oil prices attributable to the oil-intensive economy and intensifying import dependence on energy, and that empirical results imply that some of the stagnation in the country's economy can be enlightened by oil price shocks.

While the leading view in research papers probing the effects of international oil price changes on macroeconomic indicators in Türkiye until the 2000s was that there was no significant effect. Succeeding a rapid energy-intensive growth and structural transformation process, with the renewal of the periods covered by the studies in the economic literature on Türkiye, it is reached a consensus that international oil prices have impacts on many macroeconomic indicators such as real output, investment and manufacturing industry growth.

2.2.3. Research On Weakening Of Pass-Through

Çatık and Önder (2011) examined the effects of crude oil prices on inflation in two periods, high and low inflation periods between 1996 and 2007, with Markov regime change models. It has been uncovered that the pass-through is asymmetric and as inflation targeting is achieved, the pass-through of oil prices recede during the low inflation period, consistent with Taylor (1999)'s thesis.

Çatık and Karaçuka (2012)'s study covering the period 1994-2009 with MS-VAR models claimed that the pass-through from crude oil prices to consumer prices dropped considerably over time, and the main reason for this was the stabilization of the exchange rate. Moreover, close to the findings of Sarı and Soytaş (2006), it was specified by Çatık and Karaçuka (2012) that the high tax rates utilized to domestic fuel prices in the abovementioned periods caused this effect to shrink. Another vital structural finding in the study is that the relationship between producer prices and consumer prices declines in low inflation cycles and reinforces in high inflation cycles.

In Peker and Mercan's (2011) study, which examined the period between 1996 and 2009 using the ARDL bounds test, the crude oil price had no statistical effect on inflation in Türkiye, consistent with the findings of Kibritçioğlu and Kibritçioğlu

(1999) and Berument and Taşçı (2002) in their early studies. However, in the long-term analysis of Peker and Mercan (2011), it was observed that domestic fuel prices had significant inflationary effects, and a 10% fuel price increase in the aforementioned period was observed to have an inflationary effect of 4.52%.

When the studies encounter that pass-through has weakened are examined, it is understood that researches that cover the years 2001-2007, when international oil prices increased steadily. Moreover; considering that the inflation targeting regime was introduced in Türkiye in the displayed period and that the main trend of inflation was decreasing with the coordinated monetary and fiscal policies giving effective results, research findings are compatible with the Taylor’s (1999) thesis that the pass-through of prices generally decreased in low inflation periods as a result of monetary policy changes.

2.2.4. Studies Supporting The Phenomenon Of Strengthening Pass-Through (Post - 2012)

According to the variance decomposition findings based on VAR models formulated by Yaylalı and Lebe (2012) with quarterly data between 1986 and 2010; a 100% crude oil price upside shock causes consumer prices to rise by 14.8%. In this sense, it contradicts the finding suggested in early studies that crude oil prices do not have an inflationary effect.

In the sliding windows analysis with VAR models by Dedeoğlu and Kaya (2014), which contains findings in the economic literature that the inflation pass-through of crude oil prices for Türkiye has strengthened over time, it has been claimed that the pass-through intensified in the 1990-2012 period. Dedeoğlu and Kaya (2014) attributed the reason for the escalation in pass-through to the fact that Türkiye has a constantly growing economy and that oil and oil-based imported products have a significant share in growth.

Yanıkkaya et al. (2015), who examined the period 1990-2013, evaluated that there was a structural break after 2002 and that the ratio of imports to national income, which was around 15% on average, reached 25% between 2003 and 2013, which may have led to a surge in pass-through.

In their study, Akçelik and Öğünç (2016) appraised that there was a structural transformation in Türkiye after 2001, as pointed out by Yanıkkaya et al. (2015), and presented the period 2004-2014 the subject of research. The pass-through from crude oil prices to import prices in Türkiye is at the level of 32%, one-third of this is reflected in domestic fuel prices within two months due to high tax rates, and the cumulative reflection on consumer prices within a year is 4.2% and 5% in the long term, and on producer prices permeability was approximately twofold these rates. Akçelik and Öğünç (2016) attributed the upsurge in pass-through to the rise in the share of oil-based products in the consumer basket over time and, as an even more important factor, to the expanding share of energy-intensive production.

In his study examining the 2000-2020 period with NARDL models, Altunöz (2022) delved into the effects of international oil price changes on producer and consumer prices. Similar to the findings of Yaylalı and Lebe (2012), it is detected that a 100% international oil price shock rose consumer prices by 15.2%.

In Yılmazkuday (2022)'s study with SVAR models, it was determined that there is a 14% pass-through from crude oil prices to consumer prices and 26% pass-through from exchange rates in the long run, in line with the findings of Altunöz (2022). On the other hand, by using the variance decomposition method, he put forward that 40% of the 1-unit inflation in the country can be explained by global oil prices and 17% by changes in the exchange rate.

In summary, it has been shown from this review that there is a consensus in the economic literature that the pass-through from international oil prices to consumer prices has strengthened in Türkiye in the 2010s and afterwards. Although the reasons for the upsurge in pass-through cannot be fully explained, the strengthening of the link between economic growth dynamics and energy-intensive sectors and the relative rise in the share of energy in price dynamics are considered as key factors.

As far as can be reached, in the empirical studies conducted in the economic literature on the pass-through of energy prices to consumer prices in Türkiye, international crude oil prices or, at least partially, domestic fuel prices have been used as the energy reference price. However, in Türkiye, where the domestic energy sector is significantly privatized and the energy markets are quite developed compared to similar countries, the use of only international oil prices as the energy reference price and the absence of studies on other reference prices are seen as a deficiency in the economic literature. From this point of view, it is aimed to contribute to the economic literature by utilizing the Market Clearing Price, which is the reference electrical energy price formed by the matching of supply and demand in the day-ahead electricity markets, a research subject in the thesis study. In addition, the possible interaction of energy prices with monetary policy was also examined by econometric analysis as a research subject.

CHAPTER 3

RESEARCH

3.1. SCOPE, PURPOSE AND METHOD OF THE RESEARCH

Within the scope of this thesis study, the effects of energy prices on domestic inflation in Türkiye are investigated. The effects of international crude oil prices and MCP (Market Clearing Price) on CPI (Consumer Price Index) were investigated in two separate models for the period between 2012 and 2022. While the international crude oil price, one of the dependent variables that forms the basis of the study, is a frequently used variable in the economic literature, it is anticipated that MCP will contribute to the literature in this sense, as it has not been used so far as far as researched in the economic literature. On the other hand, the independent variables used in econometric models were determined in accordance with international and domestic economic literature. It is expected that the research results will support decision makers in determining the policy instruments applied to establish price stability and financial stability.

In the created econometric models, unit root tests were applied to determine the stationarity levels of the series. Using the Eviews 12 package software, the existence of a long-term relationship between the dependent and independent variables was checked with the NARDL Bounds Test. Then, short- and long-term coefficients were estimated with NARDL by applying structural break tests, diagnostic tests were applied and analyzed. In addition, the monetary policy response function was estimated using the modified Taylor equation for the period 2006 q1 - 2022 q4, and the possible effects of energy prices on the monetary policy impact were analyzed.

3.2. RESEARCH DATA

Explanations and data sources regarding the dependent and independent variables utilized in the models in the research are presented in Table 3.1.

TABLE 3.1 EXPLANATIONS ABOUT THE VARIABLES IN THE MODELS

Variable	Abbreviation	Logarithmic Abbreviation	Description	Source
Consumer Price Index	CPI	LNCPI	Index value of prices of goods and services for consumption by households at a monthly frequency of 2012:01=100	TurkStat
Brent Petroleum Price	OIL	LNOIL	Monthly average price of European Brent Oil obtained from Spot FOB daily prices	CBRT
Market Clearing Price	MCP	LNMCP	Monthly average price obtained from hourly electricity prices in the day ahead market	EXIST Transparency Platform
Exchange Rate	EXR	LNEXR	Monthly average basket price obtained from daily prices of US Dollar Foreign Exchange Buying Rate and Euro Foreign Exchange Buying Rate (0.5*US Dollar + 0.5*Euro)	CBRT
Money Supply	M3	LNM3	Monthly value consisting of the sum of money in circulation, demand deposits, time deposits, funds obtained from repo, money market funds and issued securities with a maturity of up to 2 years.	CBRT
Policy Interest Rate	INT	LNINT	Weighted Average Funding Cost of the CBRT Funding	CBRT
GDP Growth Rate	GDP	LNGDP	Seasonally and calendar adjusted on the gross domestic product in chain linked volume index and percentage change	TurkStat
Real Effective Exchange Rate	REER	LNREER	Weighted average value of TL with relative to a basket of currencies formed by the countries which have significant shares in Türkiye's foreign trade	CBRT

3.3. UNIT ROOT (STATIONARITY) TEST

In econometric studies conducted with time series, it is necessary to first analyze the stationarity of the series (Karaca, 2003). As shown in the study of Granger and Newbold (1974), in econometric analyzes made with series using level data without performing stationarity analysis, although there is no relationship between two variables, non-significant relationships, also called pseudo regression, can be analyzed as significant and lead to misleading results and analyses.

In this context, the stationarity of the logarithmic series in the study was tested using the Lee Strazicich Lm unit root test, which was introduced by Lee et al. (2013). Unlike conventional unit root tests, Lee Strazicich's method takes structural breaks into account. The L-S test, which provides information on the unknown break dates, strengthens the shortcomings of the traditional unit root tests, including the augmented Dickey-Fuller (ADF), the Phillips-Perron (PP), and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS).

TABLE 3.2 LEE STRAZICICH LM UNIT ROOT TEST RESULTS

Variable	Level Values I(0)		First Difference Values I(1)		Decision
	Test Statistics	Estimated Breakpoint	Test Statistics	Estimated Breakpoint	
LNCPI	-3,092	2020M12	-9,312***	2021M09	I(1)
LNOIL	-2,981	2015M07	-9,382***	2016M09	I(1)
LNMCP	-1,482	2021M09	-5,806***	2015M11	I(1)
LNM3	-3,019	2019M07	-10,381***	2017M12	I(1)
LNINT	-2,056	2014Q4	-6,721***	2017Q3	I(1)
LNGDP	-4,330*	2012Q1	-5,515***	2002Q2	I(1)
LNREER	-2,515	2018Q2	-10,703***	2000Q2	I(1)

According to MacKinnon (1996)'s critical values; * indicates stationarity at 10%, ** indicates 5%, and *** indicates stationarity at 1% significance level.

As shown in Table 3.2, according to the L-S unit root test results, all variables used in the models have unit roots at level values. One can observe that after taking the first differences of the non-stationary series, all the variables become stationary, that is, they contain at most single unit root and are I (1). The L-S test estimates of these series' structural break periods will not be incorporated into the model. The structural break test of the model will be utilized to ascertain the break periods in the structural break analysis section.

3.4. NARDL BOUND TEST

ARDL Cointegration Test, which has relative advantages compared to alternative cointegration tests in the literature, was introduced to the economic literature by Pesaran et al. (2001). The advantages of the ARDL method can be listed as the fact that it can be used even if some of the time series are I (0) and some of them are I (1), it can give healthy results even when the number of samples is low, and it has long and short-term analysis (Narayan, 2004; Şimşek, 2016).

NARDL, in other words, non-linear ARDL test; It was presented by Shin et al. (2014) as an advanced form of ARDL. It consists of dynamic error correction models that allow capturing asymmetries between variables in both the short and long term. In this method, the effects of positive and negative changes of independent variables on the partial sums of positive and negative decompositions of the dependent variable can be examined.

In this context, NARDL method; It allows co-integration and asymmetric nonlinearities to be modeled together in a single equation and also outperforms other traditional cointegration techniques in samples with low number of observations (Shahzad et al, 2017).

The general ARDL equation developed by Pesaran et al. (2001) is as follows:

$$\Delta y_t = \mu + \rho y_{t-1} + \theta x_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \pi_i \Delta x_{t-i} + \varepsilon_t \quad (1)$$

In equation (1), Δ is the first difference operator, y_t is the dependent variable, μ is the constant term, x_t is the variable vector of size kx1, ρ and θ are the long-term coefficients, α_i and π_i are the short-term coefficients, p and q are the lag numbers of the dependent and independent variables respectively, and ε_t represents the error term.

Since the basic assumption of the ARDL approach is that all independent variables have a linear relationship, Shin et al. (2014) and whose general equation is presented below, NARDL has been applied.

$$y = \beta^{+} {x_t}^{+} + \beta^{-} {x_t}^{-} + u_t \tag{2}$$

In equation no. (2), β^{+} and β^{-}represent the long-term parameters, ${x_t}^{+}$ and ${x_t}^{-}$ represent the partial sums of positive and negative changes.

As a result of processing the asymmetric parameters in equation (2) into ARDL equation (1), asymmetric unconstrained error correction model equation (3) is obtained.

$$\Delta y_t = \mu + \rho y_{t-1} + \theta^{+} x_{t-1}^{+} + \theta^{-} x_{t-1}^{-} + \sum_{i=1}^{p-1} \alpha_i \Delta\, y_{t-i} + \sum_{i=0}^{q-1} (\pi_i^{+} \Delta\, x_{t-i}^{+} + \pi_i^{-} \Delta x_{t-i}^{-}) + \varepsilon_t \tag{3}$$

Based on equation no. (3), the long-term effects of positive and negative changes of the independent variable on the dependent variable are expressed as $\beta^{+} = -\left({\theta^{+}}/{p}\right)$ ve $\beta^{-} = -({\theta^{-}}/{p})$.

The existence of the cointegration relationship is tested with the F bounds test suggested in the study of Pesaran et al. (2001). The bound test, in which the coefficients of the variables in the estimated error correction model are tested to be equal to zero within the framework of the hypothesis given in equation (4), is analyzed by comparing the obtained F statistics values with the lower and upper limits recommended by Pesaran et al. (2001). In this context; If the F statistic value exceeds the upper limit, the null hypothesis that the series are not cointegrated will be rejected and it will be concluded that there is cointegration. F statistic value; If it is between the lower and upper bound, a decision cannot be made; if it is below the lower bound, the null hypothesis will be accepted and it will be concluded that there is no cointegration.

$$H_0: \rho = \theta^{+} = \theta^{-} = 0 \tag{4}$$

$$H_1: \rho \neq \theta^{+} \neq \theta^{-} \neq 0 \tag{5}$$

After concluding that there is cointegration, the existence of an asymmetric relationship in the long run is investigated by testing the null hypothesis in equation (6) through the Wald test. To investigate the existence of asymmetry in the short term, the null hypothesis in equation (7) is tested through the Wald test.

$$H_0: \beta^+ = \beta^- \tag{6}$$

$$H_0: \sum_{i=0}^{q-1} \pi_i^+ = \sum_{i=0}^{q-1} \pi_i^- \tag{7}$$

The NARDL models included in the thesis study are as follows, respectively:

Model 1: $\Delta LNCPI_t = \mu + \rho LNCPI_{t-1} + \theta_1^+ LNEXR_{t-1}^+ + \theta_1^- LNEXR_{t-1}^- + \theta_2^+ LNOIL_{t-1}^+ + \theta_2^- LNOIL_{t-1}^- + \theta_4^+ LNM3_{t-1}^+ + \theta_4^- LNM3_{t-1}^- + \sum_{i=1}^{p-1} \alpha_i \Delta\, LNCPI_{t-i} + \sum_{i=0}^{q} (\pi_i^+ \Delta\, LNEXR_{t-i}^+ + \pi_i^- \Delta LNEXR_{t-i}^-) + \sum_{i=0}^{q} (\pi_i^+ \Delta\, LNOIL_{t-i}^+ + \pi_i^- \Delta LNOIL_{t-i}^-) + \sum_{i=0}^{q} (\pi_i^+ \Delta\, LNM3_{t-i}^+ + \pi_i^- \Delta LNM3_{t-i}^-) + \varepsilon_t$

Model 2: $\Delta LNCPI_t = \mu + \rho LNCPI_{t-1} + \theta_1^+ LNEXR_{t-1}^+ + \theta_1^- LNEXR_{t-1}^- + \theta_2^+ LNMCP_{t-1}^+ + \theta_2^- LNMCP_{t-1}^- + \theta_4^+ LNM3_{t-1}^+ + \theta_4^- LNM3_{t-1}^- + \sum_{i=1}^{p-1} \alpha_i \Delta\, LNCPI_{t-i} + \sum_{i=0}^{q} (\pi_i^+ \Delta\, LNEXR_{t-i}^+ + \pi_i^- \Delta LNEXR_{t-i}^-) + \sum_{i=0}^{q} (\pi_i^+ \Delta\, LNMCP_{t-i}^+ + \pi_i^- \Delta LNMCP_{t-i}^-) + \sum_{i=0}^{q} (\pi_i^+ \Delta\, LNM3_{t-i}^+ + \pi_i^- \Delta LNM3_{t-i}^-) + \varepsilon_t$

Model 1 and Model 2 employ identical methodology; however, Model 1 utilizes the energy price as the international oil price, whereas Model 2 uses the Market Clearing Price.

3.5. STRUCTURAL BREAK ANALYSIS

When performing econometric analysis, whether the equation coefficients are stable or not is determined by the presence of structural breaks in the series. In this context, the phenomenon of structural break, which was first introduced by Chow (1960) in the economic literature, has been developed over time. In Chow's (1960) suggestion for structural break detection, it was necessary to have preliminary information about the series and to determine the structural break dates externally.

However, in this thesis study, the approach proposed by Bai and Perron (2003), which allows detecting multiple structural breaks internally, was used.

In the approach suggested by Bai and Perron (2003), breaks in the regression models estimated by the least squares method are examined. In this context; $UDmax$, $WDmax$ and $sup\ F$ statistics of Bai-Perrron structural break tests and structural break period information for the models to be estimated in the thesis are given in Table 3.3.

TABLE 3.3 BAI-PERRON STRUCTURAL BREAK TEST

Model	**Bai-Perron Test Statistics**						**Break Date**
	$UDmax$	$WDmax$	$sup\ F(1/0)$	$sup\ F(2/1)$	$supF(3/2)$	$supF(4/3)$	
Model 1	351,6507*	356,2347*	117,2169*	0,3575	9,1816	6,3923	2022.01
Model 2	144,7215*	172,1291*	40,0634*	1,3573	11,4501	3,1878	2022.01

Range 2012M01-2022M12. Values with statistical significance within the 5% confidence interval are indicated with *. Structural fracture tests were applied with a maximum of five fractures in the range of [0.15, 0.85].

2022:01 stands out as the structural break period in both models. It draws attention as it is a period in which inflation accelerated after the exchange rate shock experienced in December 2021.

3.6. ESTIMATION RESULTS

According to the Bai-Perron structural break analysis, January 2022 was added as a dummy variable to Model 1 and Model 2 and the estimation phase of the models was started. Prediction results of the models are presented through tables and evaluations, respectively.

3.6.1. Results Of Model 1

TABLE 3.4 MODEL 1 NARDL RESULTS

Variable	Coefficient	t Statistics	Probability
$Constant$***	1.028195	4.99	0.0000
$Trend$	-0.000166	-0.62	0.5356
$LNCPI$(-1)***	1.071345	9.90	0.0000
$LNCPI$ (-2)***	-0.472579	-3.89	0.0002
$LNCPI$ (-3)***	0.355747	2.91	0.0043
$LNCPI$ (-4)*	-0.147849	-1.96	0.0518
$LNEXR^{+}$***	0.226779	3.08	0.0026
$LNEXR^{+}$(-1)**	-0.141451	-1.99	0.0487
$LNEXR^{-}$*	-0.081066	-1.75	0.0814
$LNOIL^{+}$	0.001023	0.21	0.8338
$LNOIL^{-}$***	0.011380	4.00	0.0001
$LNM3^{+}$*	-0.132119	-1.75	0.0814
$LNM3^{+}$(-1)***	0.322859	3.46	0.0007
$LNM3^{+}$(-2)***	-0.147758	-2.80	0.0059
$LNM3^{-}$**	0.298167	2.25	0.0264
$Dummy\ Variable$**	0.045654	2.61	0.0101

* represents 10%, ** represents 5%, and *** represents 1% significance level.

TABLE 3.5 MODEL 1 LONG TERM RESULTS

Long Term Results			
Variable	**Coefficient**	**t Statistics**	**Probability**
$LNEXR^{+}$ ***	0.441345	2.63	0.0095
$LNEXR^{-}$	-0.419303	-1.46	0.1470
$LNOIL^{+}$	0.005293	0.21	0.8316
$LNOIL^{-}$ ***	0.058862	3.92	0.0001
$LNM3^{+}$ *	0.222322	1.94	0.0545
$LNM3^{-}$ *	1.542219	1.77	0.0788
Descriptive Statistics			
Autocorrelation (Breush-Godfrey): F=1.378 (p=0.256)			
Heteroskedasticity (Harvey): F=0.887 (p=0.5805)			

* represents 10%, ** represents 5%, and *** represents 1% significance level.

As shown in Table 3.5, Model 1 has been subjected to tests frequently applied in the economic literature to test whether there are autocorrelation and heteroskedasticity problems, and no problems were detected. Thereupon, F bounds test was applied to the model for cointegration analysis and Wald tests were applied to detect the presence of asymmetry.

TABLE 3.6 MODEL 1 COINTEGRATION AND ASYMMETRY TESTS

***F*-Bounds Test**				
H0: No cointegration.	**Value**	**Significance Level**	**I(0)**	**I(1)**
		10%	2.53	3.59
F***	6.394	5%	2.87	4.00
k	6	2,5%	3.19	4.38
		1%	3.6	4.9
Wald Test				
	χ^2 Statistics	**t Statistics**	**Probability (χ^2)**	
W_{LR-EXR}***	12.83	3.58	0.0005	
W_{LR-OIL} **	4.32	-2.07	0.0399	
W_{LR-M3}	5.24	-2.29	0.0239	

* represents 10%, ** represents 5%, and *** represents 1% significance level.

When the results of Model 1 are evaluated, one can conclude that exchange rate, Brent oil price and money supply variables have a significant relationship with inflation in the short term. In the long run, exchange rate and Brent oil have significant and asymmetrical findings.

According to Model 1 predictions; A 100% increase in the exchange rate causes a 22% increase in the CPI in the short term, and a 100% increase in the long term causes a 44.1% increase. A 100% decrease in the Brent oil price causes a 1.13% decrease in the CPI in the short term, and a 100% decrease in the long term causes a 5.9% decrease in the CPI. On the other hand, the effect of the increases in the Brent oil price on the CPI is statistically significant. It is observed that it does not render significant results and according to the Wald test results, the Brent oil price has asymmetric effects on inflation.

3.6.2. Results Of Model 2

TABLE 3.7 MODEL 2 NARDL RESULTS

Variable	Coefficient	t Statistics	Probability
$Constant$***	1.776041	6.87	0.0000
$Trend$	0.000590	1.15	0.2520
$LNCPI$(-1)***	0.964512	10.78	0.0000
$LNCPI$(-2)***	-0.475448	-3.71	0.0003
$LNCPI$(-3)**	0.408392	2.50	0.0141
$LNCPI$(-4)***	-0.429514	-2.63	0.0097
$LNCPI$(-5)**	0.313673	2.41	0.0175
$LNCPI$(-6)*	-0.115688	-1.82	0.0705
$LNEXR^{+}$***	0.232718	4.34	0.0000
$LNEXR^{+}$(-1)**	-0.131348	-1.99	0.0489
$LNEXR^{+}$(-2)	0.035539	0.70	0.4816
$LNEXR^{+}$(-3)	-0.086835	-1.65	0.1007
$LNEXR^{+}$(-4)***	0.125274	2.75	0.0070
$LNEXR^{+}$(-5)**	-0.073587	-2.41	0.0177
$LNEXR^{-}**$	-0.100755	-2.08	0.0394
$LNPTF^{+}$	-0.001449	-0.14	0.8841
$LNMCP^{+}$ (-1)	0.013774	1.11	0.2685
$LNMCP^{+}$ (-2)	0.007799	0.58	0.5612
$LNMCP^{+}$ (-3)	0.014851	1.34	0.1827
$LNMCP^{+}$ (-4)	-0.012433	-1.32	0.1869
$LNMCP^{+}$ (-5)***	0.026258	3.22	0.0017
$LNMCP^{-}$*	0.016251	1.83	0.0695
$LNMCP^{-}$ (-1)	0.000202	0.01	0.9859
$LNMCP^{-}$ (-2)	0.005559	0.43	0.6652
$LNMCP^{-}$ (-3)	-0.012486	-1.00	0.3169
$LNMCP^{-}$ (-4)***	0.038857	3.29	0.0014
$LNM3^{+}$***	-0.152233	-2.64	0.0097
$LNM3^{+}$ (-1)***	0.287956	4.21	0.0001
$LNM3^{+}$ (--2)***	-0.134736	-2.65	0.0092
$LNM3^{-}***$	0.354003	3.29	0.0014
$Dummy\ Variable$***	0.044038	4.04	0.0001

* represents 10%, ** represents 5%, and *** represents 1% significance level.

TABLE 3.8 MODEL 2 LONG TERM RESULTS

Long Term Results			
Variable	**Coefficient**	***t* Statistics**	**Probability**
$LNEXR^{+}$ ***	0.304608	3.27	0.0015
$LNEXR^{-}$ *	-0.301596	-1.92	0.0578
$LNMCP^{+}$ ***	0.146076	4.89	0.0000
$LNMCP^{-}$ ***	0.144825	6.52	0.0000
$LNM3^{+}$	0.002954	0.03	0.9722
$LNM3^{-}$ ***	1.059658	2.86	0.0052
Descriptive Statistics			
Autocorrelation (Breush-Godfrey): F=0.443 (p=0.643)			
Heteroskedasticity (Harvey): F=0.741 (p=0.824)			

* represents 10%, ** represents 5%, and *** represents 1% significance level.

Model 2, as presented in Table 3.8; In order to test whether there are autocorrelation and heteroscedasticity problems, it was subjected to tests that are frequently accepted in the economic literature, and no problems were found. Thereupon, F bounds test was applied for cointegration analysis and Wald tests were applied to detect the presence of asymmetry in the model.

TABLE 3.9 MODEL 2 COINTEGRATION AND ASYMMETRY TESTS

***F*-Bounds Test**				
H0: No cointegration.	**Value**	**Significance Level**	**I(0)**	**I(1)**
		10%	2.53	3.59
F***	11.557	5%	2.87	4
k	6	2,5%	3.19	4.38
		1%	3.6	4.9
Wald Test				
	χ^2 Statistics	***t* Statistics**	**Probability (χ^2)**	
W_{LR-EXR}***	20.02	4.47	0.0000	
W_{LR-PTF}	1.04	-1.01	0.3083	
W_{LR-M3}***	9.85	-3.13	0.0017	

* represents 10%, ** represents 5%, and *** represents 1% significance level.

When the results of Model 2 are evaluated; one can observe that exchange rate, MCP and money supply variables have a significant relationship with inflation in the short term. In the long run, while exchange rate and MCP are significant in both directions, money supply has only a negative significant relationship. While the exchange rate and money supply have asymmetric findings in the long term, as a result of the Wald tests applied, it is observed that the relationship between MCP and CPI is symmetrical.

A 100% increase in the exchange rate causes a 23.3% increase in the CPI in the short term, and a 100% decrease causes a 10% decrease in the CPI in the short term. In the long run, a 100% increase in the exchange rate causes a 30.5% increase in the CPI.

A 100% increase in the Market Clearing Price will lead to a 2.6% increase in the CPI in the short term, a 100% decrease will lead to a 3.8% decrease in the CPI in the short term, a 100% increase will lead to a 14% increase in the long term. An increase of 6% and a 100% decrease results in a 14.5% decrease. A 100% decrease in the money supply in the long run causes a 105.9% decrease.

When the Model 2 estimation results are examined; Reaching similar results with Model 1 regarding the effect of exchange rate on inflation implies that it is an appropriate choice to separate MCP and Brent oil price data and examine them in different models. On the other hand, while the Brent oil price has asymmetrical effects on inflation, detailed evaluations of the symmetrical effects of the MCP are included in the conclusion chapter of the thesis.

3.7. MONETARY POLICY EFFECT

This section explores and discusses the effects of international energy prices on the monetary policy response. According to the CBRT as an energy-importing country, the key interest rate is currently the central bank’s main monetary policy tool. The central bank also implements monetary policy in the context of inflation targeting since 2006. Accordingly, this monetary policy response analysis focused on post-2006 inflation targeting regime.

The Taylor rule framework is utilized to describe the Central Bank’s monetary policy behavior. According to the Taylor rule, central banks adjust nominal policy rates on the basis of movements in inflation and in GDP gaps. However, in this equation, the original Taylor equation is adjusted to include the impact of exchange rate and oil prices, as they have been shown to have a significant impact on the economy and whether influence monetary policy or not.

Building on Alekhina and Yoshino (2018)'s work, with the help of modified Taylor Rule one can observe that how oil price changes affect monetary policy responses in a net oil importer country, using quarterly GDP, policy interest rate, consumer price inflation, gdp growth rate, Brent crude oil prices and investment data between 2006: q1 and 2022: q4. The modified equation is as follows:

$$int_t = \alpha_0 + \alpha_1(\pi_t - \pi_t{}^*) + \alpha_2(y_t - y_t^*) + \alpha_3(e_t - e_t^*) + \alpha_4(oil_t - oil_t{}^*) + \varepsilon_t$$

int_t represents policy interest rate of CBRT, π_t represents consumer price inflation, $\pi_t{}^*$ represents official inflation target, y_t, e_t and oil_t represents potential GDP growth rate, real effective exchange rate and brent crude oil prices respectively. The starred symbols of the rest as potential values are calculated by Hodrick-Prescott filter method.

TABLE 3.10 MODIFIED TAYLOR RULE- RESULTS

Variable	2006-2017	2018-2022
C	6.533***	17.44***
CPI	1.141***	-0.104*
GDP	-0.831*	-0.603
$REER$	-0.025	-0.269
OIL	-0.000	0.132*
R^2	0.459	0.398

* represents 10%, ** represents 5%, and *** represents 1% significance level.

The analysis is divided into two parts: before and after 2018, which is considered a single-digit inflation period. The analysis results confirm that the Central Bank remained strongly committed to inflation targeting according to the Taylor rule until 2018. However, the exchange rate and the pandemic shocks after 2018, an inflationary period was entered and one can observe that the Taylor rule and inflation targeting weakened in this period. In the case of oil price shocks, while the analysis did not give a significant outcome pre-2018, it gained significance, albeit weakly, in the central bank reaction function in the post-2018 period.

In the literature, Gürkaynak et al. (2023) and Ulug et al. (2023) also came to conclusions about the erosion of inflation targeting post-2018. According to

Gürkaynak et al. (2023), the Taylor rule was invalid during the relevant time period. On the other hand, as far as research is concerned, no study on the effects of global oil prices during the aforementioned time frame has been discovered.

CONCLUSION AND POLICY IMPLICATIONS

A significant part of the empirical studies conducted in Türkiye to date have concluded that there is a strong pass-through from oil prices to consumer prices. However, in some of the studies, albeit a small number, for example; Çatık and Önder (2011), Çatık and Karaçuka (2012), it was concluded that the relationship between oil prices and inflation weakened over time. One of the most important reasons for this may be the downward trend in inflation in the periods covered by the studies, the decrease in pass-through in low inflation periods, or the relatively low level of energy demand and energy deficit. As a matter of fact, the study of Çatık and Karaçuka (2012) covering the period 1994-2009 also supports the view that pass-through decreases significantly in periods of low inflation. However, in many studies conducted in 2014 and later, such as Dedeoğlu and Kaya (2014), Yanıkkaya et al. (2015), Akçelik and Öğünç (2016), Nazlıoğlu et al. (2019), Altunöz (2022), Yılmazkuday (2022); it was concluded that the pass-through of oil prices on inflation increased over time. The reason for this is generally considered to be that as the country's total production capacity and national income grow, the demand for the energy item, which is supplied through imports, increases at the same or higher rate and the share of oil and oil-based goods and services among cost items increases relatively.

In the empirical findings in the thesis show that the pass-through from international oil prices to consumer prices in Türkiye is asymmetrical in the 2012-2022 period. While negative price shocks are significant and a permanent negative shock of 10% affects consumer prices by 0.59 points, the reason why positive oil price shocks do not have a significant relationship is the Eşel-Mobil application implemented in Türkiye in the 2018-2021 period. Eşel-Mobil application, which is a kind of subsidy mechanism, is an application that allows the increases in the exchange rate and oil prices, which are among the cost items of the fuel sales price, to be compensated by covering them from the fixed SCT item, and in a sense, it is an application that restricts the upward price changes in the final sales prices of fuel.

It is considered that due to this application, an asymmetry has occurred in the pass-through of oil prices and the application prevents the reflection of positive shocks in fuel prices on consumer prices in the relevant period. In a sense, one can argue that the model results in the study confirm the effectiveness of this mechanism, which was implemented in the relevant period to combat inflation. In addition, since final domestic fuel prices are kept under control as a managed price in every period, it is understandable that international energy prices are not included as an important variable in the central bank response function.

According to the model investigating the effects of MCP, an important finding is that the pass-through of MCP to consumer prices is bidirectional and symmetrical in the long run. Here, it is considered that the reason why the relationship is symmetrical is that the change in electricity market prices passes through domestic producer prices to consumer prices through the cost channel. In this respect, it is concluded that MCP is an important and effective indicator as a determinant of inflation. As a result, it is considered that there is a need for the public sector and economic decision makers to interpret and take the MCP into account as an important variable such as the international oil price.

The analysis conducted through the modified Taylor Rule confirms that the monetary authority remained strongly committed to inflation targeting in the 2006-2018 period within the framework of inflation targeting regime. However, it is observed that the Brent oil price is not a significant variable in the monetary policy response function both before and after 2018. In this respect, MCP which is detected to have significant effects on inflation, should be regarded as an important data. It is considered that the Central Bank can carry out a policy in the decisions it will take and the macroprudential measures it will implement by evaluating the MCP with sectoral effects and the magnitude of the shock in volatile periods as well as the international oil price which has been determined by econometric findings to cause inflationary pressures.

On the other hand, it is anticipated that localizing energy supply and reducing import dependency will both positively affect the current account balance in the long term and reduce the volatility in domestic energy prices by stabilizing the Market Clearing Price. In this context, in order to support the financing of domestic and renewable energy production investments, it is recommended that these investments be evaluated and prioritized within selective loans within the framework of macroprudential policies to be implemented by the Central Bank.

This thesis study added significantly to the body of knowledge in two areas. First, the way that inflation is explained in econometric models that account for asymmetric effects is by using the Market Clearing Price. Second, using the modified Taylor rule, determine whether oil prices are part of the central bank response function.

The choice of reference prices for energy prices is one of the trickiest problems in figuring out inflation dynamics. This thesis study has certain limitations as a result. The Market Clearing Price, however, only provides an estimate of the energy costs associated with domestic electricity; it ignores other energy prices such as natural gas and coal. Another notable restriction is that the market clearing price had a more liberal structure up until 2020, at which point it changed to a managed/directed structure with the intervention of regulation authority.

This thesis offers fresh avenues for further investigation in this area. Future research with data on energy reference prices from a wider spectrum regarding other fossil fuels and renewables could be beneficial. The literature might benefit from a new energy price index created in line with the nation's primary energy supply distribution or from research on the connection between inflation, monetary policy and a higher frequency energy price index.

BIBLIOGRAPHY

Abbott, M. (2016). The Economics of the Gas Supply Industry. Routledge.

Ahuja, D., and Tatsutani, M. (2009). Sustainable energy for developing countries. SAPI EN. S. Surveys and Perspectives Integrating Environment and Society, (2.1)

Akçelik, F., and Öğünç, F. (2016). Pass-through of crude oil prices at different stages in Türkiye. Central Bank Review, 16(1), 41-51.

Akyüz, M., and Akgül, D. (2020). Serbest tüketici kavramı ve elektrik perakende satış şirketlerinin pazarlama stratejisi uygulamaları üzerine kavramsal bir çalışma. Çağ Üniversitesi Sosyal Bilimler Dergisi, 17(1), 90-101.

Alekhina, V., and Yoshino, N. (2019). Exogeneity of world oil prices to the Russian Federation's economy and monetary policy. Eurasian Economic Review, *9*(4), 531-555.

Alekhina, V., and Yoshino, N. (2018). Impact of world oil prices on an energy exporting economy including monetary policy (No. 828). ADBI Working paper.

Alim, A., Hartley, P. R., and Lan, Y. (2018). Asian spot prices for LNG and other energy commodities. The Energy Journal, 39(1).

Aloui, C., Nguyen, D. K., and Njeh, H. (2012). Assessing the impacts of oil price fluctuations on stock returns in emerging markets. Economic Modelling, 29(6), 2686-2695.

Altunöz, U. (2022). The nonlinear and asymetric pass-through effect of crude oil prices on inflation. OPEC Energy Review, 46(1), 31-46.

Arihan, C. (2021). Oil Crisis (Oil Price Revolution) of 1973 and the United States' Response to the Crisis: The International Energy Agency. Journal of Management Policy & Practice, 22(1).

Bachmeier, L. J., and Cha, I. (2011). Why don't oil shocks cause inflation? Evidence from disaggregate inflation data. Journal of Money, Credit and Banking, 43(6), 1165-1183.

Bai, J., and Perron, P. (2003). Computation and analysis of multiple structural change models. Journal of applied econometrics, 18(1), 1-22.

Balke, N. S., Brown, S. P., and Yucel, M. K. (2002). Oil price shocks and the US economy: Where does the asymmetry originate?. The Energy Journal, 23(3).

Barsky, R. B., and Kilian, L. (2001). Do we really know that oil caused the great stagflation? A monetary alternative. NBER Macroeconomics annual, 16, 137-183.

Bayraç, H. N. (2005). Uluslararasi petrol piyasasının ekonomik analizi. Osmangazi Üniversitesi, 67.

Bent, R., Orr, L. and Baker, R. (Ed.). (2002). Energy: Science, policy, and the pursuit of sustainability. Island Press.

Bernanke, B. S., Gertler, M., Watson, M., Sims, C. A., and Friedman, B. M. (1997). Systematic monetary policy and the effects of oil price shocks. Brookings papers on economic activity, 1997(1), 91-157.

Bernanke, B., Gertler, M., and Watson, M. W. (2004). Oil shocks and aggregate macroeconomic behavior: The role of monetary policy: A reply. Journal of Money, Credit, and Banking, 36(2), 287-291.

Berument, H., and Taşçı, H. (2002). Inflationary effect of crude oil prices in Türkiye. Physica A: Statistical Mechanics and its Applications, 316(1-4), 568-580.

Berument, M. H., Ceylan, N. B., and Dogan, N. (2010). The impact of oil price shocks on the economic growth of selected MENA1 countries. The Energy Journal, 31(1).

Binici, İ. (1971). Türkiye'nin Petrol Politikası Nedir?. Elektrik Mühendisliği Dergisi, (171-172), 6-13.

Blanchard, O. J., and Gali, J. (2007). The Macroeconomic Effects of Oil Shocks: Why are the 2000s so different from the 1970s?. NBER Working Papers, 13368.

Blanchard, O. J., and Riggi, M. (2013). Why are the 2000s so different from the 1970s? A structural interpretation of changes in the macroeconomic effects of oil prices. Journal of the European Economic Association, 11(5), 1032-1052.

Bodansky, D. (2003). Nuclear energy: principles, practices, and prospects. Springer Science & Business Media.

BP Stats Review. (2023). Access: 7 October 2023, BP Statistical Review of World Energy, https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

British Petroleum. (2022). BP Energy Outlook 2022 Edition.

Brown, S. P., and Yücel, M. K. (2008). What drives natural gas prices?. The Energy Journal, 29(2).

Burbidge, J., and Harrison, A. (1984). Testing for the effects of oil-price rises using vector autoregressions. International economic review, 459-484.

Cardis, E., and Hatch, M. (2011). The Chernobyl accident—an epidemiological perspective. Clinical Oncology, 23(4), 251-260.

Carlstrom, C. T., and Fuerst, T. S. (2006). Oil prices, monetary policy, and counterfactual experiments. Journal of Money, Credit and Banking, 1945-1958.

Castro, C., Jiménez-Rodríguez, R., Poncela, P., and Senra, E. (2017). A new look at oil price pass-through into inflation: evidence from disaggregated European data. Economia Politica, 34(1), 55-82.

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. Econometrica: Journal of the Econometric Society, 591-605.

Conflitti, C., and Luciani, M. (2019). Oil price pass-through into core inflation. The Energy Journal, 40(6).

Çatık, A. N., and Karaçuka, M. (2012). Oil pass-through to domestic prices in Türkiye: does the change in inflation regime matter?. Economic research-Ekonomska istraživanja, 25(2), 277-296.

Çatik, A. N., and Önder, A. Ö. (2011). Inflationary effects of oil prices in Türkiye: a regime-switching approach. Emerging Markets Finance and Trade, 47, 5, 125-140.

Çıraklı, M.E. (2019). The effect of utilization of domestic coal resources on Turkey's current account balance: An example of Afşin-Elbistan Lignites. Master's Thesis, Hacettepe University, Social Sciences Institute, Ankara.

Darby, M. R. (1982). The price of oil and world inflation and recession. The American Economic Review, 72(4), 738-751.

Darrat, A. F., Gilley, O. W., and Meyer, D. J. (1996). US oil consumption, oil prices, and the macroeconomy. Empirical Economics, 21(3), 317-334.

Davis, S. J., and Haltiwanger, J. (2001). Sectoral job creation and destruction responses to oil price changes. Journal of monetary economics, 48(3), 465-512.

De Gregorio, J., Landerretche, O., Neilson, C., Broda, C., and Rigobon, R. (2007). Another Pass-through Bites the Dust? Oil Prices and Inflation [with Comments]. Economía, 7, 2, 155–208.

De Vries, B. J., Van Vuuren, D. P., and Hoogwijk, M. M. (2007). Renewable energy sources: Their global potential for the first-half of the 21st century at a global level: An integrated approach. Energy policy, 35(4), 2590-2610.

Dedeoğlu, D., and Kaya, H. (2014). Pass-through of oil prices to domestic prices: Evidence from an oil-hungry but oil-poor emerging market. Economic Modelling, 43, 67-74.

Dickey, D. A., and Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica: journal of the Econometric Society, 1057-1072.

Natural Gas Market 2021 Sector Report. (2021). Energy Market Regulatory Authority. Ankara.

Doğru, C. (2010). Türkiye'de elektrik piyasasının yeniden yapılanması sürecine bir bakış. Sosyal Bilimler Metinleri, 2010(1), 1-30.

Doğrul, H. G., and Soytaş, U. (2010). Relationship between oil prices, interest rate, and unemployment: Evidence from an emerging market. Energy Economics, *32*(6), pp. 1523-1528.

Du, L., Yanan, H., and Wei, C. (2010). The relationship between oil price shocks and China's macro-economy: An empirical analysis. Energy policy, *38*(8), pp. 4142-4151.

Tariff Based on Electricity Bills. (2022). Access: 8 September 2022, EPDK, https://www.epdk.gov.tr/Detay/Icerik/3-1327/elektrik-faturalarina-esas-tarife-tablolari

Electricity Market Report. (2022). Energy Market Regulatory Authority. Ankara.

Engin, N. (2010). Enerji Kaynağı Olarak Doğalgaz ve Türkiye. Marmara Coğrafya Dergisi, (22), 233-244.

Europe must not backslide on climate action despite war in Ukraine. (2022). Nature, 607(7917), 8.

Ferderer, J. P. (1996). Oil price volatility and the macroeconomy. Journal of macroeconomics, 18(1), 1-26.

Fernihough, A., and O'Rourke, K. H. (2014). Coal and the European industrial revolution. National Bureau of Economic Research, 19802.

Filis, G., and Chatziantoniou, I. (2014). Financial and monetary policy responses to oil price shocks: evidence from oil-importing and oil-exporting countries. Review of Quantitative Finance and Accounting, *42*(4), 709-729.

Finkelman, R. B., Orem, W., Castranova, V., Tatu, C. A., Belkin, H. E., Zheng, B., and Bates, A. L. (2002). Health impacts of coal and coal use: possible solutions. International Journal of Coal Geology, 50(1-4), 425-443.

Furtana, T.E. (2020). Türkiye'nin enerji bağımlılığındaki politik riskin dış ticarete etkileri. PhD Thesis, İstanbul Ticaret University Graduate School of Foreign Trade, İstanbul.

Gisser, M., and Goodwin, T. H. (1986). Crude oil and the macroeconomy: Tests of some popular notions: Note. Journal of Money, Credit and Banking, 18(1), 95-103.

Granger, C. W., and Newbold, P. (1974). Spurious regressions in econometrics. Journal of econometrics, 2(2), 111-120.

Güney, P. and Hasanov M. (2013). The effects of oil prices changes on output growth and inflation: evidence from Türkiye. Journal of Economics and Behavioral Studies, 5(11), 730-739.

Gürkaynak, R. S., Kısacıkoğlu, B., and Lee, S. S. (2023). Exchange rate and inflation under weak monetary policy: Turkey verifies theory. Economic Policy, eiad020.

Halkos, G. E., and Gkampoura, E. C. (2020). Reviewing usage, potentials, and limitations of renewable energy sources. Energies, 13(11), 2906.

Hamilton, J. D. (1983). Oil and the macroeconomy since World War II. Journal of political economy, 91(2), 228-248.

Hamilton, J. D. (1988). A neoclassical model of unemployment and the business cycle. Journal of political Economy, 96(3), 593-617.

Hamilton, J. D. (1996). This is what happened to the oil price-macroeconomy relationship. Journal of monetary economics, 38(2), 215-220.

Hamilton, J. D. (2009). Understanding crude oil prices. The energy journal, 30(2).

Hamilton, J. D., and Herrera, A. M. (2004). Comment: oil shocks and aggregate macroeconomic behavior: the role of monetary policy. Journal of Money, credit and Banking, 265-286.

Heather, P. (2015). The evolution of European traded gas hubs . Oxford Institute for Energy Studies. http://www.jstor.org/stable/resrep31037.8, 10-15.

Heather, P. (2021). European traded gas hubs: German hubs about to merge (No. 170). OIES Paper: NG.

Herzog, A. V., Lipman, T. E., and Kammen, D. M. (2001). Renewable energy sources. Encyclopedia of life support systems (EOLSS). Forerunner Volume-‘Perspectives and overview of life support systems and sustainable development, 76.

Hooker, M. A. (1996). What happened to the oil price-macroeconomy relationship?. Journal of monetary Economics, 38(2), 195-213.

Hooker, M. A. (2002). Are oil shocks inflationary? Asymmetric and nonlinear specifications versus changes in regime. Journal of money, credit and banking, 540-561.

Högselius, P. (2013). Before Siberia: The Rise of the Soviet Natural Gas Industry. Red Gas Palgrave Macmillan, 181(1), 13-29.

Hubbert, M. K. (1956). Nuclear energy and the fossil fuels (95). Houston, TX: Shell Development Company, Exploration and Production Research Division.

Hulshof, D., Van Der Maat, J. P., and Mulder, M. (2016). Market fundamentals, competition and natural-gas prices. Energy policy, 94, 480-491.

Hultman, N. E. (2011). The political economy of nuclear energy. Wiley Interdisciplinary Reviews: Climate Change, 2(3), 397-411.

Huntington, H. G. (1998). Crude oil prices and US economic performance: where does the asymmetry reside?. The Energy Journal, 19(4).

International Atomic Energy Agency. (2022). Energy, Electricity and Nuclear Power Estimates for the Period up to 2050. Reference Data Series(1). Vienna.

Issawi, C. (1978). The 1973 oil crisis and after. Journal of Post Keynesian Economics, 1(2), 3-26.

İnançlı, S., Figan, T., and Dilek, S. (2020). Natural Monopolies And Regulations In Turkish Energy Markets. Journal of Original Studies, 1(2), 141-154.

Kandemir Kocaaslan, O. (2021). Are the responses of output and investment to oil price shocks asymmetric?: The case of an oil-importing small open economy. Empirical Economics, 61(5), 2501-2516.

Karaca, O. (2003). Türkiye'de enflasyon-büyüme ilişkisi: zaman serisi analizi. Doğuş Üniversitesi Dergisi, 4(2), 247-255.

Karaoğlu, A. (2020). Uluslararası Elektrik Piyasalarında Rekabetin Temin Edilmesi ve Ekonomik Düzenlemeler. Master's Thesis, Gazi University, Social Sciences Institute, Ankara.

Kibritçioğlu, A., and Kibritçioğlu, B. (1999). Inflation Effect of Crude oil Prices. Hazine Müsteşarlığı Ekonomik Araştırmalar Genel Müdürlüğü Araştırma ve İnceleme Dizisi, 21.

Kilian, L. (2009). Not all price shocks are alike: Disentangling demand and supply shocks in the crude oil market. American Economic Review, 99(3), 1053–1069

Kilian, L., and Lewis, L. T. (2011). Does the Fed respond to oil price shocks?. The Economic Journal, 121(555), 1047-1072.

Koç, E. and Kaya, K. (2015). Enerji Kaynakları - Yenilenebilir Enerji Durumu. Mühendis ve Makina, 56(668), 36-47.

Koppelaar R., and Middelkoop W. (2017). The Tesla Revolution : Why Big Oil Is Losing the Energy War. Amsterdam University Press.

Lazard. (2023). Lazard’s Levelized Cost of Energy Analysis–Version 16.0. New York.

LeBlanc, M. and Chinn, M. D. (2004). Do high oil prices presage inflation? The evidence from G-5 countries. UC Santa Cruz Economics Working Paper, 561, 04-04.

Leduc, S., and Sill, K. (2004). A quantitative analysis of oil-price shocks, systematic monetary policy, and economic downturns. Journal of Monetary Economics, 51(4), 781-808.

Lee, Junsoo, and Mark C. Strazicich, 2013, “Minimum LM Unit Root Test with One Structural Break.” Economics Bulletin, 33(4): 2483-2492.

Li, R., Joyeux, R., and Ripple, R. D. (2010). International steam coal market integration. The Energy Journal, 31(3).

Lin, S. X., and Tamvakis, M. (2010). OPEC announcements and their effects on crude oil prices. Energy Policy, 38(2), 1010-1016.

MacKinnon, J. G. (1996). Numerical distribution functions for unit root and cointegration tests. Journal of applied econometrics, 11(6), 601-618.

Maghyereh, A. (2004). Oil Price Shocks and Emerging Stock Markets: A Generalized VAR Approach. International Journal of Applied Econometrics and Quantitative Studies, 1(2), 27-40.

Mandal, K., Bhattacharyya, I., ve Bhoi, B. B. (2012). Is the oil price pass-through in India any different?. Journal of Policy Modeling, 34(6), 832-848.

MAPEG Petroleum Statistics. (2022). Access: 2 November 2022, ETKB Maden ve Petrol İşleri Genel Müdürlüğü, https://www.mapeg.gov.tr/Custom/Petrolistatistik

Martin, P., and Di Mauro, B. W. (2022). Winter is coming: Energy policy towards Russia. VoxEU. org, 23.

Mazighi, A. E. H. (2005). Henry Hub and national balancing point prices: what will be the international gas price reference?. OPEC review, 29(3), 219-230.

Moriarty, P., and Honnery, D. (2012). What is the global potential for renewable energy?. Renewable and Sustainable Energy Reviews, 16(1), 244-252.

Mork, K. A. (1989). Oil and the macroeconomy when prices go up and down: an extension of Hamilton's results. Journal of political Economy, 97(3), 740-744.

Mork, K. A. (1994). Business cycles and the oil market. The Energy Journal, 15.

Narayan, P. K. (2004). Fiji's tourism demand: the ARDL approach to cointegration. Tourism Economics, 10(2), 193-206.

National Energy Balance Sheet. (2021). Access: 30 September 2022, ETKB Enerji İşleri Genel Müdürlüğü İstatistikleri, https://enerji.gov.tr/Preview/tr/63d0007a-f593-458b-9610-353eb2545897

Nazlioglu, S., Gormus, A., and Soytas, U. (2019). Oil prices and monetary policy in emerging markets: structural shifts in causal linkages. Emerging Markets Finance and Trade, 55(1), 105-117.

Noble, P. G. (2009). A short history of lng shipping. Texas Section SNAME.

Nuclear Power and Secure Energy Transitions (2022). International Energy Agency. Paris.

Ou, B., Zhang, X. and Wang, S., (2012). How does China's macro-economy response to the world crude oil price shock: a structural dynamic factor model approach. Comput. Ind. Eng. 63, pp. 634–640.

Peker, O. and Mercan, M. (2011). The Inflationary Effect of Price Increases in Oil Products in Türkiye. Ege Akademik Bakış, 11, 4, 553-562.

Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics, 16(3), 289-326.

Petroleum Market Report. (2022). Energy Market Regulatory Authority. Ankara.

Petroleum and Natural Gas Market Report. (2021). Türkiye Petrolleri Anonim Ortaklığı. Ankara.

Pratt, J. A., Melosi, M. V. and Brosnan, K. A. (Eds.). (2014). Energy Capitals: Local Impact, Global Influence. University of Pittsburgh Press.

Qazi, A., Hussain, F., Rahim, N. A., Hardaker, G., Alghazzawi, D., Shaban, K., and Haruna, K. (2019). Towards sustainable energy: a systematic review of renewable energy sources, technologies, and public opinions. IEEE access, 7, 63837-63851.

Razmi, F , Mohamed, A , Chin, L , and Habibullah, M . (2015). The Role of Monetary Policy in Macroeconomic Volatility of Association of Southeast

Asian Nations-4 Countries against Oil Price Shock over Time . International Journal of Energy Economics and Policy, 5 (3) , pp. 731-737.

Rotemberg, J. J., and Woodford, M. (1996). Imperfect competition and the effects of energy price increases on economic activity. National Bureau of Economic Research, 5634.

Sakashita, Y., and Yoshizaki, Y. (2016). The effects of oil price shocks on IIP and CPI in emerging countries. Economies, 4(4), 20.

Sarı, R., and Soytaş, U. (2006). The relationship between stock returns, crude oil prices, interest rates, and output: evidence from a developing economy. The Empirical Economics Letters, 5(4), 205-220.

Sarıtürk, M. (2008). Kamu yönetiminde esneklik ve bağımsız idari otoriteler: Enerji Piyasası Düzenleme Kurumu örneği. PhD Thesis, Dokuz Eylül University Social Sciences Institute, İzmir.

Sekin, S. (1998). Türkiye'de petrol. Marmara Coğrafya Dergisi, (2), 122-127.

Selçuk, Ö. Z., and Togay, S. (2018). Elektrik Sektöründeki Yapısal Reformların Ekonomik Büyüme Üzerindeki Etkileri: Türkiye Örneği. Maliye Araştırmaları Dergisi, 4(3), 171-184.

Shahzad, S. J. H., Nor, S. M., Ferrer, R., and Hammoudeh, S. (2017). Asymmetric determinants of CDS spreads: US industry-level evidence through the NARDL approach. Economic Modelling, 60, 211-230.

Shin, Y., Yu, B., and Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In Festschrift in honor of Peter Schmidt (pp. 281-314). Springer, New York, NY.

Sinan, B. (2021). Türkiye'de Yekdem İle Döviz Kuru, Elektrik Tüketimi Arasındaki İlişki. Finans Ekonomi ve Sosyal Araştırmalar Dergisi, 6(2), 191-207.

Sobacı, M. Z. (2005). Bağımsız İdari Oteriteler Ve Türkiye uygulamasından Bir örnek: Enerji Piyasası Düzenleme Kurumu. PhD Tesis, Uludağ University Social Sciences Institute, Bursa.

Solak, A. O. (2012). Petrol fiyatlarını belirleyici faktörler. Uluslararası Alanya İşletme Fakültesi Dergisi, 4(2), 117-124.

Speight, J. G. (2018). Handbook of natural gas analysis. John Wiley & Sons.

Spot Prices for Crude Oil and Petroleum Products. (2022). Access: 5 September 2022, U.S. Energy Information Administration Database, https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm

Sribna, Y., Trokhymets, O., Nosatov, I., and Kriukova, I. (2019). The globalization of the world coal market–contradictions and trends. In E3S Web of Conferences, 123.

Stern, J. (2003). Natural gas in Europe− the importance of Russia. Centrex Europe Energy & Gas AG. http://www. centrex. at/en/files/study_stern_e. pdf, 24, 2014.

Stern, J. (2014). International gas pricing in Europe and Asia: A crisis of fundamentals. Energy Policy, 64, 43-48.

Şeker, A. (2016). Yenilenebilir Enerji, Türkiye'de Yenilenebilir Enerji Potansiyeli Ve Yeşil Pazarlama Ve Yenilenebilir Enerjinin Pazarlanması. Journal of International Social Research, 9(46).

Şener, G. M., and Sözen, A. (2016). Doğal Gaz Yeraltı Depolamanın Termodinamik Kritikleri. Gazi Mühendislik Bilimleri Dergisi, 2(1), 21-39.

Şimşek, T. (2016). Türkiye'de enerji tüketimi ve ekonomik büyüme arasındaki ilişkinin ARDL sınır testi ile incelenmesi. Journal of International Management Educational and Economics Perspectives, 4(1), 69-78.

Tang, W., Wu, L., and Zhang, Z. (2010). Oil price shocks and their short-and long-term effects on the Chinese economy. Energy Economics, 32, 3-14.

Tatom, J. A. (1981). Energy prices and short-run economic performance. Federal Reserve Bank of St. Louis Review, 63(1), 3-17.

Taylor, J. B. (1999). A historical analysis of monetary policy rules. University of Chicago Press in Monetary Policy Rules, 319-348.

TEİAŞ Electricity Generation-Transmission Statistics. (2022). Access: 20 October 2022, Türkiye Elektrik İletim AŞ İstatistikleri, https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri

The International Energy Agency. (2023). World Energy Outlook. Paris.

The International Renewable Energy Agency (2023). Energy Agency World Energy Transitions Outlook 2023: 1.5°C Pathway. Abu Dhabi.

The Organisation for Economic Co-operation and Development/ The International Energy Agency. (2004). Energy Statistics Manual. Paris.

Theisen, N. (2014). Natural Gas Pricing in the EU: from oil-indexation to a hybrid pricing system. Regional Centre for energy policy research, 40.

Topal, F. (2019). Yenilenebilir enerji kaynakları destekleme mekanizmasının (YEKDEM) elektrik piyasalarına olan etkileri ve sürdürülebilir bir model önerisi. Master’s Thesis, Afyon Kocatepe University, Institute of Science and Engineering, Afyonkarahisar.

Torul, O., and Alper, C. E. (2010). Asymmetric effects of oil prices on the manufacturing sector in Türkiye. Review of Middle East Economics and Finance, 6(1), 90-105.

Ulug, M., Işık, S., and Mert, M. (2023). The effectiveness of ultra-loose monetary policy in a high inflation economy: a time-varying causality analysis for Turkey. Economic Change and Restructuring, 56(4), 2855-2887.

USA Shale gas Production. (2021). Access: 30 Eylül 2022, US Energy Information Administration, http://www.eia.gov/dnav/ng/hist/res_epg0_r5302_nus_bcfa.htm

Valcarcel, V. J., and Wohar, M. E. (2013). Changes in the oil price-inflation pass-through. Journal of Economics and Business, 68, 24-42.

Wang, Y. and Zhu, Q. (2015) “Energy price shocks, monetary policy and China’s economic fluctuations”, Asian-Pacific Economic Literature, 29(1), pp. 126–141.

Voyvoda, Ö. K., and Voyvoda, E. (2019). Türkiye’de Enerji Sektörünün Yeniden Yapılandırılması Sürecinde Hukuk Düzenlemeleri – Elektrik Sektörü. Çalışma ve Toplum, 127-154.

Wang, Y., Wu, C., and Yang, L. (2013). Oil price shocks and stock market activities: Evidence from oil-importing and oil-exporting countries. Journal of Comparative economics, 41(4), 1220-1239.

Yanıkkaya, H., Kaya, H., and Akgül, D. (2015). Petrol Fiyatlarının Enflasyona Geçişkenliği Değişti mi?. Central Bank Review, 15(3), 75-88.

Yardımcı, O. (2011). Türkiye doğal gaz piyasası: Geçmiş 25 yıl, gelecek 25 yıl. Ekonomi Bilimleri Dergisi, 3(2), 157-166.

Yaylalı, M. and Lebe, F. (2012). İthal ham petrol fiyatlarinin Türkiye’deki makroekonomik aktiviteler üzerindeki etkisi. Marmara Üniversitesi İktisadi ve İdari Bilimler Dergisi, 32(1), 43-68.

Yergin, D. (2003). The prize: The epic quest for oil, money & power. (Translator: Tuncay, K.). Türkiye İş Bankası Kültür Yayınları.

Yilmazkuday, H. (2022). Drivers of Turkish inflation. The Quarterly Review of Economics and Finance, 84, 315-323.

Yurtoğlu, N. (2017). Cumhuriyet Döneminde Türkiye'de Petrol Arama Politikaları (1923-1950). Gazi Akademik Bakış, 10(20), 145-168.

Zhang, D., Wang, T., Shi, X., and Liu, J. (2018). Is hub-based pricing a better choice than oil indexation for natural gas? Evidence from a multiple bubble test. Energy Economics, 76, 495-503.

Zou, C., Zhao, Q., Zhang, G., and Xiong, B. (2016). Energy revolution: From a fossil energy era to a new energy era. Natural Gas Industry B, 3(1), 1-11.

APPENDIX 1: ORIGINALITY REPORT

HACETTEPE ÜNİVERSİTESİ SOSYAL BİLİMLER ENSTİTÜSÜ	Doküman Kodu *Form No.*	FRM-YL-15
	Yayım Tarihi *Date of Pub.*	04.12.2023
FRM-YL-15 **Yüksek Lisans Tezi Orijinallik Raporu** *Master's Thesis Dissertation Originality Report*	Revizyon No *Rev. No.*	02
	Revizyon Tarihi *Rev.Date*	25.01.2024

TO HACETTEPE UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF......ECONOMICS.........................

Date 02/04/2024

Thesis Title (In English): The Effects of Energy Prices on Inflation And Monetary Policy: The Case of Turkey

According to the originality report obtained by ~~myself~~/my thesis advisor by using the Turnitin plagiarism detection software and by applying the filtering options checked below on 01/02/2024 for the total of ......90.... pages including the a) Title Page, b) Introduction, c) Main Chapters, and d) Conclusion sections of my thesis entitled above, the similarity index of my thesis is .21.... %.

Filtering options applied**:

1. ☐ Approval and Decleration sections excluded
2. ☐ References cited excluded
3. ☐ Quotes excluded
4. ☒ Quotes included
5. ☐ Match size up to 5 words excluded

I hereby declare that I have carefully read Hacettepe University Graduate School of Social Sciences Guidelines for Obtaining and Using Thesis Originality Reports that according to the maximum similarity index values specified in the Guidelines, my thesis does not include any form of plagiarism; that in any future detection of possible infringement of the regulations I accept all legal responsibility; and that all the information I have provided is correct to the best of my knowledge.

Kindly submitted for the necessary actions. Muhammed Taha Çiçek

Name-Surname/Signature

Student Information		
	Name-Surname	Muhammed Taha Çiçek
	Student Number	N20134293
	Department	Economics
	Programme	Economics M.A. with thesis

SUPERVISOR'S APPROVAL

Prof. Dr. Özge Kandemir Kocaaslan

APPROVED
(Title, Name and Surname, Signature)

**As mentioned in the second part [article (4)/3]of the Thesis Dissertation Originality Report's Codes of Practice of Hacettepe University Graduate School of Social Sciences, filtering should be done as following: excluding refence, quotation excluded/included, Match size up to 5 words excluded.

APPENDIX 2: ETHICS BOARD WAIVER FORM

	HACETTEPE ÜNİVERSİTESİ SOSYAL BİLİMLER ENSTİTÜSÜ	Doküman Kodu *Form No.*	FRM-YL-09
		Yayım Tarihi *Date of Pub.*	22.11.2023
	FRM-YL-09 **Yüksek Lisans Tezi Etik Kurul Muafiyeti Formu** *Ethics Board Form for Master's Thesis*	Revizyon No *Rev. No.*	02
		Revizyon Tarihi *Rev.Date*	25.01.2024

HACETTEPE UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF Economics

Date: 02/04/2024

ThesisTitle (In English): The Effects of Energy Prices on Inflation and Monetary Policy: The Case of Turkey

My thesis work with the title given above:

1. Does not perform experimentation on people or animals.
2. Does not necessitate the use of biological material (blood, urine, biological fluids and samples, etc.).
3. Does not involve any interference of the body's integrity.
4. Is not a research conducted with qualitative or quantitative approaches that require data collection from the participants by using techniques such as survey, scale (test), interview, focus group work, observation, experiment, interview.
5. Requires the use of data (books, documents, etc.) obtained from other people and institutions. However, this use will be carried out in accordance with the Personal Information Protection Law to the extent permitted by other persons and institutions.

I hereby declare that I reviewed the Directives of Ethics Boards of Hacettepe University and in regard to these directives it is not necessary to obtain permission from any Ethics Board in order to carry out my thesis study; I accept all legal responsibilities that may arise in any infrigement of the directives and that the information I have given above is correct.

I respectfully submit this for approval.

Muhammed Taha ÇİÇEK

Name-Surname/Signature

Student Information		
	Name-Surname	Muhammed Taha ÇİÇEK
	Student Number	N20134293
	Department	Economics
	Programme	Economics M.A. with thesis

SUPERVISOR'S APPROVAL

Prof. Dr. Özge Kandemir Kocaaslan

APPROVED
(Title, Name Surname, Signature)