Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Trade and Finance

Master's Thesis

The Impact of Electricity Price on Economic Inflation in Azerbaijan

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Bachelor of Science Gulnisa Nazarova, BS

Economics and Management

Thesis title

The impact of electricity price on economic inflation in Azerbaijan

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Objectives of thesis

i. To analyze the relationship between electricity prices and economic inflation in Azerbaijan.
ii. To examine the factors influencing electricity prices in Azerbaijan
iii. To assess the impact of electricity price fluctuations on different sectors of the Azerbaijani economy
iv. To investigate the role of government policies and regulations in shaping electricity prices and their effects on inflation

Methodology

In the world of economics, understanding the factors influencing inflation can provide governments with crucial insights to inform policymaking. For countries like Azerbaijan, where energy plays a vital role in its economic landscape, one question often emerges: How do electricity prices influence inflation?

Diploma thesis's aim is determined if there exists a cause-and-effect relationship between electricity prices and the rate of economic inflation in Azerbaijan.

For this study, the information on electricity prices will be gleaned from reputable entities such as Azerbaijan's Ministry of Energy, local utility companies, and globally recognized energy agencies. Concurrently, data on inflation rates will be harnessed from resources like Azerbaijan's Central Bank, the World Bank, and the International Monetary Fund (IMF). Focus is on the period from 2000 to 2022, ensuring consistency for accurate comparisons.

The study will center on two primary elements. In this context, the dependent variable is Azerbaijan's yearly inflation rate, expressed as a percentage. Conversely, the independent variable is defined by the electricity price, represented as cost per kWh.

To delineate this relationship, a regression model is employed. This analytical tool aims to project potential shifts in the inflation rate when electricity prices alter, ensuring all other factors are constant. The inclusion of control variables like the GDP growth rate, unemployment statistics, international fuel prices, and exchange rates enriches the analysis, offering a layered perspective on the topic.

The technical aspects of the study involve the Ordinary Least Squares (OLS) method. Chosen for its widespread applicability and straightforwardness, this method will estimate how closely tied the two variables are.

From this analysis, we will be testing two contrasting hypotheses. The first, a null hypothesis, suggests that electricity prices don't significantly sway economic inflation in Azerbaijan. Conversely, the alternative hypothesis posits that they do.

In conclusion, this research seeks to shed light on the intricate dance between electricity prices and economic inflation in Azerbaijan.

The proposed extent of the thesis

50-60

Keywords

inflation, electricity price, energy consumption, price change, GDP, Azerbaijan

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Recommended information sources

Bednář, O.; Čečrdlová, A.; Kadeřábková, B.; Řežábek, P. Energy Prices Impact on Inflationary Spiral. Energies 2022, 15, 3443. https://doi.org/10.3390/en15093443

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Expected date of thesis defence

2023/24 SS – PEF

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Electronic approval: 3. 11. 2023

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Prague on 11. 03. 2024

Declaration

I declare that I have worked on my master's thesis titled " The Impact of Electricity Price on Economic Inflation in Azerbaijan" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2024 ______________________________

Acknowledgement

I would like to thank Fandi Ghaeth, Ph.D. and all other persons, for their advice and support during my work on this thesis.

The Impact of Electricity Price on Economic Inflation in Azerbaijan

Abstract

This study delves into the impact of electricity pricing on Azerbaijan's inflation, exploring the relationship between electricity price fluctuations and economic inflation. It aims to investigate the linkage between electricity prices and inflation, identify electricity pricing determinants, assess how electricity price changes affect Azerbaijan's various economic sectors, and analyze government policy's role in electricity pricing and its effects on inflation. The research methodology includes an econometric analysis using the Ordinary Least Squares (OLS) method, focusing on variables like electricity price, interest rate, exchange rate, and GDP to study their impact on inflation.

A dual-case study approach enriches this investigation. The first case study examines the direct correlation between electricity prices and inflation, while the second, titled "Assessing the Dynamics of Electricity Pricing in Azerbaijan," explores the broader economic consequences of electricity price variations. It evaluates sectoral impacts, particularly on agriculture and investigates government interventions in electricity pricing, including subsidies and tariffs, to understand their influence on the economy. This research aims to shed light on the complex interplay between electricity pricing, sectoral economic performance, and inflation in Azerbaijan, providing valuable insights for energy sector policymakers and stakeholders.

Keywords: inflation, electricity price, energy consumption, price change, GDP, Azerbaijan

Vliv ceny elektřiny na ekonomickou inflaci v Ázerbájdžánu

Abstrakt

Tato studie se zabývá dopadem cen elektřiny na ázerbájdžánskou inflaci a zkoumá vztah mezi kolísáním cen elektřiny a ekonomickou inflací. Jeho cílem je prozkoumat souvislost mezi cenami elektřiny a inflací, identifikovat determinanty tvorby cen elektřiny, posoudit, jak změny cen elektřiny ovlivňují různá hospodářská odvětví Ázerbájdžánu, a analyzovat roli vládní politiky při stanovování cen elektřiny a její dopady na inflaci. Metodologie výzkumu zahrnuje ekonometrickou analýzu využívající metodu obyčejných nejmenších čtverců (OLS) se zaměřením na proměnné, jako je cena elektřiny, úroková míra, směnný kurz a HDP, za účelem studia jejich vlivu na inflaci.

Toto šetření obohacuje přístup duální případové studie. První případová studie zkoumá přímou korelaci mezi cenami elektřiny a inflací, zatímco druhá s názvem „Hodnocení dynamiky tvorby cen elektřiny v Ázerbájdžánu“ zkoumá širší ekonomické důsledky kolísání cen elektřiny. Hodnotí sektorové dopady, zejména na zemědělství, a zkoumá vládní zásahy do cen elektřiny, včetně dotací a tarifů, aby pochopil jejich vliv na ekonomiku. Tento výzkum si klade za cíl objasnit složitou souhru mezi cenami elektřiny, odvětvovou ekonomickou výkonností a inflací v Ázerbájdžánu a poskytnout cenné poznatky pro tvůrce politik v energetickém sektoru a zúčastněné strany..

Klíčová slova: inflace, cena elektřiny, spotřeba energie, změna cen, HDP, Ázerbájdžán

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1. Introduction

1.1 Overview of Azerbaijan

Situated in the southern part of the Great Caucasus Mountains between Europe and Asia, Azerbaijan shares borders with five neighboring countries on land. To the north, it meets Russia along a 390 km border. Along its northwest, it shares a 471 km border with Georgia. Iran borders Azerbaijan to the south, running along the Aras river for 765 km. To the west and southwest, Azerbaijan shares a 1007 km border with Armenia. Additionally, its enclave, the Nakhchivan Autonomous Republic, shares a 15 km border with Turkey. With a coastline stretching 2647 km along the Caspian Sea, Azerbaijan's 86,600 km² territory is home to a diverse population of 10 million people. Baku, the country's capital and largest city with a population of 2.3 million, also serves as its economic and political epicenter. The official currency is the Azerbaijani Manat (AZN), and while Azerbaijani is the primary language, Russian is widely spoken as well.

Picture 1. Azerbaijan Map

Source: Worldmotor,2024

Due to its strategic location, Azerbaijan has benefited from commercial routes, cultural exchanges, and geopolitical connections throughout history. Its proximity to the Caspian Sea supports its position as a key actor in the regional dynamics of energy while also providing access to an abundance of maritime resources. Furthermore, the nation's close proximity to neighboring countries like Georgia, Armenia, Russia, Iran, and Armenia cultivates complex diplomatic relations and geopolitical factors that influence its socioeconomic development.

After the restoration of independence in 1991, the Republic of Azerbaijan embarked on asserting its sovereign rights in the economic domain and initiating autonomous policies. Key objectives of these policies included restructuring the economic system to accommodate various forms of ownership, transitioning towards a market-oriented economy, and fostering integration into the global economic framework.
Economically, the post-independence years can be delineated into two distinct phases. The initial phase spanning from 1991 to 1995 was marked by economic turbulence and regression. Conversely, the period following 1996 witnessed a notable upturn characterized by enhanced macroeconomic stability and robust economic growth. (Azerbaijan,2024)
Between 2013 and 2017, the annual average increase in the gross domestic product (GDP) was recorded at 1.4%, a significant decrease from the 5.5% yearly growth observed between 2008 and 2012. This reduction was largely attributed to the performance of the hydrocarbon industry, which represents about one-third of the nation's GDP and accounts for more than 90% of its total exports. The downturn in global oil prices in 2014, coupled with a decrease in oil production, primarily drove this downturn. Additionally, the fall in oil prices resulted in reduced remittance flows from Azerbaijan’s partners in the hydrocarbon sector.However, after facing a severe downturn due to the Covid-19 pandemic, which saw the economy shrink by 4.3% in 2021 (or 5.6%, according to government figures), Azerbaijan's economy experienced a swift rebound. This recovery was bolstered by strong performances in sectors such as manufacturing, transportation, retail trade, and information and communications technologies. Moreover, there has been a notable recovery in the service sectors, including hospitality.

In the realm of exports, oil and gas constitute over 90% of Azerbaijan’s total, with a significant surge in production seen in the 2000s after the Shah Deniz gas field was discovered, peaking in 2010. There have been substantial investments by both the government and international firms in the energy sector. This includes the construction of new power facilities and the renovation and upgrading of the gas and electricity networks, enhancing the reliability and security of energy supply.

The potential for renewable energy development in Azerbaijan is vast, with excellent opportunities for solar and wind energy, as well as considerable prospects for biomass, geothermal, and hydroelectric power. However, the adoption of these resources has been modest when measured against the country's extensive potential and long-term energy goals.

Renewable energy presents a viable solution for Azerbaijan to meet its climate objectives, notably its commitment to a 35% reduction in greenhouse gas emissions by 2030 compared to the levels in 1990, as outlined in its nationally determined contribution (NDC) to the Paris Agreement. This commitment highlights the country's strategy to leverage alternative and renewable energy sources to meet these goals.

Despite the extensive privatization across various sectors since gaining independence, the energy sector in Azerbaijan remains largely state-controlled, with only a small fraction of hydropower plants being privately owned, contributing to less than 1% of the nation's electricity production. (IEA,2024)

1.2 Electricity in Azerbaijan

Electricity is increasingly becoming a dominant force in global energy consumption due to the world's economic expansion in recent years. The need for resources to generate electricity has surged dramatically. From 1990 to 2016, the worldwide demand for electricity saw a twofold increase, and it is anticipated to represent 40% of the overall energy consumption by 2040. (Topcu et al., 2019)

The energy and utilities sector, particularly electricity, is a cornerstone of Azerbaijan's economic and social progress. The country has achieved complete electrification, with electricity ranking as the third most consumed energy source—following natural gas and oil—for both household and industrial purposes. Significant investments in power generation and transmission infrastructure since 2009 have led to notable enhancements in power supply quality. The country now produces enough electricity to meet its domestic needs, and its power network is equipped to deliver electricity of satisfactory quality to nearly all its citizens.

According to the Table 1, Azerbaijan's energy landscape is heavily reliant on its fossil fuel resources, primarily natural gas and oil, which have historically powered its economy. However, recognizing the importance of sustainable and environmentally friendly energy sources, the country is making significant investments in renewable energy. This shift includes expanding hydropower capacity, installing solar power plants, and exploring wind energy potential, with the goal of increasing the renewable share in its energy mix to 30% by 2030. This diversification strategy not only aims to reduce carbon emissions but also to enhance energy security and reduce dependence on fossil fuels.

Table 1. Sources of electricity in Azerbaijan

Energy Source	Utilization
Natural Gas	Primary source for thermal power plants.
Oil	Used in thermal power plants, significant but declining source.
Hydropower	Renewable source from water; several hydroelectric power plants.
Wind	Particularly in areas like the Absheron peninsula, Caspian Sea coast.
Solar	Increasing importance with major solar power plant installations.
Biomass	Contributes to the renewable energy sector; uses organic materials.

Source: IEA,2023

The energy sector, particularly the oil, gas, and power sectors, plays a pivotal role in Azerbaijan's economic landscape. Its significance is underscored by efforts to enhance energy efficiency and the expansion of the nation's energy infrastructure.

Azerbaijan's prominent role in the production of oil and natural gas places the nation at the heart of the global energy market. Consequently, the international pricing trends of these critical commodities are of paramount importance. Variations in the global prices of oil and natural gas have a direct and significant effect on the costs associated with generating electricity. This relationship underscores the deep ties between the fluctuations in global energy markets and the determination of electricity prices within the domestic sphere of Azerbaijan. Azerbaijan has achieved complete electrification, with electricity ranking as the third most used energy source, following natural gas and oil, for both residential and industrial applications. Prioritizing the sustainable growth of the power sector is a key governmental agenda. According to Table 2, there is a detailed account of the growth in installed capacity and electricity production in Azerbaijan from 2003 to 2022.

Table 2. Electricity Generation Capacity (MWt) (2003-2022)

Years	Plant capacity for the end of the year	Electric and CHP plants working with fuel - total	Hydroelectric plants	Wind plants	Solar plants	Solid domestic waste plant	Biogas electric plants
2003	5,673.1	4,703.0	970.1	-	-	-	-
2004	5,665.1	4,695.0	970.1	-	-	-	-
2005	5,157.1	4,187.0	970.1	-	-	-	-
2006	5,624.0	4,599.0	1,025.0	-	-	-	-
2007	5,728.0	4,703.0	1,025.0	-	-	-	-
2008	5,798.0	4,773.0	1,025.0	-	-	-	-
2009	6,389.7	5,401.0	987.0	1.7	-	-	-
2010	6,397.7	5,401.0	995.0	1.7	-	-	-
2011	6,350.0	5,352.0	998.0	-	-	-	-
2012	6,420.0	5,397.0	1,023.0	-	-	-	-
2013	7,353.3	6,230.1	1,082.5	2.7	1.0	37.0	-
2014	7,353.4	6,233.4	1,077.9	2.7	2.4	37.0	-
2015	7,806.7	6,652.8	1,103.4	7.7	4.8	37.0	1.0
2016	7,910.4	6,726.8	1,105.0	15.7	24.9	37.0	1.0
2017	7,941.5	6,748.0	1,106.4	15.7	28.4	42.0	1.0
2018	7,828.9	6,552.2	1,130.8	66.0	34.9	44.0	1.0
2019	7,641.6	6,350.3	1,144.8	66.1	35.4	44.0	1.0
2020	7,621.6	6,326.1	1,149.4	66.0	35.1	44.0	1.0
2021	7,965.2	6,649.4	1,157.2	66.0	47.9	44.0	0.7
2022	7,976.9	6,652.3	1,164.7	64.0	51.2	44.0	0.7

Source: own construction according to data of the State Statistical Committee of the Republic of Azerbaijan,2024

The varied mix of energy sources that Azerbaijan employs for generating electricity—ranging from hydroelectric, solar, and wind power to conventional fossil fuels—is fundamentally important. After the initial setup of infrastructure, renewable energy sources generally incur lower operational expenses than their fossil fuel counterparts. This difference significantly impacts the future direction of electricity pricing, underscoring the critical role of energy diversification in shaping the economic landscape of electricity. Currently, Azerbaijan possesses sufficient electricity generation capacity to fully meet the nation's peak energy requirements. The utilization of these generating capacities varies based on factors such as demand, weather conditions, and seasonal changes. Despite these variations, the country's capacity is more than adequate to ensure a stable supply of electricity. This surplus capacity not only meets domestic demand but also supports the export of electrical power to other countries. The evolution of electricity production over the past two decades is detailed in Table 3.

Table 3. Electricity Production in Azerbaijan (Billion kWt/h) (2003-2022)

Years	Production of electricity	electricity and CHP plants working with fuel	hydroelectric power station	avtoproducers (working with fuel)	by generator	wind power station	solar power station	electricity generated from wastes incineratio
2003	21,286.3	18,681.0	2,470.0	104.9	30.4	-	-	-
2004	21,743.2	18,589.0	2,755.0	365.4	33.8	-	-	-
2005	22,871.5	19,344.0	3,009.0	430.5	88.0	-	-	-
2006	24,542.7	21,407.0	2,518.0	475.9	141.8	-	-	-
2007	21,847.0	19,051.0	2,364.0	432.0	-	-	-	-
2008	21,641.6	19,090.0	2,232.0	319.6	-	-	-	-
2009	18,868.3	16,289.0	2,308.0	269.2	-	2.1	-	-
2010	18,709.2	15,003.0	3,446.0	259.7	-	0.5	-	-
2011	20,294.0	17,317.0	2,676.0	301.0	-	-	-	-
2012	22,988.0	19,537.0	1,821.0	1,630.0	-	-	-	-
2013	23,354.4	20,065.6	1,489.1	1,664.0	-	0.8	0.8	134.1
2014	24,727.7	21,401.2	1,299.7	1,848.1	-	2.3	2.9	173.5
2015	24,688.4	20,904.6	1,637.5	1,955.3	-	4.6	4.6	181.8
2016	24,952.9	20,699.0	1,959.3	2,062.0	-	22.8	35.3	174.5
2017	24,320.9	20,445.4	1,746.4	1,899.5	-	22.1	37.2	170.3
2018	25,229.2	21,242.9	1,768.0	1,934.1	-	82.7	39.3	162.2
2019	26,072.9	22,289.7	1,564.8	1,872.9	-	105.4	44.2	195.9
2020	25,839.1	22,471.3	1,069.5	1,954.6	-	96.1	47.0	200.6
2021	27,887.8	24,308.8	1,277.3	1,961.9	-	91.4	55.2	193.2
2022	29,039.8	25,137.4	1,595.7	1,957.2	-	83.3	60.9	205.3

Source: own construction according to data of the State Statistical Committee of the Republic of Azerbaijan,2024

In 2019, Azerbaijan produced 26.1 terawatt hours (TWh) of electricity, marking a 20% increase since 2008. The predominant energy source was natural gas, contributing 92% to the total in that year (with an average of 88% over the past ten years), while hydropower represented 6% (averaging 9% over ten years) and other renewables like solar, wind, and waste made up 1%. Co-generation facilities accounted for 7.5 TWh or 31% of 2019's overall production.

By 2021, the nation's electricity production rose to 27.8 TWh, showing a 7.9% growth from the previous year. Thermal power plants were responsible for approximately 95% of this output, with the remainder primarily sourced from hydropower.

Azerbaijan's total generation capacity exceeds 7.5 gigawatts (GW), which includes 6.5 GW from oil and gas and 1.1 GW from hydroelectric power. The country also has a modest capacity in wind, solar, and other renewable energies. (IEA,2023)

2. Objectives and Methodology

2.1. Objectives

The aim of this thesis is to analyse and obtain a proper insight about the impact on inflation of Azerbaijan, considering the electricity price. The objectives of the thesis could be quoted as follows :

1. To analyse the relationship between electricity prices and economic inflation in Azerbaijan.
2. To examine the factors influencing electricity prices in Azerbaijan
3. To assess the impact of electricity price fluctuations on different sectors of the Azerbaijani economy
4. To investigate the role of government policies and regulations in shaping electricity prices and their effects on inflation

2.2. Methodology

Case Study 1. The Impact of Electricity Price on Inflation of Azerbaijan – Econometric One Equation Model.

Many studies investigating the effect of electricity prices on inflation typically utilize different versions of the Vector Autoregression (VAR) model for their analysis. Nevertheless, this study adopts an alternative econometric approach, diverging from the VAR model. It employs the Ordinary Least Squares (OLS) technique to explore the influence of electricity prices on inflation expectations in Azerbaijan. The primary objective of this research is to analyze the connection between electricity prices and inflation.

Inflation = f (Unit Vector, Electricity Price, Interest Rate, Exchange Rate, GDP)

$$\beta_{11}y_{1t} = \gamma_{11}x_{1t}+\gamma_{12}x_{2t} + \gamma_{13}x_{3t} + \gamma_{14}x_{4t}+ \gamma_{15}x_{5t} + u_{1t}$$

- Endogenous variable

y_{1t} - Inflation (%)

- Exogenous variables

x_{1t} - Unit Vector

x_{2t} - Electricity Price (U.S. Dollars per kilowatt-hour (kWh))

x_{3t} - Interest Rate (%)

x_{4t} - Exchange Rate (Domestic Currency per U.S. Dollar)

x_{5t} - Nominal GDP (U.S. Dollars)

Case Study 2. "Assessing the Dynamics of Electricity Pricing in Azerbaijan: Influences, Sectoral Impacts, and the Role of Government Policy"

This case study explores the multifaceted impacts of electricity price fluctuations on key sectors of the Azerbaijani economy, including manufacturing, agriculture, and services, alongside an examination of the government's role through policy interventions. Through a combination of sectoral impact analysis and case studies, this research delineates how variations in electricity pricing have influenced operational costs, investment decisions, and overall competitiveness within these crucial sectors. By utilizing charts and tables, the case study presents a detailed visualization of sector-specific impacts, offering insights into the differential vulnerabilities and adaptive capacities of these sectors to electricity price dynamics.

Part 1, "Agricultural Sector Analysis," delves into the sectoral impact analysis, providing empirical findings on the repercussions of electricity price changes. In this context, analysis will concentrate primarily on the agriculture sector. This focus will allow for a deeper exploration of how electricity price fluctuations specifically affect this sector.

Part 2, "Policy Analysis," offers a comprehensive overview of the Azerbaijani government's strategies regarding electricity pricing, encompassing subsidies, tariffs, and regulatory measures. This segment evaluates the efficacy and ramifications of these policies on modulating electricity prices, their indirect effects on inflation, and the broader economic landscape. Through an analytical lens, this part scrutinizes the interplay between policy objectives and outcomes, identifying any unintended consequences or feedback loops that have emerged from these governmental interventions.

3. Literature Review

3.1. Azerbaijan's Economic Analysis through Balanced Pricing Models

Y. Hasanli, F. Hasanov, and M. Mansimli, researchers from the Institute for Scientific Research on Economic Reforms under the Ministry of Economy of the Republic of Azerbaijan, developed a balanced pricing model for the Azerbaijani economy, which they presented at the EcoMod conference in 2010. Their model, which relies on the intersectoral balances of production and distribution of goods and services for the years 2001 and 2006, encompasses 101 economic activity sectors. This approach aimed to analyze the relationship between value added rates and price levels, using a methodology informed by the System of National Accounts (SNA). Their work, especially Hasanli's on "input-output" models, significantly contributes to research and knowledge expansion in Azerbaijan's economic studies.

The focus is on understanding how changes in electricity tariffs influence other economic sectors and the overall economy in Azerbaijan by Fariz Mammadov (2021). Utilizing the Inter-Industry Balance Model and the Equilibrium Price Multiplier Model, the study empirically constructs these models for Azerbaijan's economy to analyze and assess the implications of electricity price changes. Data from the State Statistical Committee of the Republic of Azerbaijan served as the primary source, with the inter-industry balance model covering 96 sectors of the economy. Through simulations, the study evaluates the potential economic impacts of 10%, 20%, and 30% increases in electricity prices, providing insights into the consequential effects on Azerbaijan's economy.

This review explores significant contributions and findings from Mammadov's study, highlighting the innovative application of economic modeling to assess the ripple effects of electricity tariff adjustments. The methodology employed allows for a detailed examination of sector-specific and overarching economic outcomes resulting from price modifications, marking an important contribution to the discourse on energy policy and economic development. Mammadov's work stands as a critical reference for policymakers and stakeholders, emphasizing the nuanced understanding required to navigate the complexities of energy pricing and its economic ramifications.

3.2. Energy Prices and Economic Performance

Since the end of 2003, the price of crude oil has doubled, significantly impacting economic metrics. Initially, oil's total cost represented about 2 percent of the GDP. Therefore, James D.Hamilton (2005) a hypothetical 10 percent reduction in oil supply, which could lead to a doubling of prices in the short term, would directly decrease GDP by roughly 0.2 percent. Following this surge in oil prices, the total cost of oil has risen to account for approximately 3.5 percent of GDP. Consequently, a similar percentage increase in oil prices at this new level would exert a more substantial direct impact on the economy.

Electricity consumption serves as an indicator of production inputs at the corporate level and is integral to the production function in power generation. It is positively associated with both inputs to and outputs of production processes (Hu and Hu, 2013). Despite the growing use of renewable energy sources like wind and solar in power generation, their inability to meet base load requirements without sufficient energy storage capacity, which remains impractical on the necessary scale, limits their utility (Romero and Aguilar, 2011). Kumari and Sharma (2018) discovered that electricity usage is crucial for achieving high GDP levels, which in turn attracts more Foreign Direct Investment (FDI). Tang (2009) identified positive causal links between FDI and electricity consumption.

Conversely, Ouédraogo (2010) reported no significant causal link between electricity consumption and capital formation. Hamdi et al. (2014) highlighted a bidirectional relationship between FDI and electricity consumption, suggesting mutual influence. Furthermore, Asiamah et al. (2019) noted a significant positive impact of electricity production on attracting FDI.

The decrease in output due to rising energy prices could be lessened if firms could utilize alternative energy sources or find cost-effective ways to adjust their production methods to conserve oil. However, some infrastructure and machinery may only be economical in an environment of low energy costs and could become obsolete when energy prices escalate. The decommissioning of such equipment might result in a more significant loss of output. During the 1970s, studies examining this effect, such as the one by Charles R. Hulten, James Robertson, and Frank Wykoff titled "Energy Obsolescence and the Productivity Slowdown" in the book "Technology and Capital Formation" edited by Dale W. Jorgenson and Ralph Landau (MIT Press, 1989), found the impact of retiring obsolete equipment to be minimal.

However, a considerable reduction in energy availability could make the effect of retiring obsolete equipment disproportionately larger, significantly affecting productivity and economic output.

Electricity consumption patterns can be significantly influenced by electricity prices, leading to energy savings, emission reductions, and an improved load factor (Hu and Hu, 2013). In the manufacturing sector, electricity and labor intensity may decrease (increase) in response to electricity price increases (decreases) resulting from deregulation (Bölük and Koç, 2010). Osigwe and Arawomo (2015) identified a two-way causality between electricity consumption and electricity prices. Sun et al. (2019) reported that the industrial sector in APEC member countries accounted for the largest portion of electricity usage, approximately 45.5% in 2016, and observed an increasing trend. While Jamil and Ahmad (2010) stated that electricity consumption is influenced by electricity prices, they found no reciprocal effect. Cho and Kim (2007) emphasized that electricity prices significantly impact electricity consumption. Conversely, Aytac and Guran (2010) argued that electricity prices do not affect electricity consumption.

3.3. Labor Costs, Inflation, and Economic Growth Interplay

Labor costs significantly influence the price of final goods and services sold to consumers. Therefore, variations in the factors affecting wage developments, such as differences in labor market institutions and structural unemployment, can lead to inflation differentials. Beck et al. (2009) analyzed regional inflation dynamics within a subset of euro area countries, discovering that local structural factors, including limited competition in labor and goods markets, significantly contribute to explaining inflation variability. They also identified that price variations in other non-traded inputs (besides wages, such as rents and regulated markets like electricity) across countries play a crucial role in driving inflation differences.

Regarding energy costs, differences in market structures were key in causing inflation differentials in 2022. The extent to which energy commodity prices affected retail electricity and gas prices varied across the EU, reflecting disparities in national energy markets. Several factors contribute to these differences in pass-through effects. Firstly, some Member States adjusted taxes, levies, and network charges to mitigate the pass-through. Secondly, those with regulated prices witnessed a lower pass-through, with numerous Member States implementing price regulation measures during the crisis. Thirdly, the difference in contracting practices (fixed versus variable price) and adjustment frequency matters, as fixed-price contracts slow down the transmission from wholesale to retail prices. Countries where a significant portion of consumers have fixed-price contracts thus saw a more gradual pass-through.

Local profit margin developments also play a role in inflation differentials. The rise in inflation in 2022 coincided with a notable increase in unit profits. Historically, unit labor costs have been the most persistent factor in GDP deflator changes, with unit profits being more volatile and often cushioning the impact of rising unit labor costs during recessions. Post-pandemic, however, there's been a positive correlation in most countries between changes in unit labor costs and unit profits. Assuming firms set prices as a markup over marginal costs, it's challenging to determine from aggregate data whether increases in unit profits are due to higher marginal costs or increased markups. Archanskaia et al. (2023) utilized input-output analysis to show that the hike in producer prices in 2022 was generally proportional to the change in input costs across the euro area, especially when including wage costs, indicating no significant or widespread increase in margins. This suggests that the rise in corporate profit leaves room for real wage adjustments with limited secondary effects on inflation.

The recent increase in energy prices is expected to lower the real GDP in the coming decade but is not anticipated to have a lasting impact on inflation. Furthermore, if these higher prices remain stable, the standard of living in the United States will decline more significantly than the GDP level. Structuralists argue that inflation is necessary for economic growth, whereas monetarists believe that inflation hampers economic growth. Chowdhury (2002) investigated the limitations of macroeconomic policy in Indonesia and found no statistically significant link between inflation and growth within the country. In contrast, Gillman et al. (2004) determined that inflation adversely affects economic growth across OECD countries. Judson and Orphanides (1996), Ghosh and Phillips (1998), Khan and Senhadji (2001), Risso and Carrera (2009), López-Villavicencio and Mignon (2011), and Hung (2017) all documented that inflation negatively impacts economic growth once it surpasses a specific threshold value, whereas it has no significant effect when below this threshold. Meanwhile, Attari and Javed (2013) discovered that in the short term, the inflation rate does not influence economic growth; however, government spending does. In the long term, they found a correlation between inflation, economic growth, and government expenditure.

National electricity usage encompasses the entire consumption of power across both the industrial framework and residential areas. This includes the electricity usage across primary, secondary, and tertiary sectors of industry, regarded as productive electricity consumption since it generates added value (Hu and Hu, 2013). Such consumption is driven by actual economic activities (Jamil and Ahmad, 2010). Studies by Narayan and Smyth (2009) indicate that rises in electricity consumption correlate positively with increases in GDP. Similarly, Chandran et al. (2010) identified a significant positive link between electricity usage and real GDP, while Ouédraogo (2010) noted a beneficial causal connection between electricity consumption and economic growth in both the short and long term. Yoo and Kim (2006) examined the causal link between power production and economic growth in Indonesia from 1971 to 2002, finding a one-way causality from economic growth to power generation without reciprocal effects. Conversely, Squalli (2007) reported a negative causality from GDP to electricity consumption. Contrasting findings were presented by Ozturk and Acaravci (2011) and Bah and Azam (2017), who observed no causal connection between electricity consumption and economic growth.

The modest increase in core inflation up to this point suggests that if energy prices were to stabilize through the end of 2007, overall inflation would decrease from the current rate of about 3.5 percent to around 2 percent next year, indicating that the surge in energy prices wouldn't result in long-term higher inflation rates.

These estimates are derived from a macroeconomic model developed by Global Insight, a firm specializing in economic analysis and forecasting. The Congressional Budget Office (CBO) utilized this model to hypothesize the economic trajectory from 2004 to 2006 if energy prices had increased by an average of 2 percent per year—mirroring the GDP price index's growth rate prior to the energy price surge—and contrasted this scenario with actual developments. This simulation incorporated assumptions that monetary policy would adjust in response to shifts in inflation and employment, employing a framework akin to the Taylor rule, as detailed in John B. Taylor’s work, (“Discretion Versus Policy Rules in Practice,” published in the Carnegie-Rochester Conference Series on Public Policy, volume 39, in December 1993, pages 195–214,). This inclusion offers a nuanced view of the potential economic outcomes under different energy price growth scenarios, emphasizing the delicate balance between energy prices, GDP growth, and inflation.

3.4. Influence of Energy Pricing on Investment and Policy Implications

Developing countries often face a shortfall in funds necessary for development, leading them to seek loans and investments from international sources to bridge this financial gap. According to Ouédraogo (2010), a high level of investment is associated with robust economic growth, suggesting a reciprocal relationship. Wang (2010) discovered that while inward Foreign Direct Investment (FDI) initially has a negative impact on domestic investment, its cumulative effect over time tends to be beneficial. Elheddad (2014) observed that FDI inflows significantly boost public domestic investment, yet they tend to dampen private domestic investment. Choe (2003) reported a mutual causality between FDI and economic growth but noted that while gross domestic investment doesn't directly spur economic growth, strong economic growth can lead to increased domestic investment. Adams (2009) identified a significant positive influence of FDI on economic growth. Kim and Seo (2003) acknowledged several positive impacts of FDI on economic growth, although they noted these effects to be marginal. Contrarily, Hermes and Lensink (2003) argued that FDI could have a significant adverse effect on the economy of the host country. Mohamed et al. (2013) found no causal link between FDI and economic growth, highlighting instead a bidirectional correlation between economic growth and domestic growth in the long run.

Inflation, particularly when rates fluctuate, can contribute to increased economic uncertainty and higher interest rates (Landau, 1985). Over the long term, as inflation escalates, the aggregate benefits paid to recipients also rise. Some pension fund managers might argue that inflation's impact is negligible due to the associated rise in interest rates, which in turn increases the discount rate used for calculating the present value of their obligations. This is because interest rates tend to increase as inflation does (Greer, 2005). Chu et al. (2017) support Fisher's equation, which posits a positive long-term relationship between nominal interest rates and inflation. Conversely, Reenu and Sharma (2015) observed a negative correlation between inflation and interest rates, albeit with a weak coefficient. Al-Khazali (1999) determined that the nominal interest rate and inflation rate were uncoordinated, finding no direct causality between inflation and interest rates, and vice versa.

Baba et al. (2023) observed an increased persistence of inflation and its vulnerability to external price pressures in the post-pandemic period, noting that the influence of past inflation has grown more substantial, while the impact of inflation expectations has diminished during high inflation periods. Examining instances of significant inflation spikes over the past three decades, Blanco et al. (2022) noted that inflation tends to remain elevated after such surges, with the process of disinflation taking longer than the initial inflation rise. Furthermore, Baba and Lee (2022) investigated how wage growth responds to inflation triggered by commodity price increases in Europe, finding a strong pass-through from rising prices to wages, especially under conditions of high prevailing inflation. This cycle of inflation feeding into wages, which in turn can fuel further inflation, underscores the challenges in managing inflationary pressures, particularly after economic shocks.

Borrowing from the public can lead to an increase in interest rates, which may subsequently decrease investment and capital accumulation (Landau, 1985). Elevated interest rates diminish the present value of future cash flows, making investment opportunities less appealing. Consequently, real interest rates are a critical factor influencing corporate investment decisions (Bodie et al., 2017). Low interest rates can affect both the volume and nature of international investments (Ammer et al., 2019). In domestic contexts, reduced deposit rates encourage investment by lowering the cost of capital (Ma, 2017). Reenu and Sharma (2015) identified a positive but insignificant effect of interest rates on Foreign Direct Investment (FDI). Conversely, Asiamah et al. (2019) and Tripathi et al. (2015) discovered a significant negative impact of interest rates on FDI, a finding supported by Greene and Villanueva (1991), Onyeiwu and Shrestha (2004), and Yohanna (2013). However, Li and Liu (2005) argued that interest rates do not influence FDI inflows, considering FDI as a direct investment rather than a portfolio investment.

Variations in wage and price rigidities can lead to enduring inflation rates, potentially causing inflation differentials following common shocks or exacerbating persistent differentials. Andersson et al. (2009) discovered that differences in the evolution of product market regulations are a factor in explaining inflation differentials within the euro area. Calmfors and Driffill (1988) suggest that the structure of labor market institutions can result in varying inflation outcomes. Specifically, they argue that economies with either highly centralized or highly decentralized wage bargaining systems are better equipped to handle supply shocks than those with a degree of centralization that falls in between.

Balassa (1964) and Samuelson (1964) noted that in the medium-term convergence process, lower-income economies tend to experience higher inflation and an appreciation of the real exchange rate as they catch up to higher income levels. This happens because these economies often see quicker productivity improvements in sectors producing tradable goods compared to non-tradable goods sectors, leading to a relative increase in the prices of non-tradable goods as wages become uniform across sectors. Therefore, inflation differentials among countries can be attributed to variations in initial income levels, price levels, relative output growth, and productivity advancements. Given that convergence unfolds gradually, such inflation differentials are expected to be enduring, though their contribution to overall inflation disparities across countries has been found to be minimal, as indicated by studies such as Honohan and Lane (2003) and Checherita-Westphal et al (2023).

High inflation rates can signal economies are "overheating," where demand surpasses the ability to supply goods and services, leading to heightened price increases (Bodie et al., 2017). In such scenarios, investors are advised to exercise caution (Greer, 2005). Contrarily, Reenu and Sharma (2015) discovered a positive significant impact of inflation on Foreign Direct Investment (FDI). Inflation diminishes the purchasing power of income, reducing the net benefits from investments due to decreased consumption utility. This illustrates the adverse influence of both foreign and domestic inflation on respective investments (Sayek, 2009). The detrimental effects of inflation on economic growth are attributed to the reduction in real investment within the economy (Aydin et al., 2016). Moreover, several studies including those by Ahn et al. (1998), Onyeiwu and Shrestha (2004), Wang (2004), Li and Liu (2005), Kaur and Sharma (2013), Reenu and Sharma (2015), and Asiamah et al. (2019) have all highlighted a significant negative relationship between inflation and FDI.

Variations in the business cycles among euro area Member States can lead to disparities in inflation rates. Honohan and Lane (2003) identified a positive and statistically significant correlation between inflation differentials and the output gap within the euro area, suggesting that differences in economic activity relative to potential output contribute to varying inflation rates among member states. Giannone and Reichlin (2006) emphasized the significance of divergences in business cycles across these countries, indicating that these variations are crucial in understanding economic behaviors within the euro area.

Furthermore, Andersson et al. (2009) discovered that inflation differentials are primarily influenced by disparities in the business cycle positions of the Member States. This finding underscores the impact of economic phases—whether expansion or contraction—on inflation rates across different countries within the euro zone.

Altissimo et al. (2006) observed how varying reactions of euro area countries to common euro area shocks could elucidate the development of inflation differentials. This indicates that even when faced with the same economic stimuli, the individual economic structures and policies of Member States lead to different inflationary outcomes, further contributing to the complexity of managing inflation within a unified monetary zone.

The diversity in economic structures can lead to varying levels of exposure to asymmetric shocks or to differences in reactions to common shocks, such as fluctuations in energy prices or changes in the nominal exchange rate of the euro. Beck et al. (2009) highlighted that countries with a more energy-intensive production are more vulnerable to changes in energy prices, while economies more engaged in trade outside the union are more susceptible to shifts in the euro's nominal exchange rate. Consequently, inflation differentials among countries can emerge from these distinct responses to shared economic disturbances. Several studies have observed a growing alignment in inflation trends across advanced economies, although the extent to which common factors explain inflation variance greatly differs from one country to another. A possible reason for this pattern, as suggested by Borio and Filardo (2007), is globalization, which likely has diminished the linkage between domestic economic activity and inflation. Ciccarelli and Mojon (2010) discovered that nearly 70% of the inflation variability in 22 OECD economies from 1960 to 2008 is attributable to common factors, indicating a shared basis for inflation. Forbes (2019) further corroborated that global influences significantly shape inflation dynamics, as the traditional connection between domestic economic slack and inflation (the Phillips curve) has become less pronounced over time.

More recently, Cascaldi-Garcia et al. (2023) employed a dynamic factor model to demonstrate that core inflation in the euro area, as well as in other countries, is predominantly influenced by a "common component" across various items, rather than by unique, item-specific shocks. However, post-pandemic research by Binici et al. (2022) revealed an increased significance of domestic factors in explaining domestic inflation within the euro area, suggesting a shift towards more locally driven inflationary pressures in the aftermath of the global health crisis.

3.5. Energy Prices and Their Asymmetric Effects on Inflation

In recent years, the relationship between energy prices and inflation has garnered significant attention, especially within the context of the European Union. Bednár, Cecrdlová, Kaderábková, and Režábek (2022) delve into this intricate dynamic, highlighting the paramount role of electricity within the energy mix and its consequential impact on inflationary pressures. Their study underscores the steadily increasing share of electricity in overall energy consumption, a trend not adequately reflected in the consumption basket relevant for measuring inflation and, by extension, for formulating monetary policy. They argue for a revision of the energy mix reflected in inflation in favor of electricity, positing that such a shift could offer a more accurate gauge of inflationary pressures. Furthermore, their research suggests that the share of renewable electricity sources might be inversely related to inflation, presenting a compelling insight for policymakers amidst the backdrop of high inflation rates and unstable fossil energy sources supply. (Bednár et al., 2022).

An escalation in oil prices directly contributes to increased production expenses, leading to inflation (Shahbaz and Ali, 2016, as cited in Shahbaz et al., 2017). Bekhet and Othman (2011) identified a unidirectional Granger-causality from electricity consumption to inflation, indicating that rises in electricity consumption impact inflation. Günay (2016) discovered that inflation adversely affects electricity demand (consumption), aligning with Iyke (2015), who found a causal link between inflation and electricity consumption where inflation negatively impacts electricity consumption.

Countries in the euro area that adopt more expansionary discretionary fiscal policies to stimulate demand are expected to experience quicker price increases and a higher inflation differential compared to other Member States. When coupled with nominal rigidities, these inflation differentials could lead to inefficient and potentially enduring competitive disadvantages. Furthermore, fiscal policy adjustments, such as changes in taxation and subsidies, can also affect inflation differentials within the euro area. Duarte and Wolman (2002) demonstrated that governments could impact the magnitude of inflation differentials through fiscal policy levers and public spending. However, Honohan and Lane (2003) did not find substantial evidence to support this mechanism in their analysis of the initial euro area Member States.

More recent investigations into inflation differentials, such as the study by Checherita-Westphal et al. (2023) covering the period 1999-2019, only identified weak evidence of an indirect effect of fiscal policy on inflation through the output gap, particularly when the economy operates above its potential. The recent examination of fiscal policy's impact on inflation has been further complicated due to a significant portion of discretionary fiscal measures in 2022 and part of 2023 being aimed at suppressing inflation, including energy price caps or freezes, as observed in countries like France and Malta. Dao et al. (2023) found that unconventional fiscal measures taken to counteract the adverse effects of the energy crisis in the euro area were successful in curbing the rise in inflation, having only a limited impact on inflation through demand stimulation.

In principle, the increase in prices for imported oil is expected to temporarily slow productivity growth. Businesses will adjust their resource allocation in response to these higher prices, moving resources away from their optimal uses under the previous price conditions to new optimal uses given the higher prices. Essentially, companies will reduce their reliance on oil and reallocate resources to cover the costs of the more expensive oil they continue to use. This diversion of resources from other productive uses will lead to some loss of output. This adjustment process will negatively impact productivity growth, but once the adjustments are finalized, productivity growth should no longer be affected.

In practice, however, the rise in energy costs does not seem to cause any lasting decrease in productivity growth. The proportion of energy costs in the economy in the early 1970s was too small to significantly contribute to the productivity slowdown that began in 1973. As mentioned earlier, the immediate effect on production due to a decrease in oil usage is represented by oil’s percentage of total GDP. Since oil expenses made up about 2 percent of the total output in 1973, a 10 percent decrease in oil usage would result in a one-time output reduction of at most 0.2 percent. This analysis is supported by findings from Hamilton’s study, “Oil and the Macroeconomy.”

Some analysts argue that the surge in energy costs during the 1970s had an outsized effect on the economy due to its impact on investment and innovation, leading to a permanent decrease in productivity growth. A key theory proposes that the hike in energy prices caused a significant portion of the capital stock to become obsolete. This obsolescence, spurred by the higher costs of energy, necessitated adjustments in both the composition and use of capital assets, as firms were forced to abandon or modify previously efficient machinery and infrastructure that became too costly to operate under the new energy price regime. Martin Baily's (1981) study show that this shift not only disrupted the immediate productivity of affected industries but also had a long-term impact by altering the trajectory of investment towards adapting to or mitigating the effects of higher energy costs, potentially at the expense of broader innovative activities.

For gas and coal power plants, the introduction of a risk premium could result in a 5-10% increase in electricity prices to encourage investment, according to Blyth et al. (2007). Variations in electricity prices affect both the demand for electricity and the desire for investment. The future of electricity price control hinges on identifying the optimal level and type of investment in power generation and ensuring consumers have full market participation (Murray, 1998). Rising electricity costs are likely to deter investments in the manufacturing sector, while higher capital costs diminish electricity demand (Bölük and Koç, 2010). Barteková and Ziesemer (2018) observed that elevated electricity prices weaken a country's ability to attract Foreign Direct Investment (FDI). In the short term, higher electricity prices lead to a decline in net FDI inflows, exerting a significant negative impact on FDI inflow both in the short and long term.

According to this perspective, the slowdown in productivity growth was a result of removing some energy-intensive capital from use, leading to a decrease in output. However, this reduction in capital services wasn't captured by economic statistics. The theory that capital became obsolete due to higher energy costs is somewhat challenged by a later study by Hulten, Robertson, and Wykoff. This study found that the increase in oil prices had little effect on the secondary market prices for used equipment, suggesting that the impact of energy costs on capital obsolescence might have been overestimated.

If the rise in energy prices had led to certain capital goods becoming obsolete, one would expect the prices of used energy-intensive equipment to decline. However, the possibility remains that the study might not have detected some of the immediate impacts or the effects on specific kinds of structures and equipment. This oversight could be due to the absence of a secondary market for significant portions of the capital stock, such as steel plant furnaces, chemical production facilities, and similar assets, which makes it challenging to assess the full extent of energy price impacts on these specialized investments.

Evidence regarding the impact of energy costs on the productivity slowdown that began in the mid-1970s remains ambiguous. Certain empirical studies, which utilize industry data to examine productivity growth, suggest that the deceleration observed from 1973 to 1994 was predominantly within energy-intensive sectors of the economy. In contrast, other research finds no evidence to support this effect. This ongoing debate is reflected in the works of several scholars, including Dale W. Jorgenson (1988), William Nordhaus's (2004) and Douglas R. Bohi's (1991).

When there's a flexible exchange rate, global energy price changes introduce external shocks that can influence the domestic economy, notably affecting inflation. Kecek's (2023) study reveals that the Croatian domestic economy shows a particularly acute sensitivity to energy price shocks, more so than to other types of supply shocks like wage increases or the cost of imported goods and services. This impact of energy price changes on domestic inflation becomes particularly apparent through the lens of the industrial sector's energy usage. Similarly, Yan and Bian's research (2023) highlights that in China, swift alterations in energy prices have a direct positive correlation with inflation, especially when there's a surge in industrial energy consumption. Furthermore, Rizvi and Sahminan (2020) provided empirical evidence that oil and energy prices have a significant effect on domestic inflation in countries such as Brazil, Russia, India, Indonesia, China, and South Africa. These findings underscore the necessity for domestic policy adjustments, particularly within the inflation targeting framework, to adequately respond to global commodity price volatility.

Ayisi (2021) highlights that domestic inflation reacts asymmetrically to global crude oil price fluctuations, leading to increased welfare costs alongside rising inflation rates. This asymmetric impact is further supported by Bawa et al. (2020), who found empirical evidence that oil price changes affect inflation in various ways, including headline, core, and food inflation. Specifically, while an increase in oil prices drives up inflation, a decrease can lower production costs, thus moderating inflation rates.

Babuga and Naseem (2021) discovered a similar asymmetric influence of oil price variations on inflation in Sub-Saharan African countries, with price increases having a more pronounced effect on inflation than decreases. This is attributed to oil's crucial role in production, where price hikes significantly escalate costs, thus boosting inflation. Bala and Chin (2018) observed that the asymmetric impact of oil prices is marked by a discrepancy in the effects of rising versus falling oil prices, with declines in oil prices having a more substantial impact on inflation due to price rigidities caused by subsidies in food and fuel prices.

Binder (2018) found that gas price inflation shapes expectations of non-gas inflation, suggesting that rising gas prices can set off anticipations of broader inflationary pressures, thereby influencing core inflation. Zhang et al. (2017) noted that hikes in natural gas prices lead to increases in the Consumer Price Index (CPI), particularly affecting the chemical industry and overall inflationary trends. Jalaee (2021) corroborated the inflationary impact of rising natural gas prices, albeit to a lesser extent.

Guo et al. (2016) demonstrated that coal prices have a bidirectional influence on the CPI, with declines in coal prices more significantly affecting the reduction in CPI than increases affect its rise. The immediate inflationary response to coal price shocks tends to diminish over time. However, rising coal prices can inflate costs, notably in agricultural products, as shown by Du et al. (2022), who found that increased coal prices elevate the prices of agricultural products in China due to coal's involvement in their production, distribution, and storage.

3.6. Exchange Rates, Price Stability, and Inflation

Naghdi and Kaghazian (2015) discovered an asymmetric long-term relationship between exchange rates and the Consumer Price Index (CPI), indicating that an increase in the exchange rate leads to higher CPI, thereby implying inflation. This effect is especially significant in countries reliant on imports, where domestic price movements are highly sensitive to exchange rate fluctuations. They found that the impact of a negative exchange rate shock on inflation is more substantial than that of a positive shock.

Kayamo (2021) highlighted that the real exchange rate exerts both short-term and long-term asymmetric effects on inflation. Over time, imbalances in the exchange rate can cause price surges, resulting in elevated inflation levels. Thus, maintaining exchange rate stability, which ensures price stability, is preferred over implementing exchange rate controls to manage inflation.

Lily et al. (2021) observed that exchange rate changes have a long-term inflationary effect and can be asymmetric. The depreciation of the domestic currency leads to inflation by raising the cost of imports. El Bejaoui (2013) identified an asymmetric influence of the exchange rate on export and import prices, where export and import prices react differently to the local currency's depreciation and appreciation. The appreciation of the local currency results in a more significant pass-through to export and import prices than when the currency depreciates, suggesting that exchange rates can asymmetrically impact domestic inflation through cost-push inflation, with inflation increasing as import prices rise due to depreciation.

In contrast, inflation decreases when import prices drop as a result of the local currency's appreciation, though the effects of these changes are unequal. Valogo et al. (2023) presented findings that significant inflationary pressures arise when the home currency's depreciation exceeds a monthly threshold of 0.71%. Identifying such thresholds can give monetary authorities confidence in their efforts to control inflation by determining an exchange rate stabilization level that aligns with policy objectives.

3.7. Sector-Specific Impacts of Electricity Pricing

In parallel, G.Bijnens, J.Konings, and S.Vanormelingen investigated the effects of electricity prices on employment and investment across 10 highly industrialized European countries, focusing particularly on Belgium's production sector. Their research assessed the economic consequences of electricity cost fluctuations on the job market and investment trends.

Additionally, D. Gonese, D. Hompashe, and K. Sibanda explored the impact of rising electricity prices on the sectoral output of South Africa from 1994 to 2015. Using local data sources and panel data analysis, they provided an econometric examination of how electricity cost increases negatively affect various sectors of the South African economy.
J. M. Griffin, an Associate Professor of Economics at the University of Pennsylvania, developed an econometric model to estimate electricity demand, factoring in electricity prices, fuel conversion efficiency, and the supply of coal, natural gas, fossil fuels, and nuclear fuel. This model serves to understand the dynamics of electricity consumption based on its pricing and the efficiency of different energy sources.

S. Kwon, S. H. Cho, R. K. Roberts, T. Kim, and T.E. Yu from the University of Tennessee explored the dynamics of electricity price volatility, noting the growing global interest in curbing energy consumption due to rising electricity demand. They acknowledged price control as a common strategy for managing short-term electricity demand, despite its potential to dampen economic activity. Their research assessed the repercussions of electricity price fluctuations on demand and the manufacturing sector, employing econometric techniques and the two-stage least squares model (GS2SLS) for various scenarios.

E. Lange, through his master's thesis, examined the effects of increasing electricity prices on consumer demand within South Africa's economic framework.

N. Q. Khanh's 2011 study highlighted that Vietnam's electricity prices were below long-term marginal costs, impacting energy efficiency and supply security negatively. The research also discussed the Vietnamese government's intentions to adjust electricity tariffs upwards and analyzed the potential effects of such adjustments on goods and service prices through a static "input-output" model.

The Economic Development Department (EDD) and the Department of Trade and Industry (DTI) in South Africa evaluated the impact of surging electricity prices on the competitiveness of specific mining and value chains. Their study aimed to delve into the nexus between South Africa’s mining value chains and sustainable development, especially regarding energy concerns, assessing if the hike in electricity prices has propelled local mining and manufacturing sectors toward more sustainable practices.

M. T. P. Zarandi and T. Rahmani investigated how increasing electricity prices for irrigation affects Iran's agriculture, the country being a significant consumer of water in this sector. Their research, utilizing economic valuation methods, indicated a considerable impact of electricity prices on water costs, thereby adversely affecting agricultural output.

These diverse studies, conducted across various countries, share a methodological foundation in econometric regression analysis and "input-output" models. In our research, we employ the "input-output" approach to holistically integrate all economic sectors and establish a balanced assessment of conditions.

4. Practical Part

4.1. Case Study 1. The Impact of Electricity Price on Inflation of Azerbaijan – Econometric One Equation Model

4.1.1. Data Set

To initiate the empirical section and econometric analysis, it's essential first to introduce the dataset employed for this estimation. Table 4 outlines the comprehensive dataset compiled using data sourced from the The State Statistical Committee of the Republic of Azerbaijan, the International Monetary Fund (IMF) and Climate Scope spanning a period of 20 years from 2003 to 2022. The period is determined based on data availability.

Table 4. Data set for estimation

Year	Inflation (%)	Electricity Prices (USD per KWh)	Interest Rate (%)	Exchange Rate (AZN per USD)	GDP (USD)	UV (intercept)
	y_1	x_2	x_3	x_4	x_5	x_1
2003	2.12130	0.01910	7.94230	0.98215	7276413079	1
2004	6.70876	0.02120	5.92029	0.98270	8680410158	1
2005	9.57703	0.02330	2.00904	0.94542	13245421881	1
2006	8.22667	0.02530	5.89582	0.89345	20981929498	1
2007	16.58564	0.02740	-1.56862	0.85812	33049426816	1
2008	20.78295	0.02950	-6.27259	0.82162	48851318826	1
2009	1.34990	0.03160	47.90106	0.80378	44292408817	1
2010	5.66424	0.03370	6.30070	0.80265	52909294792	1
2011	7.75390	0.03580	-2.88598	0.78969	65952763949	1
2012	1.00652	0.03790	15.02961	0.78565	69679913510	1
2013	2.42380	0.04000	17.68622	0.78454	74160553009	1
2014	1.44762	0.04210	19.39168	0.78435	75239737489	1
2015	4.04837	0.04420	28.94544	1.02456	53076244755	1
2016	12.43832	0.04630	1.48583	1.59572	37867007023	1
2017	12.84446	0.04836	0.31858	1.72115	40866632048	1
2018	2.33423	0.04909	4.69177	1.70002	47112479289	1
2019	2.71230	0.04904	17.56491	1.70000	48174235294	1
2020	2.82429	0.04904	26.53682	1.70000	42693000000	1
2021	6.65937	0.05297	-4.24616	1.70000	54825411765	1
2022	12.30000	0.05882	-16.50948	1.70000	78721058824	1

Source: The State Statistical Committee of the Republic of Azerbaijan, International Monetary Fund (IMF), Climate Scope, 2024

4.1.2. Time Series analysis

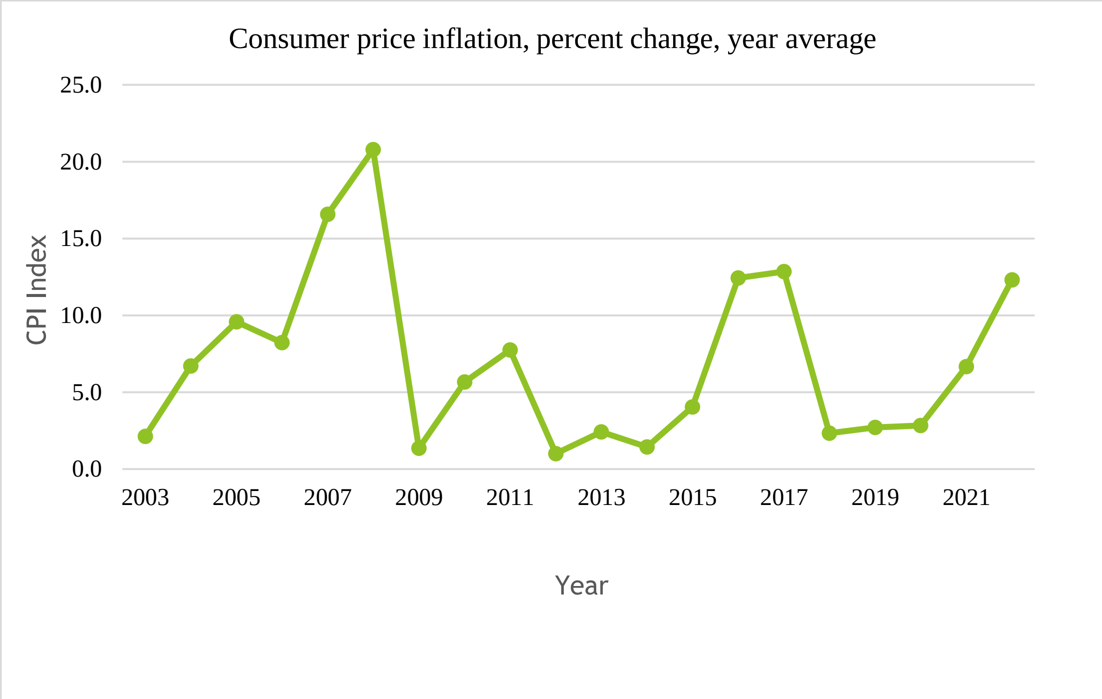
Certainly, since the data utilized for the analysis comprises time series data, it enables the examination of the progression of each variable through scatterplots. Employing this method is beneficial for gaining insights into the context of the Azerbaijani economy, which is instrumental in crafting relevant recommendations for the Azerbaijani government. These insights will be discussed in the results and discussion section of this diploma thesis. Initially, the author focuses on the inflation variable, subsequently referred to as y.

Inflation – The dependent variable in this study is the inflation rate of Azerbaijan, represented as annual percentage changes over the period from 2003 to 2022.

The below data reveals fluctuations in the inflation rate across the two decades, highlighting the economic volatility and price stability within the country. Notably, there was a significant increase in 2008 when inflation peaked at 20.8%, indicative of a period of heightened economic activity or potential overheating of the economy. Subsequent years have seen varying rates, with other prominent spikes in 2016 and 2022, where inflation rates were recorded at 12.4% and 12.3%, respectively. In contrast, there were years of relatively low inflation, such as in 2009 and 2015, with rates at 1.3% and 4.0%, respectively, suggesting periods of economic stabilization or possibly subdued economic activity. This variable's trajectory provides insight into the economic environment of Azerbaijan and serves as a vital indicator for assessing the impacts of fiscal and monetary policies, as well as external economic shocks on the nation's economy.(IMF,2024).

Graph 1 illustrates the evolution of this variable throughout the 20-year period under review.

Graph 1. Consumer price inflation (%) in Azerbaijan between 2003-2022

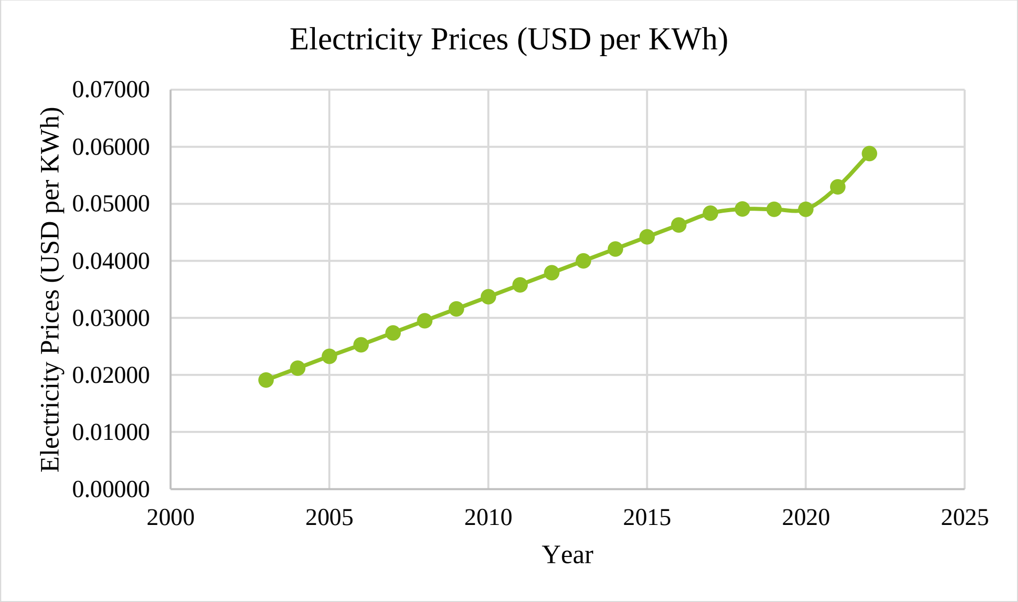


Source: own construction according to data of The International Monetary Fund(IMF),2024

Electricity Price – The relationship between electricity prices and inflation is a critical aspect of economic analysis, particularly in energy-dependent nations like Azerbaijan. As a key determinant of production costs and consumer expenditures, fluctuations in electricity prices can exert significant influence on the overall inflationary landscape.

In the context of Azerbaijan, where the energy sector plays a pivotal role in driving economic growth and development, the dynamics of electricity prices hold particular relevance.Over the past few years, Azerbaijan has witnessed fluctuations in its average electricity prices, ranging from 48.36 USD/MWh in 2017 to 58.82 USD/MWh in 2022.Over the period since 2017, the average electricity cost in Azerbaijan has ranged between 48.36 USD/MWh (in 2017) and 58.82 USD/MWh (in 2022), demonstrating fluctuations within this timeframe.These fluctuations reflect not only changes in energy supply and demand but also broader macroeconomic factors that shape inflationary pressures within the economy. (Climatescope, 2024)

Graph 2. Electricity Prices (USD per KWh) in Azerbaijan between 2003-2022

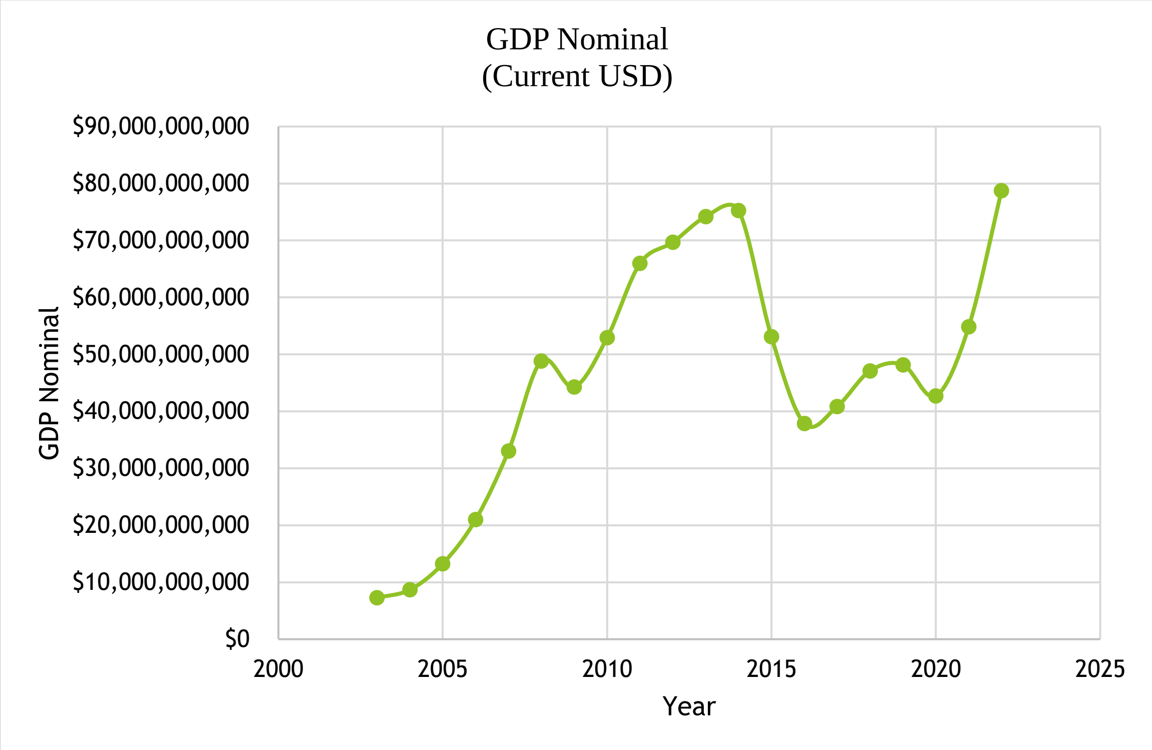


Source: own construction according to data of The Climate scope,2024

GDP – GDP serves as a gauge for a country's total economic output, encapsulating various components such as government expenditure, investments, consumption, and net exports. This study incorporates GDP as a key independent variable to provide a holistic view of Azerbaijan's economic performance, thereby enabling a detailed assessment of the impact of electricity prices on inflation. In this investigation, nominal GDP is utilized as the primary analytical metric.

Nominal GDP quantifies the overall market value of all goods and services produced over a certain period, often reported quarterly or annually. Unlike real GDP, which adjusts for inflation, nominal GDP is used in its raw form for a number of reasons. Primarily, nominal GDP offers an unaltered overview of economic activities, presenting the actual fiscal value of produced goods and services within the given timeframe without inflation adjustments. Furthermore, the use of nominal GDP aims to reflect the economic conditions as indicated by current market prices. This methodology allows for a straightforward analysis of how electricity prices influence economic inflation, omitting the distortions that inflation adjustments may introduce.(*The State Statistical Committee of the Republic of Azerbaijan,2024)*

Graph 3. Nominal GDP(USD) for Azerbaijan between 2003-2022

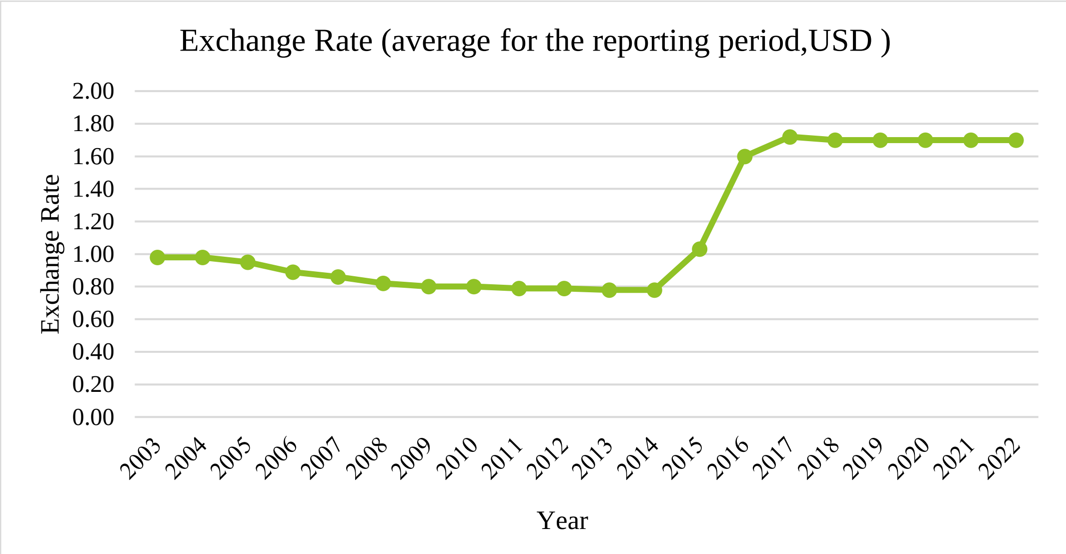


Source: own construction according to data of The State Statistical Committee of the Republic of Azerbaijan,2024

Exchange Rate – The exchange rate serves as a crucial variable in understanding economic dynamics, particularly the relationship between inflation and the cost of electricity. When a currency strengthens in value compared to the US dollar, as seen in the period post-2015, the price of imported goods, including energy commodities, tends to decrease. This deflationary effect can, in turn, influence domestic electricity pricing structures, especially in countries that are net energy importers or that link their energy prices to international markets. Conversely, a weaker currency can make imports more expensive, contributing to higher electricity prices and potentially to inflation if those costs are passed on to consumers.

In the specific context of Azerbaijan, which is a significant energy exporter, the relationship might be nuanced. The strengthening of the currency could reflect robust energy revenues that may not directly translate to lower domestic electricity prices if the local energy pricing is not directly pegged to global energy prices. However, it may affect inflation through its impact on the broader economy and the purchasing power of consumers. In this context, analyzing the exchange rate movements in tandem with electricity prices provides insights into their conjoint effects on inflation. It allows us to observe whether shifts in the currency's strength align with changes in inflation rates and to what extent electricity prices have played a role in this dynamic. (*The State Statistical Committee of the Republic of Azerbaijan,2024)*

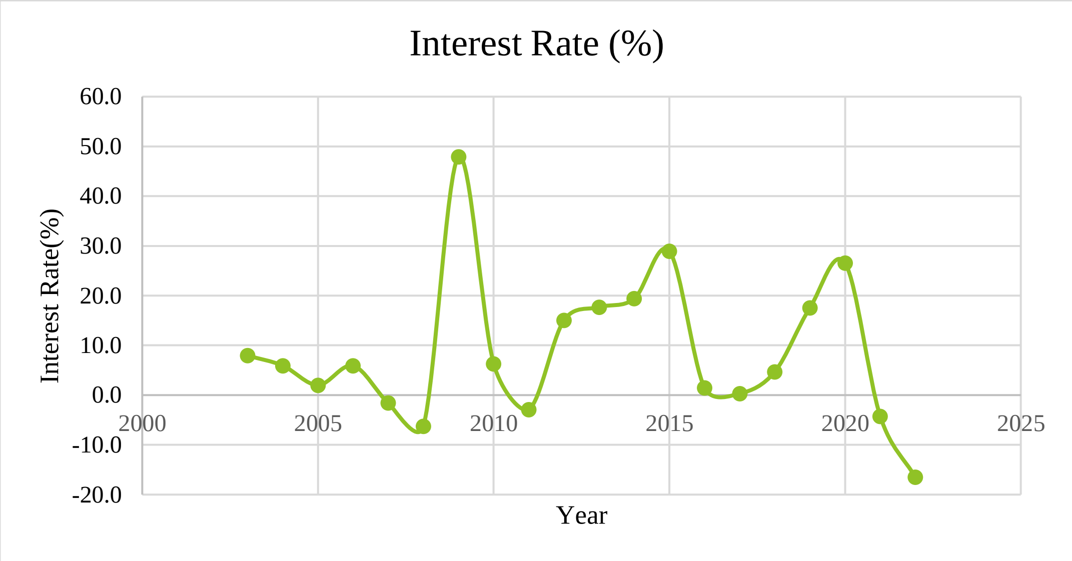
Graph 4. Exchange Rate(AZN/USD), between 2003-2022



Source: own construction according to data of The State Statistical Committee of the Republic of Azerbaijan,2024

Interest Rate – The deposit interest rate in Azerbaijan from 2003 to 2022 fluctuated, reflecting the country's economic shifts and monetary policy changes. Initially at 9.54%, it spiked to 12.22% during the 2008 financial crisis, then varied before settling at 8.98% in 2022. This rate is a key to understanding how Azerbaijan's monetary policy influences inflation and the broader economy. Higher interest rates typically curb inflation by discouraging borrowing, while lower rates may boost economic activity but increase inflation risk. This rate's trend also hints at its impact on electricity prices, where higher rates could raise project financing costs. Analyzing this data can reveal how interest rates affect economic sectors like energy, crucial for Azerbaijan's economy.

Graph 5. Interest Rate(%), between 2003-2022



Source: own construction according to data of The International Monetary Fund(IMF),2024

4.1.3. Economic and Econometric Model

4.1.3.1. Economic model

One-equation model describes the relationship between one endogenous variable which is the inflation and other exogenous variables such as the electricity price, interest rate, exchange rate, and GDP. The objective of this model is to investigate the influence of electricity price fluctuations on economic inflation within the context of Azerbaijan. In the following, the author introduces an economic framework that will serve as the foundation for the development of an econometric model.

Economic model formula: $y_1 = f(x_1, x_2, x_3, x_4, x_5)$

Inflation = f (Unit Vector, Electricity Price, Interest Rate, Exchange Rate, GDP)

4.1.3.2. Econometric model

The formulation of the econometric model for our function is following:

Identification of variables: $y_1 \ = x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5$

Addition of parameters: $\beta_1 y_1 = \gamma_1 x_1 \quad \gamma_2 x_2 \quad \gamma_3 x_3 \ \gamma_4 x_4 \ \gamma_5 x_5$

Creation of functional form: $\beta_1 y_1 = \gamma_1 x_1 + \ \gamma_2 x_2 \ + \ \gamma_3 x_3 + \gamma_4 x_4 + \gamma_5 x_5$

Addition of random parameter: $\beta_1 y_1 = \gamma_1 x_1 + \ \gamma_2 x_2 \ + \ \gamma_3 x_3 + \gamma_4 x_4 + \gamma_5 x_5 \ + u$

Expression of time: $\beta_{11} y_{1t} = \gamma_{11} x_{1t} + \gamma_{12} x_{2t} + \gamma_{13} x_{3t} + \gamma_{14} x_{4t} + \gamma_{15} x_{5t} \ + u_{1t}$

Final Econometric model: $\beta_{11}y_{1t} = \gamma_{11}x_{1t}+\gamma_{12}x_{2t} + \gamma_{13}x_{3t} + \gamma_{14}x_{4t}+ \gamma_{15}x_{5t} + u_{1t}$

4.1.4. Declaration of variables

- Endogenous variable

y_{1t} - Inflation (%)

- Exogenous variables

x_{1t} - Unit Vector

x_{2t} - Electricity Price (US Dollars per kilowatt-hour (kWh))

x_{3t} - Interest Rate (%)

x_{4t} - Exchange Rate (%)

x_{5t} - Nominal GDP (US Dollars)

4.1.5. Correlation Matrix

A correlation matrix is utilized to examine potential high correlations among variables, which could indicate multicollinearity issues. Multicollinearity refers to the strong interdependence among explanatory variables, typically indicated by correlation coefficients exceeding 0.8, either positively or negatively. Upon analysis of the correlation matrix (fig.1), it's evident that the correlation coefficients do not surpass 0.8 (with a 5% critical value of 0.4438), indicating the absence of multicollinearity in this model.

Figure 1. Correlation Matrix by Gretl

Correlation coefficients, using the observations 2003 - 2022
5% critical value (two-tailed) = 0.4438 for n = 20

Inflation	EP	IR	ER	GDP	
1.0000	-0.0969	-0.6816	0.0547	-0.1507	Inflation
	1.0000	-0.0666	0.7499	0.6644	EP
		1.0000	-0.2337	0.0295	IR
			1.0000	0.0330	ER
				1.0000	GDP

Source: Author,2024

4.1.6. Estimation of Parameters

To estimate linear dependencies between variables and parameters, Gretl employed the OLSM approach. The first step was to define the matrices X and Y (see table 5 below). Then, using the Gretl result, Figure 2 below displays the parameters of the equation.

Table 5. Matrices X and Y

	x_1	x_2	x_3	x_4	x_5		y_1
X=	1	0.0191	7.9423	0.98215	7276413079	Y=	2.1213
	1	0.0212	5.92029	0.9827	8680410158		6.70876
	1	0.0233	2.00904	0.94542	13245421881		9.57703
	1	0.0253	5.89582	0.89345	20981929498		8.22667
	1	0.0274	-1.56862	0.85812	33049426816		16.58564
	1	0.0295	-6.27259	0.82162	48851318826		20.78295
	1	0.0316	47.90106	0.80378	44292408817		1.3499
	1	0.0337	6.3007	0.80265	52909294792		5.66424
	1	0.0358	-2.88598	0.78969	65952763949		7.7539
	1	0.0379	15.02961	0.78565	69679913510		1.00652
	1	0.04	17.68622	0.78454	74160553009		2.4238
	1	0.0421	19.39168	0.78435	75239737489		1.44762
	1	0.0442	28.94544	1.02456	53076244755		4.04837
	1	0.0463	1.48583	1.59572	37867007023		12.43832
	1	0.04836	0.31858	1.72115	40866632048		12.84446
	1	0.04909	4.69177	1.70002	47112479289		2.33423
	1	0.04904	17.56491	1.7	48174235294		2.7123
	1	0.04904	26.53682	1.7	42693000000		2.82429
	1	0.05297	-4.24616	1.7	54825411765		6.65937
	1	0.05882	-16.50948	1.7	78721058824		12.3

Source: Author,2024

Figure 2. OLSM in Gretl

Model 1: OLS, using observations 2003-2022 (T = 20)
Dependent variable: Inflation

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	13.6742	4.14691	3.297	0.0049	***
EP	459.189	612.806	0.7493	0.4653	
IR	−0.301653	0.0834433	−3.615	0.0025	***
ER	−11.1418	13.1948	−0.8444	0.4117	
GDP	−1.90256e-010	2.15107e-010	−0.8845	0.3904	

Mean dependent var	6.990483	S.D. dependent var	5.591793
Sum squared resid	290.8111	S.E. of regression	4.403114
R-squared	0.510497	Adjusted R-squared	0.379963
F(4, 15)	3.910833	P-value(F)	0.022751
Log-likelihood	−55.14819	Akaike criterion	120.2964
Schwarz criterion	125.2750	Hannan-Quinn	121.2683
rho	0.384534	Durbin-Watson	1.122838

Excluding the constant, p-value was highest for variable 3 (Electricity Prices)

Source: Author,2024

Based on the results of the estimation, the author can advance to the model construction phase. The equation provided below constitutes the comprehensive model that forms the essence of the thesis.

The estimated equation:

$$y_{1t} = 13{,}6742 + 459{,}189x_{2t} - 0{,}301653x_{3t} - 11{,}1418x_{4t} - 0.000000000190256x_{5t} + u_{1t}$$

4.1.7. Verification of the Model

4.1.7.1. Economic Verification

The estimated parameters in the model indicate the expected change in the dependent variable for every unit increase in the corresponding independent variable, all else held constant. This interpretation adheres to the principle of ceteris paribus. For instance, a positive parameter signifies that an increase in the independent variable leads to an increase in the dependent variable, while a negative parameter suggests the opposite. This economic verification is essential for understanding the relationships between variables.

Table 6. Economic Verification

Variable	Coefficient
γ_1	13.6742
γ_2	459.189
γ_3	−0.301653
γ_4	−11.1418
γ_5	−0,000000000190256

Source: Author,2024

The analysis seeks to understand the factors influencing inflation, which is the dependent variable in this study. The independent variables considered in the model include Electricity Prices, Interest Rate, Exchange Rate, and Gross Domestic Product.

Interpretation:

$\boldsymbol{\gamma_1}$ – This suggests that, holding all other variables constant, the expected value of inflation is approximately 13.6742 percentage points.

$\boldsymbol{\gamma_2}$ – Holding all other variables constant, a one-unit increase in electricity price (measured in US Dollars per kWh) is associated with an increase in inflation by approximately 459.189 percentage points. This significant relationship underscores the critical role of energy costs in shaping the overall inflationary landscape, highlighting the sensitivity of consumer prices to fluctuations in electricity rates.

$\boldsymbol{\gamma_3}$ – Holding other factors constant, a one percentage point increase in the interest rate is associated with a decrease in inflation by approximately 0.301653 percentage units.

$\boldsymbol{\gamma_4}$ – Holding all other variables constant, a one percentage increase in the exchange rate is associated with a decrease in inflation by approximately 11.1418 percentage units.

$\boldsymbol{\gamma_5}$ – Holding other factors constant, a one USD increase in GDP is associated with a decrease in inflation by approximately 1.90256e-010 percentage points.

4.1.7.2. Statistical & Econometric Verification

The analysis employs statistical significance levels, denoted by asterisks, to indicate the reliability of the estimated coefficients. Variables with a p-value less than 0.05 are considered statistically significant, suggesting a reliable relationship with the dependent variable. Within this model, only the constant term and the interest rate met this criterion, highlighting their robust influence on inflation.

The model's explanatory power is quantified through the R-squared and Adjusted R-squared metrics. An R-squared value of 0.510497 indicates that approximately 51% of the variance in inflation can be accounted for by the specified model, signifying a moderate level of fit. Furthermore, the Adjusted R-squared, which compensates for the number of predictors used, stands at 0.379963, suggesting that the model explains roughly 38% of the inflation variance when considering the number of variables included.

The F-statistic, valued at 3.910833 with an associated p-value of 0.022751, confirms the model's overall significance. This statistic indicates that the model possesses explanatory capabilities that surpass what would be anticipated by chance alone, thereby affirming its utility in exploring the dynamics of inflation.

The Durbin-Watson statistic, measured at 1.122838, points to the presence of positive autocorrelation within the model's residuals. This phenomenon is common in time series analyses and implies that consecutive residuals are correlated. Positive autocorrelation can undermine the reliability of the model's standard error estimates, necessitating careful interpretation of the results and potential adjustments in the econometric approach to ensure accurate inference.

Table 7. R2 and Durbin-Watson results

Statistical Measure	Value Range	Result
R-squared	0 to 1	0.510497
Adjusted R-squared	0 to 1	0.379963
Durbin-Watson	0 to 4	1.122838

Source: Author,2024

The significance testing approach provides a framework for evaluating the quality of the model and the statistical significance of its parameters.

Hypothesis Testing Framework:

Null Hypothesis (H_0): The parameter is not statistically significant. This hypothesis posits that the observed effect (such as the relationship between an independent variable and the dependent variable in regression analysis) could be due to chance or factors not accounted for in the model.

Alternative Hypothesis (H_1): The parameter is statistically significant. The alternative hypothesis suggests that the observed effect is unlikely to be due to chance alone, implying a real, meaningful relationship between the variables under consideration.

This framework facilitates rigorous assessment of the model's parameters by quantitatively determining the likelihood that the observed relationships could have arisen under the assumption of the null hypothesis. Statistical significance is typically evaluated using p-values, with a pre-defined threshold (commonly set at 0.05) below which the null hypothesis is rejected in favor of the alternative. Rejecting the null hypothesis indicates that there is sufficient evidence to conclude that the parameter has a significant effect on the dependent variable, thereby contributing to the overall explanatory power and quality of the model.

For the purposes of this investigation, a significance threshold of 0.05(α =0,05) was selected.

The intercept is significant at $0.0049 < 0.05$

Electricity price is not significant since the null hypothesis about the absence of significance of the parameter was not rejected at $0.4653 > 0.05$

Exchange rate is significant at $0.0025 < 0.05$

Interest rate is not significant at $0.4117 > 0.05$

GDP is is not significant at $0.3904 > 0.05$

Indeed, the outcome of the hypothesis testing associated with the electricity price is crucial for the main objective of the diploma thesis, since the variable of the electricity price is probably one of the most important representants of the inflation.

The subsequent phase in verifying the model involves examining its econometric characteristics through three distinct tests: White's test to detect heteroscedasticity, the Jarque-Bera test for assessing the normal distribution of residuals, and the Breusch-Godfrey test to determine the existence of autocorrelation. These tests will be conducted using the data presented in Figure 3.

Figure 3. Econometric verification

White's test for heteroskedasticity -
Null hypothesis: heteroskedasticity not present
Test statistic: LM = 18.2572
with p-value = P(Chi-square(14) > 18.2572) = 0.195318

Test for normality of residual -
Null hypothesis: error is normally distributed
Test statistic: Chi-square(2) = 3.92719
with p-value = 0.140353

LM test for autocorrelation up to order 1 -
Null hypothesis: no autocorrelation
Test statistic: LMF = 2.6549
with p-value = P(F(1, 14) > 2.6549) = 0.125517

Source: Author,2024

The model exhibits no heteroscedasticity, as evidenced by a p-value of 0.195, which is greater than 0.05, indicating that the variance of the residuals remains constant. Furthermore, the absence of first-order autocorrelation is confirmed with a p-value of 0.125, surpassing the 0.05 threshold. Additionally, the residuals follow a normal distribution, with a p-value of 0.14, also exceeding 0.05. This normal distribution of residuals validates the earlier conducted F-test and t-tests, which rely on the assumption of normality due to their parametric nature.

4.1.8. Model Application and Scenario Simulation

4.1.8.1. Coefficients of Elasticity

This section lays the groundwork for calculating elasticities to determine how the price of electricity affects Azerbaijan's inflation rate, as well as a potential model simulation reflecting Azerbaijan's economic landscape. First, the author summarizes the results of the elasticity calculations detailed in Table 8.

The coefficient of elasticity (ε) is determined through the application of the following formula:

$$e_{ij} = \frac{\delta y}{\delta x} \times \frac{x}{y} \%$$

$\hat{y} = 13{,}6742 + 459{,}189 x_{2t} - 0{,}301653 x_{3t} - 11{,}1418 x_{4t} - 0{,}000000000190256 x_{5t}$

Theoretical ŷ for 2022

$\hat{y}_{1,2022} = 13{,}6742 + 459{,}189 \times 0{,}05882 + 0{,}301653 \times 16{,}50948 - 11{,}1418 \times 1{,}7 - 0{,}000000000190256 \times 78721058824 = 7{,}26365042$

$\hat{y}_{1,2022}$ = 7,26365042

Table 8. Elasticity for 2022

Electricity Price	Interest Rate	Exchange Rate	GDP
X_{2t}	X_{3t}	X_{4t}	X_{5t}
3,72	0,685	-2,60765	-2,0619

Source: Author,2024

4.1.8.2. Scenario Simulation

In the scenario where electricity prices rise by 10% in 2022, the calculation is as follows:

$$y_{1,2022} = 13{,}6742 + 459{,}189 \times 0{,}05882 \times 1{,}10 + 0{,}301653 \times 16{,}50948 - 11{,}1418 \times 1{,}7 - 0{,}000000000190256 \times 78721058824 = 9{,}9646$$

The result is 9.9646.

Under normal circumstances, the baseline figure for 2022 is 7.26365042. With a 10% increase in electricity prices that year, inflation would elevate to 9.9646 from 7.26365042. This scenario highlights the direct impact of a 10% surge in electricity costs on inflation, demonstrating a substantial rise from the initial figure of 7.26365042 to 9.9646 in the context of the 2022 inflation calculation. This emphasizes the significant influence that changes in electricity prices can have on the overall inflationary environment.

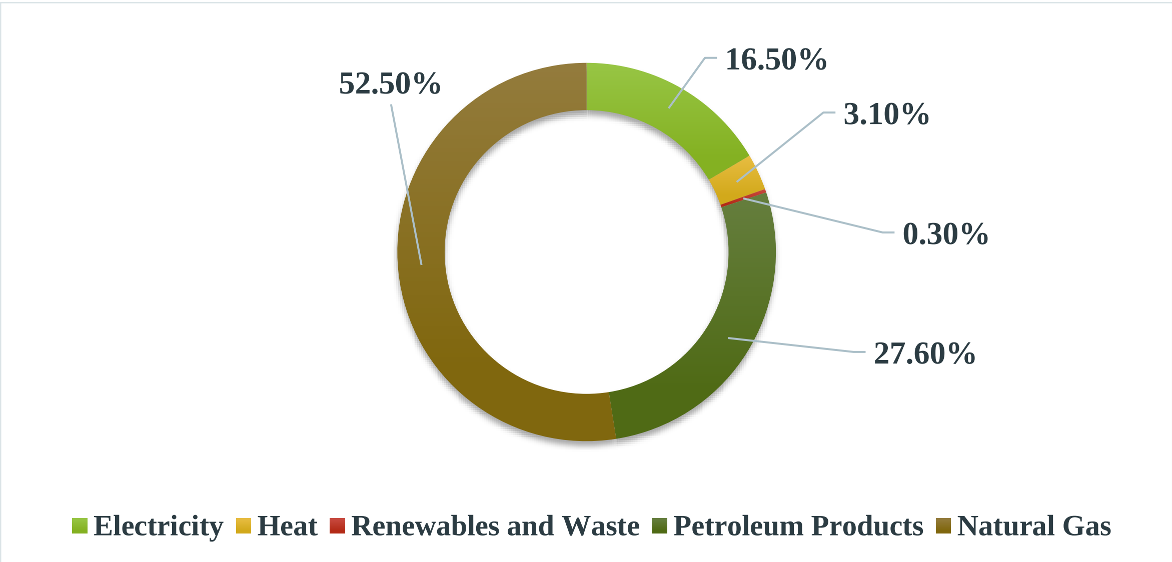
4.2. Case Study 2. Impact of Electricity Price Fluctuations on the Azerbaijani Economy and the Role of Government Policies

4.2.1. Agricultural Sectoral Analysis

In "Sector Analysis," the inaugural section of our comprehensive study, we embark on an empirical journey to unravel the intricate effects of electricity price variations across different sectors. Central to our analysis is the agriculture sector, selected for its pivotal role in the economy and its unique vulnerability to changes in electricity costs. This focus enables us to delve deeply into the nuanced ways in which fluctuations in electricity prices influence agricultural operations, shedding light on broader economic implications.

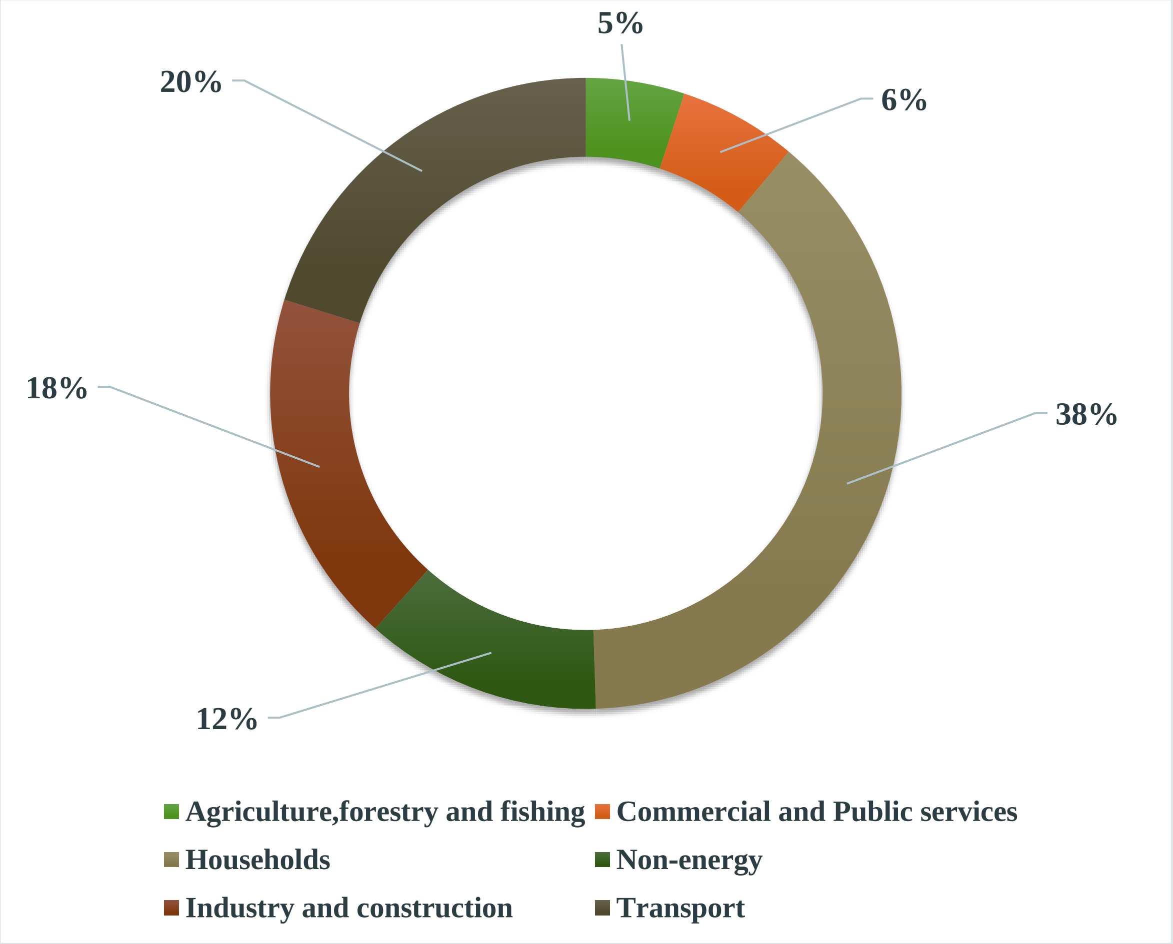
Figure 4 reveals that natural gas is the predominant source in final energy consumption, accounting for 52.5%, with petroleum products coming in second at 27.6%. Electricity comprises 16.5% of final energy consumption. It also highlights that households are the principal consumers of final energy, utilizing 38% of the total, followed by the transport sector and industry, which consume 20% and 18% respectively. Furthermore, approximately 5% of the total final energy consumption is allocated to agriculture (encompassing forestry and fisheries). (The State Statistical Committee of the Republic of Azerbaijan,2024)

Figure 4. Final Energy Consumption by Source in 2020



Source: own construction according to data of The State Statistical Committee of the Republic of Azerbaijan,2024

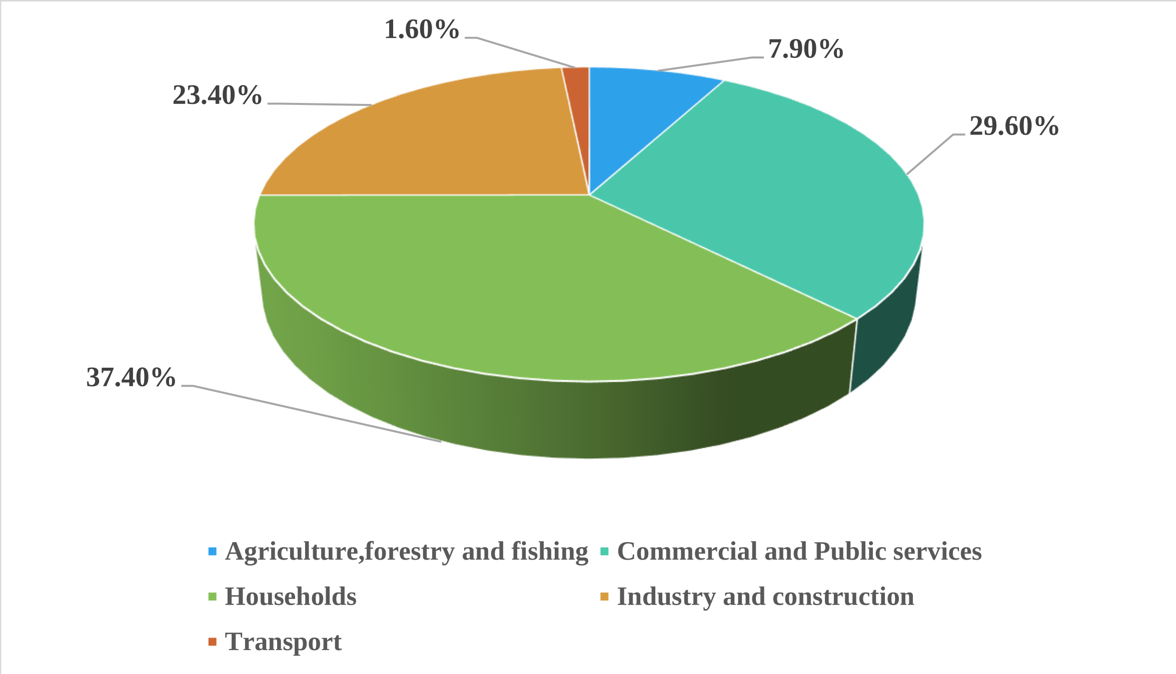
Figure 5. Final Energy Consumption by Sector in 2020



Source: own construction according to data of The State Statistical Committee of the Republic of Azerbaijan,2024

In 2020, households emerged as the primary consumers of electricity, representing 37% of the total electricity consumption. Following closely were the commerce and public services sectors, contributing to 30% of the consumption. The industrial and construction sectors combined for 23%, while agriculture accounted for 8% of the total electricity usage, as illustrated in Figure 6.

Figure 6. Electiricty Consumption by Sector in 2020



Source: own construction according to data of The State Statistical Committee of the Republic of Azerbaijan,2024

The active part of material and technical resources in the agricultural field is energy resources. They include the power of electric and mechanical engines, as well as the number of working cattle calculated on mechanical power. In the structure of energy resources, the power of engines of transport, cars and combines has a high specific weight. About 75 percent of the energy resources in the agricultural sector fall on their share

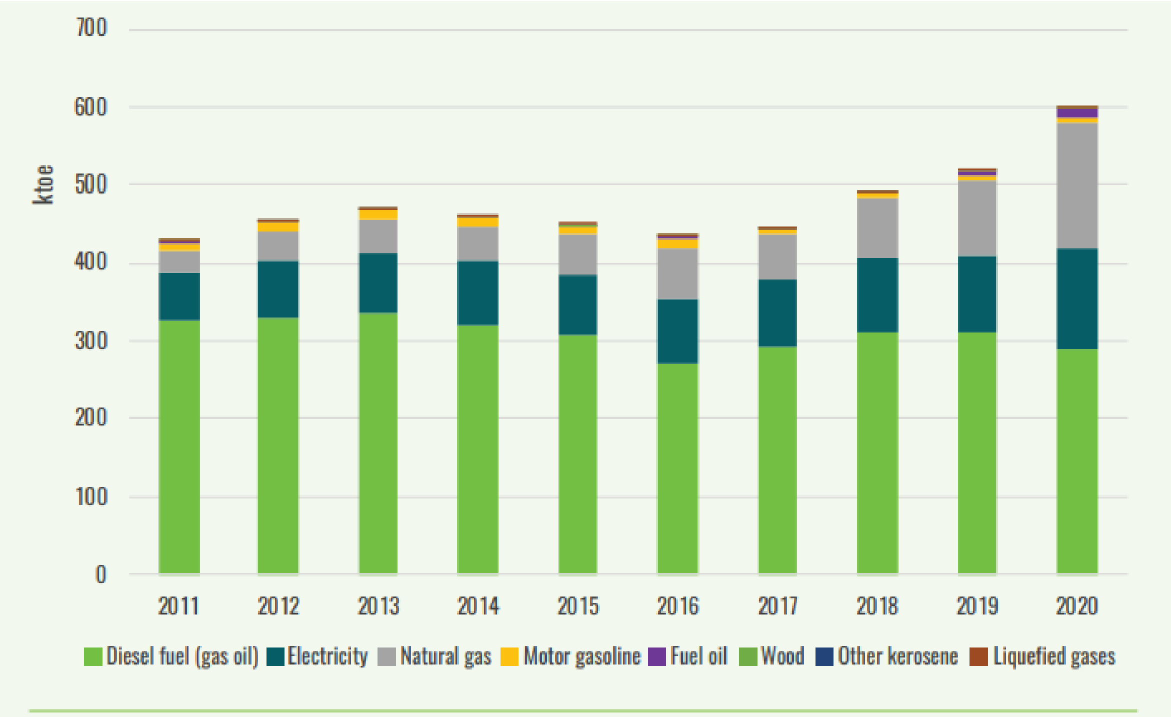
Electrification of agriculture occupies an important place among energy resources. It creates a foundation for complex mechanization and automation of agriculture. The main indicators of the provision of electricity to agriculture are the indicators of the provision of electricity and the arming of labor with electricity. The second indicator is calculated as the ratio of the total number of kilowatt-hours of electricity used in the farm to the average annual number of agricultural workers.

The economic efficiency of the use of electricity is determined by indicators such as labor productivity, the cost of production of a product unit, the return period of additional capital investments spent on electricity. These indicators are calculated by comparing two options before and after using electricity. An indicator such as the energy capacity of the product is also used in the economic analysis.

This indicator is calculated as the ratio of energy resources to the volume of the produced product. One of the main conditions for the rapid increase of labor productivity is the improvement of the level of equipment provision of the agricultural sector. It is estimated that about 50 percent of the increase in labor productivity is due to mechanization. (Ramina et al, 2023)

Notably, energy usage in the agricultural sector saw a 40% increase over the past decade. Figure 7 indicates that energy consumption escalated from 428 Tonne of oil equivalent (ktoe) in 2011 to 600 ktoe in 2020, with diesel fuel—primarily utilized in tractors and other agricultural machinery—being the most consumed. However, the usage of natural gas and electricity also saw substantial rises. Natural gas usage in total energy consumption jumped by 21%, and electricity by 5%. These increases, particularly in natural gas and electricity, often applied in pre- and post-harvest activities, suggest a trend towards agricultural modernization, marked by a shift from manual labor to mechanized farming operations. (The State Statistical Committee of the Republic of Azerbaijan,2024)

Figure 7. Energy Consumption in the Agriculture Sector, Including Forestry and Fisheries in the Period from 2011 to 2020



Source: The State Statistical Committee of the Republic of Azerbaijan,2024

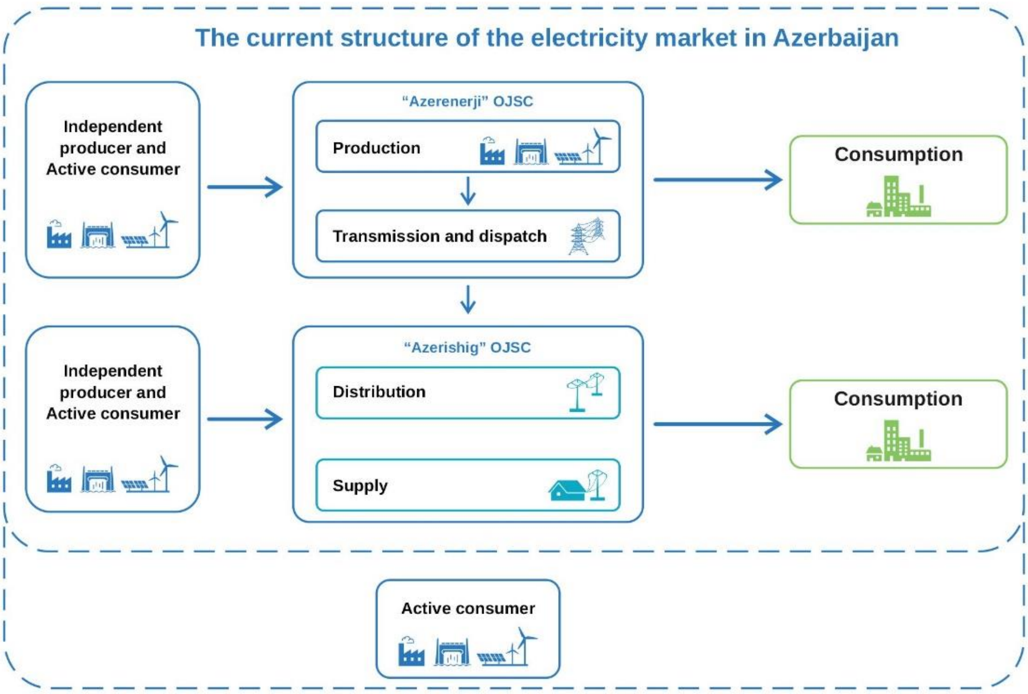
And this shows that the increase in electricity prices significantly impacts Azerbaijan's agriculture sector, primarily by raising operational costs for irrigation, machinery, and product storage. This leads to higher production costs, potentially reducing crop yields and increasing food prices. The sector might face decreased profitability and competitiveness, urging a shift towards more energy-efficient practices. Understanding these effects is vital for developing strategies to mitigate negative impacts on the economy and food security.

4.2.2. Policy Analysis

4.2.2.1. Institutional Structure and Legislation

The energy sector in Azerbaijan is primarily governed by three major government entities: the Presidential Administration, the Cabinet of Ministers, and the Ministry of Energy. Control over specific energy subsectors is held by several state-run monopolies. These include SOCAR, which oversees oil refining and the distribution and supply of natural gas (State Oil Company of the Republic of Azerbaijan); Azerenergy/Azerenerji, responsible for the generation and transmission of electricity; Azerishiq, which handles the distribution and supply of electricity; and Azeristiliktejhizat, which manages district heating services.

Figure 8. Structure of electricity market in Azerbaijan



Source: Azerbaijan Energy Regulatory Agency,2024

The Ministry of Energy serves as the primary executive body responsible for executing state policies and overseeing regulations within the energy sector. The enactment of regulatory policies is mainly carried out by the Ministry of Energy, alongside the Ministry of Economy and Industry and the Tariff Council. The Ministry of Energy plays a crucial role in applying various government-issued regulations, orders, and decrees. It operates under a board structure approved by the Cabinet of Ministers and holds the power to enact orders and decrees relevant to its field of expertise. This expertise covers a broad range of energy sector aspects, excluding tariff regulation, which falls under the jurisdiction of the Tariff Council.

Operating under the authority granted by a Presidential Decree on 26 December 2005, along with the Regulations on the Tariff (Pricing) Council and a Cabinet of Ministers Resolution dated 9 March 2006, the Tariff Council is responsible for setting tariff methodologies, approving tariff levels suggested by regulated entities (energy sector included among others), recommending modifications to pricing-related legal frameworks, and resolving disputes related to price regulation and tariff implementation. It possesses the autonomy to initiate actions within its realm of tariff authority.

The Council is composed of a chairman and twelve additional members, who function in a council capacity rather than as staff. The Economic Development Minister acts as the chairperson, while the twelve members consist of ten deputy ministers and two deputy heads of committees. Should there be a presidential decree appointing new ministers or deputy heads, it would also automatically entail the appointment of a new chairperson and council members. The tenure of the chairperson and council members is indefinite, lasting if they are designated by the president.

The power sector is governed by several key legislative documents: the Energy Resources Law (enacted on 30 March 1996), the Electricity Law (passed on 13 June 1998), and the Power Station Law (established on 28 December 1999). In response to the public demand for electricity and gas, the government initiated the State Program for the Development of the Fuel-Energy Complex of Azerbaijan for the years 2005-2015.

Under the Electricity Law, the energy framework in Azerbaijan is structured to ensure the following: The State Electrical Enterprise is tasked with managing transmission lines exceeding 110 kV, dispatch centers, and power generation entities. This enterprise is also responsible for buying electricity from independent producers to facilitate its transport via the national grid and to engage in cross-border energy trading. Furthermore, energy suppliers acquire electricity from the State Electrical Enterprise or other independent producers to distribute to end-users. Independent energy producers, who operate autonomously from the state's electrical system, generate, and directly supply electricity to consumers either through their distribution networks or through transactions with the State Electrical Enterprise or energy suppliers. These producers are also permitted to export electricity.

The primary aims of the state's involvement in regulating electricity tariffs include safeguarding the nation's energy security, ensuring a dependable electricity supply for consumers, and establishing tariff levels that balance the interests of both consumers and electricity producers. This approach encourages investment in power generation infrastructure and the expansion of network interconnections. Additionally, direct government regulation of pricing involves a designated public authority authorized by the Government to define pricing methods, sanction tariffs, and oversee all regulatory bodies and businesses. This system aims to lower prices, tariffs, and losses, while fostering a competitive market environment that includes private power plants, enhancing service quality, and ensuring competitive conditions. Furthermore, aligning with European standards through legislative harmonization with European Parliament directives and regulations, as well as implementing projects in transmission and distribution, are among the government's objectives. Beyond these regulatory aspects, numerous organizational and behavioral factors also play a crucial role in influencing the decision-making processes of project developers. (Lüthi and Prassler,2011)

Azerbaijan introduced a significant update to its electric power sector legislation, as announced in the country's official publication, Azerbaijan, on May 20, 2023. The newly enacted Law on Electric Power (No. 858-VIQ) outlines a structured approach for progressively deregulating the electric power sector and establishing a centralized electricity market in Azerbaijan.

This legislation mandates the segregation of operations within the electricity sector, specifically separating electricity generation, transmission, distribution, and supply functions. This process, known as "unbundling," ensures that entities involved in electricity generation and supply are distinct from those managing transmission and distribution networks, aiming to prevent conflicts of interest and promote efficiency.

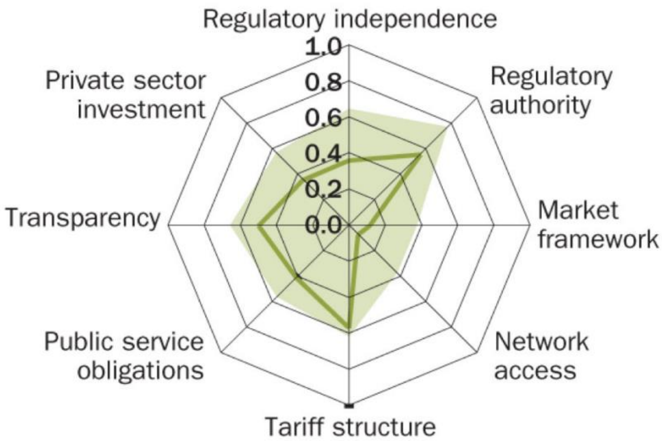
The law introduces a phased reform approach. By July 1, 2025, regulations concerning the separation of generation activities from the electricity supply chain and the distinct management of retail supply from transmission and distribution operations, along with the appointment of a market operator, will be implemented.

Further developments, including the detachment of distribution from transmission and retail supply as well as the deregulation of retail and wholesale markets—additionally introducing markets for balancing and ancillary services—are set to be enacted by July 1, 2028.

Other aspects of the law, encompassing transitional arrangements, the framework for establishing an energy market regulator, objectives, and principles for deregulating the energy sector, and detailing the government and regulator's roles, will take effect on January 1, 2024. With this, the preceding Law on Electric Power (No. 459-IQ) and the Law on Electricity and Heating Plants (No. 784-IQ) will be revoked. Furthermore, a presidential decree (Decree No. 2143) to implement the new legislation was issued, also effective from January 1, 2024. (Cantekin, Kayahan, 2024)

Figure 9 displays the outcomes for Azerbaijan's electricity sector, measured against the criteria and benchmarks set out in the evaluation model. Each axis ends at a maximum score of 1.0, indicating complete alignment with global best practices. The more complete the "web" shape is, the more closely Azerbaijan's regulatory framework for electricity aligns with international standards. The performance of Azerbaijan is depicted by the dark-colored line.

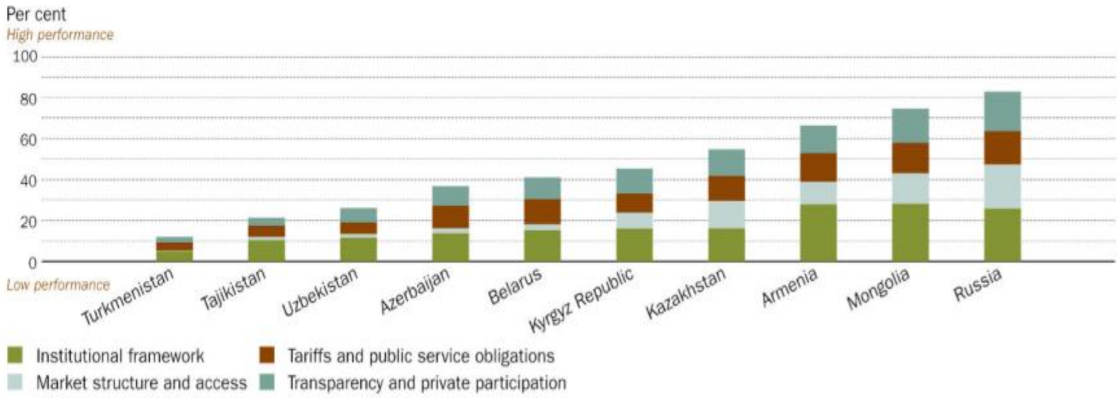
Figure 9. Electricity spider graph of Azerbaijan



Source: European Bank for Reconstruction and Development,2024

For contextual analysis, the shaded portion illustrates the average performance of the electricity sector among Group C nations. This group comprises Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyz Republic, Mongolia, Russia, Tajikistan, Turkmenistan, and Uzbekistan.

Figure 10. Electricity Sector - Comparative view of Group C countries



Source: European Bank for Reconstruction and Development,2024

In the power engineering sector, significant steps have been taken to establish a legislative framework and enhance its legal foundation. A series of laws related to power engineering were enacted, such as those addressing "Power Engineering," "Energy Resource Usage," "Electrical Power Engineering," and "Electric and Thermal Stations."

The Electricity Law stipulates that both individuals and organizations are required to secure specific authorization for engaging in the generation, transmission, and distribution of electricity unless the law states otherwise. Typically, this special authorization for operations in the power sector is awarded competitively to qualified contractors. However, the law allows for certain instances where permission can be granted without a competitive tender, based on a decision from the Ministry of Energy. Additionally, the law mandates that high-voltage installations must not be built or made operational without obtaining prior special permission, except in circumstances where the law exempts such a requirement.

4.2.2.2. Main energy legislation

The energy regulations of Azerbaijan, primarily established in the late 1990s, encompass a comprehensive framework for managing the entire spectrum of energy operations, from exploration and production to the final stages of consumption. Key legislation, such as the 1998 Law on Energy, governs the exploration, extraction, refinement, conservation, movement, allocation, and utilization of all energy resources and products. This mandates that any entity wishing to engage in energy activities must secure specialized authorization from the Ministry of Energy (MoE) through an energy contract or an application before commencing any projects.

The energy policy of Azerbaijan, articulated in Article 3 of the 1998 Law on Energy, sets forth several strategic goals:

- Efficient generation, transfer, allocation, storage, consumption, and safeguarding of energy products.
- Development of an infrastructure that ensures a steady supply of energy to all consumers, facilitating new employment opportunities, and promoting competition while minimizing monopolistic practices within the energy sector.
- Structuring of the energy sector to accommodate various forms of ownership, sustained through long-term contracts and authorizations, and to nurture a conducive environment for local enterprises producing quality goods.
- Encouragement of practices that lead to the conservation of energy resources, minimize waste, promote effective energy use, and adopt renewable energy sources.
- Minimization of the environmental footprint of energy production and use.
- Provision of subsidies to both producers and consumers in times of energy scarcity to foster greater energy efficiency.
- Establishment of beneficial legal and economic frameworks to attract and secure investments.
- Formulation and implementation of national energy programs.

During the latter half of the 1990s, a suite of laws was enacted, shaping the current landscape of energy legislation in Azerbaijan. The 1996 Law on the Use of Energy Resources outlines the country's legal, economic, and social principles underlying the state's approach to energy resource utilization and delineates broad strategies for policy execution.

The 1998 Law on Subsoil addresses the exploration, extraction, stewardship, and safety measures concerning mineral resources, inclusive of oil and gas, within Azerbaijan's territory and its sector of the Caspian Sea shelf.

The realm of gas is governed by the 1998 Law on Gas Supply, which details the production, processing, conveyance, storage, distribution, marketing, and consumption of all gas varieties.

Projects related to oil and gas exploration and extraction that involve international partnerships are predominantly managed through production sharing agreements (PSAs), with each PSA holding the force of an individual law.

Electricity-specific legislation includes the 1998 Law on the Use of Energy Resources, the 1998 Law on Electric Power Industry, and the 1999 Law on Electricity and Heating Plants. As per the 1998 Law on Electric Power Industry and its amendments, permissions are mandatory for the generation, transmission, distribution, and sale of electricity, in addition to its import and export, except as otherwise provided by law. As of April 2021, while individual statutes on renewable energy and energy efficiency are not yet in place, drafts have been prepared and are undergoing the ratification process. (IEA,2024)

4.2.2.3. Key policies and reform proposals

In recent times, Azerbaijan has shown a growing commitment to addressing climate change and enhancing the development of renewable energy sources. Following its obligations under the Paris Agreement of 2015, Azerbaijan has aimed for a 35% reduction in greenhouse gas (GHG) emissions by the year 2030, using 1990 as the reference year. To fulfill these ambitious targets, the Ministry of Energy has set forth a plan to augment the nation’s renewable energy capacity to 30% of its total energy mix. Specifically, the Ministry intends to introduce an additional 1,500 megawatt (MW) of renewable energy capacity, with a staged plan of 440 MW by 2023, an additional 460 MW from 2023 to 2025, and 600 MW from 2026 to 2030. Moreover, at the COP26 summit, Azerbaijan pledged to further cut emissions by 40% by 2050, marking this target as a voluntary commitment. This initiative is supported by a series of critical policy measures and reform propositions that are either in the drafting stage or have already been implemented.

The Republic of Azerbaijan's Energy Sector Reforms, initiated in 2019, are focused on the rapid advancement and enhancement of renewable energy sources and investment in the nation. These reforms include the formulation of a comprehensive strategy for long-term development in the energy sector, aimed at improving efficiency and introducing competitive practices into the electricity market.

The President of Azerbaijan has issued orders to bolster renewable energy projects. One such order specifically addresses the execution of pilot projects in renewable energy, fostering the exploration of renewable energy potential and inviting private sector investment. This directive also seeks to clarify legal frameworks and mechanisms essential for the execution of these pilot initiatives.

Another significant presidential order targets the establishment of a Green Energy Zone in Azerbaijan's recently reclaimed territories. Developed in collaboration with the Japanese firm TEPSCO, this initiative outlines a strategy for leveraging the renewable energy potential in these areas, incorporating green and energy-efficient technologies. Preliminary assessments have identified solar energy potential exceeding 7,200 MW in the Gubadli, Zangilan, Jabrayil, and Fuzuli regions, and wind energy potential of around 2,000 MW in the highland areas of Lachin and Kalbajar. As part of efforts to reinforce energy security in these regions, four hydroelectric power plants (HPPs) have been reactivated, and two additional HPPs are under construction on the Araks River in the Jabrayil region, which will contribute 140 MW of capacity.

Additionally, the "Azerbaijan 2030: National Priorities for Socio-Economic Development" program, instituted by the President, lays the foundation for creating zones of green energy. This initiative emphasizes energy efficiency and prioritizes the adoption of sustainable energy sources and eco-friendly technologies across various economic sectors.

Moreover, the "State Programme of Socio-Economic Development of the Regions of the Azerbaijan Republic 2019-2023," launched in January 2019, supports the regional utilization of renewable energy sources (RES) and promotes the conservation of natural resources. This program underscores the country's commitment to sustainable development and the optimal use of its renewable resources.

4.2.2.4. Tariffs

Entities within the regulated sector must provide financial reasoning for the costs included in the pricing (tariffs) structure. Once established, these tariffs are subjected to the Tariff Council's scrutiny and are made public following their endorsement. Currently, a standard tariff is applied for residential consumption, with distinct tariffs for commercial and industrial users. From a legal perspective, there is no prohibition or limitation on foreign investment in the energy sector; such investments are in fact encouraged, with assurances for the long-term acquisition of electricity. The government has implemented an interim tariff strategy aimed at achieving complete cost recovery for utility providers, including a 10% return on equity, to ensure their economic independence.

The Tariff Council, led by the Minister of Economic Development, is responsible for setting the retail and wholesale electricity tariffs, as well as the pricing for gas and other fuels. While the Council has the authority to establish tariffs for all types of renewable energy, thus far, only those for wind energy and small-scale hydroelectric power have been determined. There is currently no variation in tariffs between cogeneration and standard power systems, as a uniform rate is applied.

The Ministry of Economy is currently engaging in discussions within the Tariff Council about potential support mechanisms like feed-in tariffs and feed-in premiums to bolster the renewable energy sector.

Currently, a standard tariff is applied for residential use, with different tariffs set for commercial and industrial businesses. Within the electricity sector, the established tariff categories are as follows:

- ✓ Prices for purchasing electricity from producers;
- ✓ Prices for the wholesale distribution of electricity;
- ✓ Prices for the retail distribution of electricity;
- ✓ Prices for exporting and importing electricity.

These tariffs are computed based on a cost-benefit analysis, utilizing historical reports, actual performance data, and future projections, while also considering utility company assessments. Table 9 presents a detailed account of the electric power and service tariffs, encompassing wholesale and retail rates, as well as differentiated tariffs for usage during day and night times. (Tariff Council of Azerbaijan Republic,2024)

Table 9. Azerbaijan electricity tariffs,(Manat [AZN],October 16, 2021)

Domestic electricity tariffs	
Services	**Tariffs (with VAT, qapik/kWh)**
Purchase from the manufacturer	
On private small hydropower plants	5,0
On wind power plants	5,5
On other renewable sources	5,7
On alternative sources	6,6
Wholesale (with the exception of consumers specified in Clause 8 of this Decision)	6,6
Aluminum industry with direct power supply by 35 and 110 kV lines, stable load demand during the day, average monthly energy consumption for production purposes is not less than 5 million kWh	
Daytime (from 08.00 to 22.00)	6,4
Night time (from 22.00 to 08.00)	3,1
Transit transmission	0,2
Retail	
Domestic consumers	
for the part of monthly consumption up to 200 kW (including 200 kW).	8,0
for the part of the monthly consumption volume from 200 kW to 300 kW (300 kW included)	9,0
for the part of the monthly consumption volume exceeding 300 kW	13,0
Commercial consumers (with the exception of consumers specified in Clause 8 of Resolution No. 14 of October 16, 2021)	
Trade and service	11,0
Others	10,0

Note:AZN 1 = USD 0.59/USD 1 = AZN 1.70.
Source: Own construction according to data of the Tariffs (Price) council of Azerbaijan Republic,2024

5. Results and Discussion

5.1. Role of Electricity Price

To begin with, analysis delineates the symbiotic relationship between inflation rates and various economic indicators within the context of Azerbaijan's macroeconomic milieu. By invoking the methodological rigor of regression analysis, this study scrutinizes the interdependencies between the dependent variable, inflation rate, and a cadre of independent variables comprising Electricity Prices, Exchange Rate, Interest Rate, and Gross Domestic Product (GDP). The analytical framework is buttressed by an array of statistical tools including correlation matrices, unit root assessments, and R-squared evaluations, collectively affirming the dataset's propensity for stationarity and its resilience against spurious correlations.

Employing the Ordinary Least Squares (OLS) method as the cornerstone of our analytical paradigm, we endeavor to distill the essence of the relationships at play. This linear regression technique is instrumental in distilling the quantifiable nexus between inflation and the independent variables, with a particular emphasis on electricity prices. The OLS methodology, celebrated for its efficacy in minimizing discrepancies between empirical observations and theoretical predictions, posits a statistically significant correlation wherein a unilateral elevation in electricity prices, quantified at 1 USD per KWh, precipitates an inflationary surge estimated at 459.189 percentage points. This empirical evidence underscores the formidable impact of energy costs on the inflationary trajectory, delineating electricity price volatility as a central catalyst in consumer price fluctuations.

Further reinforcing the veracity of our model, scenario-based simulations prognosticate a 37.18% inflationary uptick consequent to a 10% augmentation in electricity prices for the fiscal year 2022. This predictive assertion corroborates the centrality of energy expenditures in the orchestration of inflationary dynamics.

The second part of analysis covers an evaluation of the agricultural sector's confluence with the energy domain, spotlighting a 40% amplification in energy consumption from 2011 to 2020, attributed to the sector's transition towards mechanization. Despite the manifold benefits accruing from electrification in bolstering productivity and operational efficiency, the specter of escalating electricity prices looms large, heralding potential adversities including escalated operational costs, diminished crop yields, and inflating food prices.

The dissertation culminates in an exhaustive dissection of Azerbaijan's energy sector's regulatory and institutional framework. At the epicenter of this analysis are pivotal entities such as the Presidential Administration, the Cabinet of Ministers, and the Ministry of Energy, operating in concert with state-sanctioned monopolies like SOCAR, Azerenergy, Azerishiq, and Azeristiliktejhizat to steward the energy sector's multifaceted operations. This section illuminates the legislative scaffolding undergirding the sector, spotlighting seminal statutes like the Energy Resources Law, the Electricity Law, and the Power Station Law, each crafted to ensure a stable electricity supply, incentivize infrastructural investments, and engender a competitive market landscape.

The thesis delves into the Tariff Council's instrumental role in sculpting equitable electricity tariffs, inclusive of provisions for renewable energy integration. This exploration accentuates the strategic imperatives aimed at harmonizing consumer and producer interests while navigating the sector towards a paradigm of efficiency, competition, and sustainability.

5.2. Recommendations

To advance Azerbaijan's energy sector towards greater liberalization and sustainability, the author suggests a multi-faceted approach:

Firm Political Commitment and Legal Structures: Strengthen political resolve and enhance legal frameworks for transparency and long-term strategic alignment, including establishing an independent regulatory authority.

Strategic Investments: Prioritize new power generation and modernize existing facilities, with a significant focus on expanding renewable energy sources like wind and solar.

Liberalization and Regional Integration: Continue liberalizing the energy market for seamless integration with regional markets, including breaking up monopolies and setting clear market opening timelines.

Structural Reforms: Implement structural reforms for competitive market separation, promote competition among generators, and ensure equitable grid access.

Energy Efficiency and Diversification: Launch initiatives for energy efficiency and diversify energy sources, including developing new interconnections with neighboring markets.

Independent Regulatory Authorities: Establish regulatory bodies with the expertise to enforce regulations, understanding costs, and regulating network access.

Facilitating Transition to New Systems: Design and implement mechanisms for a smooth transition to competitive markets, ensuring energy supply reliability.

By adopting these strategies, Azerbaijan can achieve a more efficient, sustainable, and competitive energy sector, serving as a regional benchmark for reform.

6. Conclusion

This detailed study examines the profound effect of electricity pricing on inflation within the economic landscape of Azerbaijan, uncovering a strong linkage between the cost of energy and key economic metrics. Through the application of sophisticated statistical tools like Ordinary Least Squares regression, the research uncovers a clear connection, where hikes in electricity prices markedly amplify inflationary trends. This finding emphasizes the role of energy pricing as a pivotal factor in driving changes in consumer prices, with simulations based on different scenarios further illustrating the significant risk of inflation surges following rises in electricity costs.

The inquiry goes further to assess the ramifications at the sector level, particularly in agriculture. Here, the adoption of more mechanized farming methods has made the sector more vulnerable to swings in electricity prices.

The study also delves into the regulatory and institutional framework governing Azerbaijan's energy sector, pinpointing key stakeholders and policy initiatives aimed at overseeing energy management. An analysis of the Tariff Council's strategies in establishing fair electricity prices sheds light on attempts to strike a balance in energy pricing that serves both consumers and producers, fostering a move towards a more sustainable and competitive energy landscape.

Building on these insights, the thesis suggests a series of steps to further liberalize and enhance the sustainability of Azerbaijan's energy sector. Recommendations include bolstering political and legal infrastructure, increasing investments in renewable energy sources, opening the energy market, carrying out structural adjustments, and encouraging energy conservation and diversity. Establishing independent regulatory bodies is also highlighted as a critical measure for implementing regulations and advancing towards a competitive market environment.

Ultimately, the thesis posits that through a comprehensive strategy involving political will, strategic investment, market opening, and structural reforms, Azerbaijan can significantly improve the effectiveness, sustainability, and competitive edge of its energy sector. Such measures will not only curb the inflationary effects of fluctuations in electricity prices but also establish Azerbaijan as a frontrunner in regional energy reform.

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List of figures, tables, graphs, pictures, and abbreviations

7.1. List of figures

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7.5. List of abbreviations

AZN	Azerbaijani manat
CBO	Congressional Budget Office
CPI	Consumer Price Index
DTI	Department of Trade and Industry
EDD	Economic Development Department
EU	European Union
FDI	Foreign Direct Investment
GHG	Greenhouse Gas
GS2SLS	Generalized Spatial Two Stage Least Squares
GW	Gigawatts
HPP	Hydroelectric Power Plants
IMF	International Monetary Fund
KTOE	Kilotonne of Oil Equivalent
MoE	Ministry of Energy
MW	Megawatt
MWh	Megawatt hours
NDC	Nationally Determined Contribution
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
OLSM	Ordinary Least Squares Method
PSA	Production Sharing Agreements
RES	Renewable Energy Sources
SNA	System of National Accounts
SOCAR	State Oil Company of the Republic of Azerbaijan
TWh	Terawatt hours
USD	U.S. dollar
VAR	Vector Autoregression

8. Appendix

Appendix 1. Correlation Matrix

gretl: correlation matrix

```
Correlation Coefficients, using the observations 2003 - 2022
Two-tailed critical values for n = 20: 5% 0.4438, 1% 0.5614

       Inflation ElectricityPri~    InterestRate    ExchangeRate
          1.0000         -0.0969         -0.6816          0.0547 Inflation
                          1.0000         -0.0666          0.7499 ElectricityPri~
                                          1.0000         -0.2337 InterestRate
                                                          1.0000 ExchangeRate

             GDP
         -0.1507 Inflation
          0.6644 ElectricityPri~
          0.0295 InterestRate
          0.0330 ExchangeRate
          1.0000 GDP
```

Source: SW Gretl

Appendix 2. OLSM in Gretl

gretl: model 1

File Edit Tests Save Graphs Analysis LaTeX

```
Model 1: OLS, using observations 2003-2022 (T = 20)
Dependent variable: Inflation

                      coefficient       std. error    t-ratio  p-value
  --------------------------------------------------------------------
  const                13.6742          4.14691        3.297   0.0049   ***
  ElectricityPrices   459.189         612.806          0.7493  0.4653
  InterestRate         -0.301653        0.0834433     -3.615   0.0025   ***
  ExchangeRate        -11.1418         13.1948        -0.8444  0.4117
  GDP                  -1.90256e-010    2.15107e-010  -0.8845  0.3904

Mean dependent var   6.990483   S.D. dependent var   5.591793
Sum squared resid    290.8111   S.E. of regression   4.403114
R-squared            0.510497   Adjusted R-squared   0.379963
F(4, 15)             3.910833   P-value(F)           0.022751
Log-likelihood      -55.14819   Akaike criterion     120.2964
Schwarz criterion    125.2750   Hannan-Quinn         121.2683
rho                  0.384534   Durbin-Watson        1.122838

Excluding the constant, p-value was highest for variable 3 (ElectricityPrices)

White's test for heteroskedasticity -
  Null hypothesis: heteroskedasticity not present
  Test statistic: LM = 18.2572
  with p-value = P(Chi-square(14) > 18.2572) = 0.195318

Test for normality of residual -
  Null hypothesis: error is normally distributed
  Test statistic: Chi-square(2) = 3.92719
  with p-value = 0.140353

LM test for autocorrelation up to order 1 -
  Null hypothesis: no autocorrelation
  Test statistic: LMF = 2.6549
  with p-value = P(F(1, 14) > 2.6549) = 0.125517
```

Source: SW Gretl