bilig
WINTER 2025/ISSUE 112
63-104

Araştırma Makalesi / Research Article

Dynamic Interrelationships among Energy Prices, Exchange Rates, and Inflation: An Empirical Analysis for the Turkic Republics*

Türker Batmaz**

Abstract

The dynamic interrelationships among energy, goods and financial markets in Eurasian economies are not empirically analyzed, yet; and this study attempts to handle this gap in the literature. It examines the dynamic interrelationships for energy (oil and natural gas) prices, inflation rate, and exchange rate in Türkiye, Azerbaijan, Kazakhstan, Kyrgyzstan, and Uzbekistan, covering the period from January 2010 to April 2022, by means of the Toda and Yamamoto approach to Granger causality, impulse-response functions, and variance decompositions. The empirical findings unveil that (i) inflation is mainly driven by natural gas prices, (ii) oil prices cause inflation through natural gas prices, (iii) the exchange rate pass-through to inflation seems country-specific, and (iv) there is a weak dependence between energy prices and exchange rates. Accounting for smooth structural breaks in causality analysis based on the Fourier Toda-Yamamoto approach reinforces these findings.

Keywords

Energy prices, exchange rate, inflation, Eurasian countries, causality.

JEL codes: C10, O1, Q43.

---

* Date of Arrival: 18 February 2024 – Date of Acceptance: 28 June 2024
You can refer to this article as follows:
Batmaz, Türker. "Dynamic Interrelationships among Energy Prices, Exchange Rates, and Inflation: An Empirical Analysis for the Turkic Republics." *bilig*, no. 112, 2025, pp. 63-104, https://doi.org/10.12995/bilig.7933.

** Assoc. Prof. Dr., Balıkesir University, Faculty of Economics and Administrative Sciences, Department of Economics – Balıkesir/Türkiye
ORCID: 0000.000.20360-6302
turkerbtmz@gmail.com

Enerji Fiyatları, Döviz Kuru ve Enflasyon İlişkisi: Türk Cumhuriyetleri için Dinamik Etkiler*

Türker Batmaz**

Öz

Avrasya ekonomilerinde enerji, mal ve finans piyasaları arasındaki dinamik ilişkiler henüz ampirik olarak analiz edilmemiştir. Bu çalışma literatürdeki bu boşluğu ele almaya çalışmaktadır. Çalışma, Türkiye, Azerbaycan, Kazakistan, Kırgızistan ve Özbekistan'da enerji (petrol ve doğalgaz) fiyatları, enflasyon oranı ve döviz kuru arasındaki dinamik ilişkileri, Ocak 2010-Nisan 2022 dönemini kapsayacak şekilde, Toda ve Yamamoto'nun Granger nedensellik yaklaşımı, etki-tepki fonksiyonları ve varyans ayrıştırmaları aracılığıyla incelemektedir. Ampirik bulgular (i) enflasyonun esas olarak doğal gaz fiyatlarından kaynaklandığını, (ii) petrol fiyatlarının doğal gaz fiyatları aracılığıyla enflasyona neden olduğunu, (iii) döviz kurunun enflasyona geçişkenliğinin ülkeye özgü olduğunu ve (iv) enerji fiyatları ile döviz kurları arasında zayıf bir bağımlılık olduğunu ortaya koymaktadır. Fourier Toda-Yamamoto yaklaşımına dayalı nedensellik analizinde yumuşak yapısal kırılmaların hesaba katılması bu bulguları güçlendirmektedir.

Anahtar kelimeler

Enerji fiyatları, döviz kuru, enflasyon, Avrasya ülkeleri, nedensellik.

JEL kodları: C10, O1, Q43.

---

* Geliş Tarihi: 18 Şubat 2024 – Kabul Tarihi: 28 Haziran 2024
Bu makaleyi şu şekilde kaynak gösterebilirsiniz:
Batmaz, Türker. "Dynamic Interrelationships among Energy Prices, Exchange Rates, and Inflation: An Empirical Analysis for the Turkic Republics." *bilig*, no. 112, 2025, ss. 63-104, https://doi.org/10.12995/bilig.7933.

** Doç. Dr., Balıkesir Üniversitesi, İktisadi ve İdari Bilimler Fakültesi, İktisat Bölümü – Balıkesir/Türkiye
ORCID: 0000.000.20360-6302
turkerbtmz@gmail.com

Introduction

Energy and related commodities play a crucial role for both the global economy and national economies (Dai et al.; Mensi et al.). Energy price shocks in the global market negatively affect sustainable growth as they increase input, procurement, and production costs; can lead to undesirable macroeconomic problems such as inflation (Ding et al.; Yang and Dian); and can cause increased volatility and risks in financial markets.

The importance of energy markets on both real and financial sectors has triggered an ongoing interest in investigating dynamic connections between energy prices and economic and financial variables. The literature, as reviewed in next section, reveals that fluctuations in oil and natural gas prices trigger exchange rate and inflation, which in turn have a negative impact on countries' growth and terms of trade. Even though the empirical literature extensively focuses on developed economies; the fluctuations in energy prices may also be sources of uncertainty for developing countries as well and relatively few studies have examined the effects of oil price fluctuations on developing countries (Berument et al.; Emami and Adibpour; Farzanegan and Markwardt; Olomola and Adejumo).

The literature on the Eurasian region, which has rich in energy resources, reveals that there is a very limited number of studies, and the countries in this region are not included within a comprehensive analysis framework, that this situation does not allow comparing the countries of the region with each other. Moreover, the dynamic relationships among energy, goods, and exchange rate markets are not simultaneously investigated yet for Eurasian countries. These gaps in the literature have motived us to analyze the effects of energy prices, which are of great importance for each country, on exchange rates and inflation rates in Türkiye and four other independent Turkic Republic countries (Kazakhstan, Uzbekistan, Azerbaijan, and Kyrgyzstan).

Central Asia's available energy resources are second only to the Middle East and Russia. This situation may be considered as another motivating point for empirical studies on the region. Although the Middle East still accounts for the largest portion of the world's energy production, political and economic instabilities in the Middle East make the resources in Central Asia a strategic alternative (Çınar 26). Importance of energy markets in Eurasian region has increased during last decade, which in turn leads a shift of interest from the Middle East to the Eurasian area[1]. Especially the increase in foreign investments in the Eurasian countries' energy sector can be considered an indicator of this situation.

Based on the above-mentioned gaps in the literature and the motivations, this study focuses on the selected Eurasian countries (Türkiye, Azerbaijan, Kazakhstan, Kyrgyzstan, and Uzbekistan). It aims to present a comparative analysis of the relationships among energy prices (oil and natural gas), real effective exchange rate and consumer price index for the period from January 2010 to April 2022 by means of causality analysis, impulse-response functions, and variance decomposition[2]. The empirical findings indicate that (i) energy prices are found to be main drivers of inflation, (ii) exchange rate pass-through to inflation seems country-specific, and (iii) there is a weak dependence between energy prices and exchange rates. Moreover, the Fourier Toda-Yamamoto approach suggested by Nazlioglu et al. ("Oil Prices and Real") to consider smooth structural breaks in causality analysis, support these findings, implying a dependence between energy and goods markets in the selected Eurasian countries shaped directly by natural gas prices or indirectly by oil prices through natural gas prices.

This study contributes to empirical literature in different ways. The first contribution is based on the sample of the study. In literature, most of the studies for Eurasian countries have been conducted for a single country (see Table 1). This study uses a multi-country sample to explain the relationship between energy prices, exchange rates and inflation. The second contribution is related to empirical modeling. There is no study in the literature for Eurasian countries, that consider energy, goods and exchange rate markets as integrated markets. Apart from the literature, this paper takes a dynamic and endogenous approach to model the interactions among energy prices, inflation, and exchange rates. The third contribution of the study comes from analyzing the dynamic interactions with both short-run and long-run perspective. While short-run dynamic relationships are analyzed using impulse-response functions and variance decomposition, long-run dynamic relationships are analyzed using the Toda & Yamamoto causality approach. Moreover, we account for smooth structural breaks in causality analysis based on the Fourier Toda-Yamamoto approach, suggested by Nazlioglu et al. ("Oil Prices and Real").

Literature Review

There are many studies in the literature analyzing the relationship between EP, ER and inflation. Table 1 is devoted to succinctly summarizing the empirical literature. The empirical literature focusing on the relationship between oil prices (OP) and inflation has expanded and diversified since the 1980s in line with developments in econometric analysis (see Panel A of Table 1). For instance, Burbidge and Harrison, using VAR analysis, find that OP increases are the source of high inflation in the US, Japan, Germany, the UK and Canada. Gisser and Goodwin, using Granger Causality analysis, find that the inflationary effect of OP increases in the US was stronger before 1973, and that this effect gradually decreased after 1973. Cunado and Gracia, in their study on Asian countries using Granger Causality analysis, concluded that oil prices have an impact on inflation in 6 selected countries. In the Abaunoori et al. study on Iran, they found that the increase in OP causes demand inflation through crude oil income. Husaini and Lean, using the NARDL model, concluded that there is a causality relationship between OP and consumer price index (CPI) in Indonesia, Malaysia and Thailand.

Similarly, the literature on the relationship between the ER and OP has been growing continuously through causality analysis tools. Among these, Trehan, Indjehagopian et al., Aleisa and Dibooğlu, Olomo and Adejumo, Castro and Rodriguez found a causality relationship between OP and ER. Zhang et.al, on the other hand, using VAR analysis for G20 countries, concluded that there is no relationship between OP and ER. Looking at the studies examining the relationship between OP and ER with Granger Causality test, Amano and Van Norden, Chaudhuri and Daniel, Coudert et al., Benhmad, Adıgüzel et al. and Bass found that there is a causality relationship between OP and ER.

At first glance, it is noteworthy that there is a limited number of studies examining OP and ER in Eurasian economies (see panel B of Table 1). Ağayev and Öksüzler and İpek conclude that there is no causality between OP and ER. Yaylalı and Lebe and Karimli et al., on the other hand, use the VAR method and conclude that there is a relationship between OP and

ER. In studies examining the relationship between OP and ER in Eurasian economies, Kutan and Wyzan, Ağazade ("Reeel Döviz Kuru"), Ağazade ("Petrol Fiyatları"), Altemur found that there is a relationship between OP and ER.

Table 1

Literature Review

International studies			
Author/Year	**Sample and Data**	**Method**	**Causality**
Burbidge and Harrison (1984)	USA, Japan, Germany, UK, Canada / 1961-1982	VAR	INF-OP
Gisser and Goodwin (1986)	USA / 1961: Q1-1982: Q4	Granger Causality Test	INF-OP
Trehan (1986)	USA / 1956: Q2-1985: Q4	VAR	ER – OP
Amano and Van Norden (1998)	Germany, Japan and USA / 1973: M1-1993: M6	Granger Causality Test	OP-ER
Chaudhuri and Daniel (1998)	16 OECD Countries / 1973: M1-1996: M2	Granger Causality Test	OP-ER
Indjehagopian et al. (2000)	Germany and France / 1987: M1-1997: M12	VAR	REER-OP
Aleisa and Dibooğlu (2002)	Saudi Arabia / 1980: Q1-2000: Q2	VAR	OP-ER
Akram (2004)	Norway / 1986: M1-1998: M8	OLS	OP-ER
Cunado and Gracia (2005)	Asian Countries / 1975: Q1-2002: Q2	Granger Causality Test	OP-INF
Olomo and Adejumo (2006)	Nigeria / 1970-2003	VAR	OP-ER
Chen and Chen (2007)	G7 Countries / 1972: M1-2005: M10	Panel	OP-ER
Coudert et al. (2008)	USA / 1974: M1-2004: M11	VAR	OP-ER

Korhonen and Juurikkala (2009)	OPEC Countries / 1975-2005	Panel	OP-ER
Benhmad (2012)	USA / 1970: M2-2010: M2	Granger Causality Test	OP-ER
Adıgüzel et al. (2013)	Brazil, India and Türkiye / 1999: M1-2011: M7, 1993: M3-2011: M7, 2001: M2-2011: M7	Causality Test	ER-OP
Abounoori et al. (2014)	Iran / 2003: M3 – 2013: M3	Dynamic Error Correction Model	OP-INF
Taşar (2018)	Romania / 2004-2014	Toda-Yamamoto	OP-ER
Bass (2019)	Russia / 2010-2017	Granger Causality Test	OP-ER-CPI
Castro and Rodriguez (2020)	USA / 1974: M1-2019: M7	VAR	OP-REER
Husaini and Lean (2021)	Indonesia, Malaysia and Thailand / 1978-2018	NARDL	OP-CPI
Zhang et.al (2022)	Canada, Norway and Australia / 2010: M5-2020: M6	VAR	There is no relationship between oil prices and exchange rates.
Bigerna (2023)	G20 Countries / 2010: M6-2021: 12	VAR	OP-ER-INF
Studies on Eurasian countries			
Kutan and Wyzan (2005)	Kazakhstan / 1996: M1-2003: M11	Balassa-Samuelson	OP-ER
Ağayev (2011)	Azerbaijan / 1995: M1-2010: M4	Granger Causality Test	There is no causality between the general level of prices and the exchange rate.

Öksüzler and İpek (2011)	Türkiye / 1987: M1-2010: M9	Granger Causality Test	There is no relationship between oil prices and inflation.
Yaylalı and Lebe (2012)	Türkiye / 1986: Q2-2010: Q2	VAR	OP-INF
Altıntaş (2016)	Türkiye / 2000-2013	NARDL	EP-RI
Karimli et al. (2016)	Azerbaijan-Kazakhstan-Russia / 2000: Q1-2014: Q4	VAR	OP-INF
Koçak et al. (2017)	Türkiye / 2003: Q1-2017: Q2	Granger Causality Test	OP-INF
Ağazade (2018)	Azerbaijan / 1995: M1-2017: M9	TAR-MTAR	REER-OP
Ağazade (2020)	Kazakhstan / 1995: M1-2016: M10	ARDL	REER-OP
Kartal (2023)	Türkiye / 1960-2020	Engle-Granger	INF-OP
Altemur (2023)	Türkiye / 1995: M1-2023: M2	Cointegration Tests	OP-INF-ER

OP: Oil Price / ER: Exchange Rate / INF: Inflation / EP: Energy Price / RI: Reel İncome

To summarize this empirical literature, it is noteworthy that mostly developed countries and/or OECD and G7 country groups are included in the analysis. Another noteworthy point is that energy, goods and financial markets are analyzed within the framework of models that include only two markets (energy-goods, energy-finance). Therefore, this study differs from the literature by focusing on Eurasian countries both in terms of the sample and in terms of modeling by focusing on the dynamic relationships between energy, goods and financial markets.

Econometric Methodology

To outline the details of causality testing, let us start with VAR(p) model for Granger (1969), given by

$$y_t=\alpha_0+\alpha_1 y_{t-1}+\cdots+\alpha_p y_{t-p}+u_t \tag{1}$$

where y_t are m endogenous variables, α_0 is the vector of constant terms, $\alpha = (\alpha_1, \ldots, \alpha_p)'$ is the coefficient matrix and u_t is the error term. Granger causality analysis requires testing the unit root and cointegration properties of the variables. This is because if the variable(s) in the VAR model contain a unit root or are cointegrated, the Wald test not only has a non-standard distribution, but also becomes dependent on spurious parameters (Toda and Yamamoto, 1995; Dolado and Lütkepohl, 1996). To solve this problem, Toda and Yamamoto (1995), suggest estimating the VAR($p+d$) model by adding an additional lag of the maximum unit root degree (d) of the variables to the VAR model in which the level values of the variables are used. The VAR($p+d$) model, which is the basis of the Toda and Yamamoto causality approach, is defined as follows:

$$y_t=\alpha_0+\alpha_1 y_{t-1}+\cdots+\alpha_{p+a} y_{t-(p+d)}+u_t. \tag{2}$$

The VAR models defined in both equations (4) and (5) do not take in account a possible structural break in the variables. Nazlioglu et al. ("Oil Prices and Real", "Oil Prices and Monetary") extend the Toda and Yamamoto approach using a Fourier approximation to allow for the smooth structural shifts in Granger causality analysis, which is called as the Fourier Toda and Yamamoto causality approach. The Fourier Toda and Yamamoto procedure relaxes the assumption that γ is constant over time, and defines the VAR*(p+d)* model as follows:

$$y_t= y(t) + \alpha_1 y_{t-1}+\cdots+\alpha_{p+a} y_{t-(p+d)}+u_t \tag{3}$$

where γ (t) is a function of time and denotes any structural change in $y_{t.}$ To capture structural changes as a gradual process, γ (t) is defined with a Fourier approximation, given by

$$y(\mathrm{t}) \cong y_0+y_1 sin\left(\frac{2\pi kt}{T}\right)+y_2\cos\left(\frac{2\pi kt}{T}\right) \tag{4}$$

where k is the Fourier frequency number. By substituting γ (t) in equation (6) we get

$$y_t= y_0+y_1 sin\left(\frac{2\pi kt}{T}\right)+y_2\cos\left(\frac{2\pi kt}{T}\right)+\alpha_1 y_{t-1}+\cdots+\alpha_{p+d} y_{t-(p+d)}+u_t \tag{5}$$

In both Toda and Yamamoto approach and its extension with Fourier approximation, a zero constraint ($H_o: \alpha_1 = \cdots = \alpha_p = 0$) is imposed on the first p parameter for the relevant variable of y_t to test for Granger causality. The Wald statistic used to test for Granger no causality has an asymptotic χ^2 distribution with p degrees of freedom.[3] As a final note to be emphasized, we determine the number optimal lags (p), avoiding serial correlation problem, by general-to-specific approach. The optimal Fourier frequency is determined by Schwarz information criterion as suggested by Nazlioglu et al. ("Oil Prices and Real").

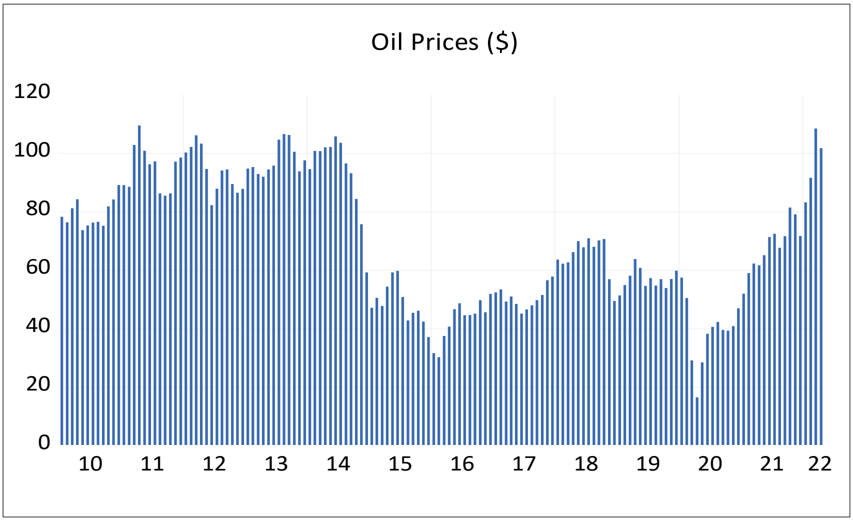
Data

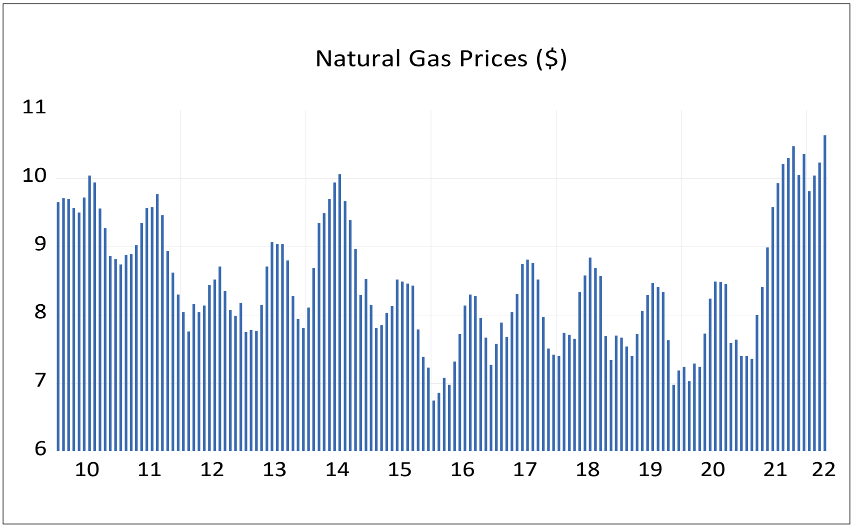
The data used in the paper cover the period 2010 M1-2022 M4. Oil and natural gas prices, CPI and real effective exchange rate (REER) are analyzed using the Toda-Yamamoto causality test. Explanations about the variables used are given in Table 2.

Table 2
Data Description Information

Variables	Acronyms	Units	References
Consumer Price Index	LCPI	Monthly (%)	International Monetary Fund (IMF)
Real Effective Exchange Rate	LREER	Monthly ($)	Bruegel
Oil Price	LOP	Monthly ($)	Energy Information Administration (EIA)
Natural Gas Price	LNGP	Monthly ($)	Energy Information Administration (EIA)

Chart 1 shows the monthly prices of oil and natural gas prices in US Dollars ($) for the period 2010 M1-2022M4. It is observed that fluctuations in natural gas prices fluctuate every year, with a minimum level between 2015 and 2016 and a maximum level in 2021 and 2022. As for oil prices, the price movements between 2010 and 2014 have been declining after 2014. While oil prices were at a minimum level between 2019 and 2020, they rose rapidly from the second half of 2020 and reached a maximum level in 2022.





Graph 1. Oil and natural gas prices (2010-2022 /Monthly) (*Energy Information Administration (EIA)*)

Table 3, which includes descriptive statistics, presents the means, standard errors, skewness and kurtosis coefficients of the data. Skewness and kurtosis coefficients are used to test the normal distribution of the data. The skewness coefficient is 0 in a normal distribution. A negative skewness coefficient indicates a right-skewed distribution, while a positive skewness coefficient indicates a left-skewed distribution. Kurtosis coefficient also takes the value 0 in a normal distribution. A positive kurtosis coefficient indicates a pointed distribution, while a negative kurtosis coefficient indicates a skewed distribution.

Table 3 shows that the skewness coefficient of world oil prices (LOP) is –0.632 during the analysis period. This coefficient indicates that world oil prices are skewed to the right. The fact that the kurtosis coefficient has a positive value (3.350) indicates that this data has a pointed distribution. When the skewness and kurtosis coefficients of world natural gas prices (LNGP) are analyzed, it is observed that both of them have positive values and have a leftward skewed distribution. The skewness coefficients of the consumer price indices (LCPI) of the countries have positive values except for Kyrgyzstan (-0.303). These coefficient values mean that the CPI is right skewed in Kyrgyzstan and left skewed in other countries. The kurtosis coefficients of the CPI have a positive and pointed distribution in all countries. The coefficients of the real effective exchange rate (LREER) are positive and left-skewed in Kazakhstan, but negative and right-skewed in other countries. In terms of kurtosis coefficients, the real effective exchange rate has a positive value and a pointed distribution in all countries.

Table 3
Descriptive Statistics

		LCPI	LNGP	LOP	LREER
Azerbaijan	Mean	4.876	2.128	4.191	4.755
	Std. Dev.	0.189	0.105	0.352	0.148
	Skewness	0.164	0.244	-0.632	-0.058
	Kurtosis	1.576	2.266	3.350	1.643
	Observations	148	148	148	148
Kazakhstan	Mean	4.191	2.128	4.191	4.460
	Std. Dev.	0.258	0.105	0.352	0.155
	Skewness	0.022	0.244	-0.632	0.236
	Kurtosis	1.685	2.266	3.350	1.359
	Observations	148	148	148	148

Uzbekistan	Mean	4.083	2.128	4.191	4.141
	Std. Dev.	0.406	0.105	0.352	0.413
	Skewness	0.109	0.244	-0.632	-0.431
	Kurtosis	1.848	2.266	3.350	1.326
	Observations	148	148	148	148
Kyrgyzstan	Mean	4.569	2.128	4.191	4.638
	Std. Dev.	0.172	0.105	0.352	0.041
	Skewness	-0.303	0.244	-0.632	-0.312
	Kurtosis	2.838	2.266	3.350	2.946
	Observations	148	148	148	148
Türkiye	Mean	5.695	2.128	4.191	4.304
	Std. Dev.	0.391	0.105	0.352	0.228
	Skewness	0.630	0.244	-0.632	-0.712
	Kurtosis	2.622	2.266	3.350	2.369
	Observations	148	148	148	148

Empirical Findings

Before proceeding to the causality analysis results, the Toda-Yamamoto approach requires the determination of the maximum degree of integration (unit root) of the variables used in the VAR model. To this end, Extended Dickey-Fuller (Dickey and Fuller), Phillips and Perron and KPSS tests (Kwiatkowski et.al) were applied. According to the unit root test results reported in Table 4, the series satisfy the stationarity condition when the first differences are taken. In this context, the maximum degree of integration (dmax) of the variables is set as 1. Table 5 presents the results from causality tests. We should note that the Toda and Yamamoto and the Fourier Toda & Yamamoto are line with each other, and hence they imply the same causal dynamics with a very few exceptions. Thereby, we can interpret this empirical evidence supporting that causal linkages are robust to smooth structural changes. To facilitate comprehensibility, the findings for each country are summarized in figures. In addition, impulse-response functions and variance decomposition results are also discussed after the causality analysis.

Table 4
Result from Unit Root Tests

Countries	Tests	Variables	Levels Intercept	Intercept and trend	First-differences Intercept	Intercept and trend
Türkiye	ADF	CPI	2.703	2.691	-2.581*	-3.420*
		REER	-0.304	-2.816	-9.186***	-9.195***
		NGP	-3.324**	-3.154*	-7.684***	-8.218***
		OP	-1.928	-1.824	-9.512***	-9.527***
	PP	CPI	4.034	4.309	-4.945***	-5.782***
		REER	0.310	-2.668	-8.841***	-9.195***
		NGP	-2.420	-1.664	-8.031***	-7.909***
		OP	-1.923	-1.843	-8.926***	-8.962***
	KPSS	CPI	1.424	0.350	0.692	0.161
		REER	1.335	0.308	0.217	0.069
		NGP	0.323	0.194	0.153	0.028
		OP	0.677	0.153	0.150	0.092
Azerbaijan	ADF	CPI	0.215	-2.489	-6.471***	-6.506***
		REER	-1.800	-2.108	-8.363***	-8.344***
		NGP	-3.324**	-3.154*	-7.684***	-8.218***
		OP	-1.928	-1.824	-9.512***	-9.527***
	PP	CPI	0.368	-1.806	-6.391***	-6.412***
		REER	-1.340	-1.525	-7.902***	-7.864***
		NGP	-2.420	-1.664	-8.031***	-7.909***
		OP	-1.923	-1.843	-8.926***	-8.962***
	KPSS	CPI	1.429	0.162	0.116	0.059
		REER	0.809	0.183	0.160	0.145
		NGP	0.323	0.194	0.153	0.028
		OP	0.677	0.153	0.150	0.092

Kazakhstan	ADF	CPI	0.681	-2.723	-5.989***	-6.045***
		REER	-1.577	-2.744	-8.401***	-8.365***
		NGP	-3.324**	-3.154*	-7.684***	-8.218***
		OP	-1.928	-1.824	-9.512***	-9.527***
	PP	CPI	0.687	-2.014	-5.967***	-6.015***
		REER	-1.459	-2.836	-8.481***	-8.446***
		NGP	-2.420	-1.664	-8.031***	-7.909***
		OP	-1.923	-1.843	-8.926***	-8.962***
	KPSS	CPI	1.455	0.123	0.114	0.060
		REER	1.151	0.121	0.057	0.055
		NGP	0.323	0.194	0.153	0.028
		OP	0.677	0.153	0.150	0.092
Uzbekistan	ADF	CPI	0.153	-2.031	-7.050***	-7.034***
		REER	-0.703	-1.658	-10.253***	-10.217***
		NGP	-3.324**	-3.154*	-7.684***	-8.218***
		OP	-1.928	-1.824	-9.512***	-9.527***
	PP	CPI	0.235	-1.818	-5.832***	-5.815***
		REER	-0.825	-1.916	-10.249***	-10.213***
		NGP	-2.420	-1.664	-8.031***	-7.909***
		OP	-1.923	-1.843	-8.926***	-8.962***
	KPSS	CPI	1.441	0.248	0.098	0.074
		REER	1.208	0.155	0.090	0.087
		NGP	0.323	0.194	0.153	0.028
		OP	0.677	0.153	0.150	0.092

Kyrgyzstan	ADF	CPI	-0.199	-2.015	-5.839***	-5.794***
		REER	-3.301**	-3.442**	-11.484***	-11.396***
		NGP	-3.324**	-3.154*	-7.684***	-8.218***
		OP	-1.928	-1.824	-9.512***	-9.527***
	PP	CPI	-0.875	-2.282	-6.041***	-5.996***
		REER	-3.270**	-3.442**	-11.410***	-11.311***
		NGP	-2.420	-1.664	-8.031***	-7.909***
		OP	-1.923	-1.843	-8.926***	-8.962***
	KPSS	CPI	1.377	0.201	0.205	0.196
		REER	0.296	0.210	0.113	0.091
		NGP	0.323	0.194	0.153	0.028
		OP	0.677	0.153	0.150	0.092

ADF: Augmented Dickey and Fuller unit root test. PP: Phillips and Perron unit root test. KPSS: Kwiatkowski et al. stationarity test. For ADF test, the optimal lag(s) were determined by the t-stat significance of the last lagged dependent variable at the 10% significance level by setting the maximum number of lags to 12. For PP and KPSS tests, the HAC (heteroscedasticity and auto-correlation consistent) long-run variance was estimated by Bartlett kernel with the Newey-West automatic bandwidth selection. The ADF and PP critical values are 3.434 (1%), 2.863 (5%), and 2.568 (10%) for the model with intercept; 3.963 (1%), 3.413 (5%), and 3.128 (10%) for the model with intercept and trend. The KPSS critical values are 0.739(1%), 0.463 (5%), and 0.347 (10%) for the model with intercept; 0.216(1%), 0.146 (5%), and 0.119 (10%) for the model with intercept. ***(1%), **(5%),*(10%).

Table 5
Results from Causality Tests

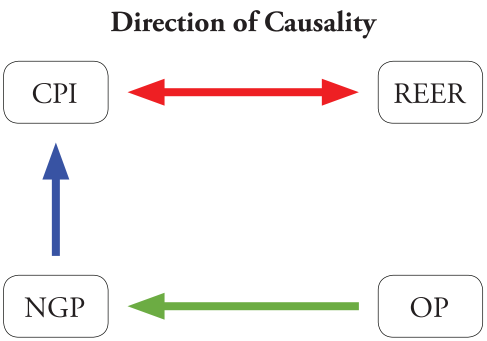
		Dependent variable			
Toda & Yamamoto		CPI	REER	NGP	OP
Türkiye	CPI		27.248***[0.0006]	10.438[0.2356]	9.375[0.3116]
	REER	35.705***[0.0000]		2.258[0.9720]	12.423[0.1333]
	NGP	15.532**[0.0496]	8.533[0.3832]		11.531[0.1734]
	OP	3.058[0.9306]	5.733[0.6771]	16.897**[0.0312]	
Azerbaijan	CPI		24.435**[0.0110]	32.764***[0.0006]	12.485[0.3283]
	REER	15.294[0.1694]		12.338[0.3387]	7.811[0.7301]
	NGP	27.777***[0.0035]	18.391*[0.0729]		15.328[0.1680]
	OP	8.848[0.6358]	8.754[0.6445]	28.306***[0.0029]	
Kazakhstan	CPI		6.751[0.5636]	16.570**[0.0349]	9.616[0.2930]
	REER	31.804***[0.0001]		10.782[0.2143]	4.605[0.7988]
	NGP	16.772**[0.0326]	6.698[0.5695]		12.622[0.1255]
	OP	9.612[0.2933]	5.423[0.7115]	20.994***[0.0072]	
Uzbekistan	CPI		2.017[0.5687]	6.058[0.1088]	1.064[0.7856]
	REER	17.281***[0.0006]		4.009[0.2604]	0.736[0.8646]
	NGP	12.734***[0.0052]	2.864[0.4130]		4.829[0.1847]
	OP	0.397[0.9408]	1.957[0.5813]	4.598[0.2036]	
Kyrgyzstan	CPI		12.487[0.1308]	14.941*[0.0603]	2.362[0.9678]
	REER	6.940[0.5431]		7.247[0.5101]	14.284[0.0747]
	NGP	16.105**[0.0409]	11.126[0.1946]		6.734[0.5656]
	OP	9.608[0.2936]	10.521[0.2303]	16.565**[0.0350]	
Fourier Toda & Yamamoto					
Türkiye	CPI		36.225***[0.0000]	13.041[0.1104]	11.244[0.1882]
	REER	32.670***[0.0001]		4.241[0.8347]	11.712[0.1645]
	NGP	5.849[0.6640]	7.147[0.5208]		13.916**[0.0840]
	OP	6.392[0.6033]	8.961[0.3456]	31.208***[0.0001]	

Azerbaijan	CPI		26.831***[0.0049]	26.427***[0.0056]	13.799[0.2443]
	REER	16.975[0.1086]		8.486[0.6692]	8.934[0.6279]
	NGP	29.375***[0.0020]	21.031**[0.0330]		14.809[0.1914]
	OP	10.093[0.5220]	8.746[0.6453]	18.412*[0.0725]	
Kazakhstan	CPI		7.879[0.4454]	9.326[0.3155]	7.481[0.4857]
	REER	37.369***[0.0000]		4.899[0.7682]	3.881[0.8677]
	NGP	10.337[0.2422]	8.472[0.3887]		14.283*[0.0747]
	OP	12.747[0.1208]	5.631[0.6884]	26.008***[0.0010]	
Uzbekistan	CPI		1.688[0.6395]	2.389[0.4955]	1.199[0.7531]
	REER	11.599***[0.0089]		1.949[0.5829]	0.220[0.9743]
	NGP	9.575**[0.0225]	5.948[0.1142]		5.348[0.1847]
	OP	0.311[0.9578]	4.084[0.2524]	9.929*[0.0192]	
Kyrgyzstan	CPI		11.409[0.1796]	14.719*[0.0648]	2.492[0.9621]
	REER	7.182[0.5171]		10.892[0.2079]	12.371[0.1354]
	NGP	15.749**[0.0461]	13.885*[0.0848]		6.868[0.5508]
	OP	11.803[0.1602]	13.912*[0.0841]	28.199***[0.0004]	

The optimal lags (p), which ensure no-serial correlation problem, were determined by general-to-specific approach by starting from 12 lags. The optimal Fourier frequency was determined by Schwarz information criterion by starting from 3 frequency. The p-values in parentheses are based on the asymptotic chi-square distribution. VAR(p+d) models were estimated with d equal to 1. VAR models include world NGP and OP; and the respective country CPI and REER. p-value<=0.1 (10%), 0.05 (5%), and 0.01(1%).

Türkiye

According to the results of the Toda-Yamamoto causality test applied to reveal the relationship between EP, ER and the CPI, a bidirectional causality relationship is found between the CPI and the REER in Türkiye. On the other hand, there is a unidirectional causality relationship from OP to NGP, while a unidirectional causality relationship is observed from NGP to the CPI. As a result of the analysis, no causality relationship was found between OP and the CPI in Türkiye. This result reveals that fluctuations in NGP have an effect on the CPI in Türkiye, but this is not the case for fluctuations in OP.


Direction of Causality
CPI
REER
NGP
OP

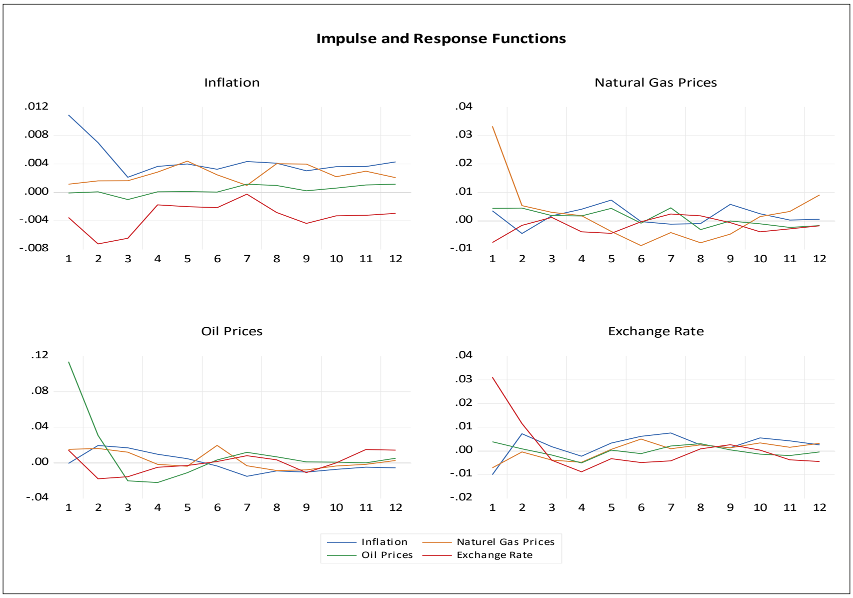

Impulse and Response Functions
Inflation
Natural Gas Prices
Oil Prices
Exchange Rate
Inflation
Naturel Gas Prices
Oil Prices
Exchange Rate

Figure 1. Causality, Impulse-Response Functions and Variance Decomposition (Türkiye)

According to the impulse response functions and variance decomposition in Figure 1, the REER, oil and natural gas prices have no effect on the CPI in Türkiye in the first month of the year. The REER, which starts to show its effect as of the second month of the year, makes its maximum effect felt in the 3rd and 4th months and continues to affect the CPI in the remaining periods of the year. NGP, on the other hand, have an effect on the CPI starting from the 3rd month and continue to have an increasing effect until the end of the year. In Türkiye, oil-natural gas prices and the CPI have an impact on the REER in every month of the year. The effect of the CPI increases from the 5th month onwards and is maximized in the last month of the year.

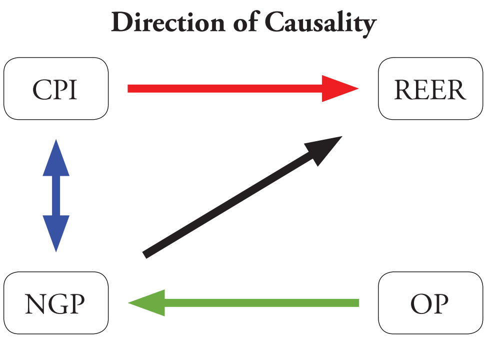
Among energy sources, fossil energy sources are the most in demand. The distribution of non-renewable energy resources on earth is unbalanced. For this reason, energy-dependent countries like Türkiye have to meet their energy needs through imports. Türkiye's rapidly developing industrial sector causes country's energy need to increase day by day. The energy input used by Türkiye is largely composed of fossil resources. Since Türkiye is foreign dependent in terms of fossil energy resources, it has to meet this need through imports. Türkiye's energy imports are as high as 75% (Uysal et al. 64).

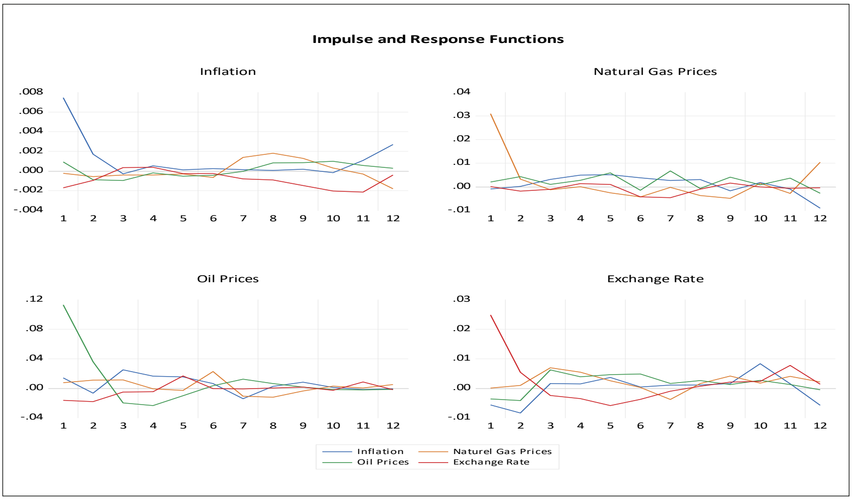
From a microeconomic perspective, fluctuations in the energy market cause an increase in production costs in energy importing countries (Özdemir and Yüksel 2). Since energy imports are denominated in foreign currency, exchange rate fluctuations also affect the course of economic activities. Therefore, reduction of exchange rate fluctuations and stability in the foreign exchange market are important for energy importing countries (Duygulu 108-109). In economies like Türkiye, where imports of raw materials and intermediate goods are high, savings are insufficient, and external deficits are constantly being run, exchange rate stability increases its importance since exchange rate affects both input costs and the pace of development (Baum et al. 3).

Türkiye is approximately 85% dependent on foreign oil and 90% dependent on natural gas. Especially in the industrial sector, crude oil is used as the main input. A wide range of products are produced from oil derivatives. Therefore, an increase in OP increases domestic demand for foreign exchange and pressurizes ER upwards. For this reason, the domestic inflation rate also increases. The pass-through effect of the exchange rate on domestic prices can occur through different paths. This pass-through can be through the prices of imported consumption goods, capital goods and imported inputs, as well as through the prices of domestic goods/services denominated in foreign currency (Özdamar 67-69).

Azerbaijan

According to the causality test results for Azerbaijan, there is a unidirectional causality relationship from OP to NGP. There is also a unidirectional causality relationship between NGP and CPI and REER. In Azerbaijan, where there is a unidirectional causality relationship from the CPI to the REER, there is no bidirectional causality relationship between the variables.


Direction of Causality
CPI
REER
NGP
OP


Impulse and Response Functions
Inflation
Natural Gas Prices
Oil Prices
Exchange Rate
Inflation
Naturel Gas Prices
Oil Prices
Exchange Rate

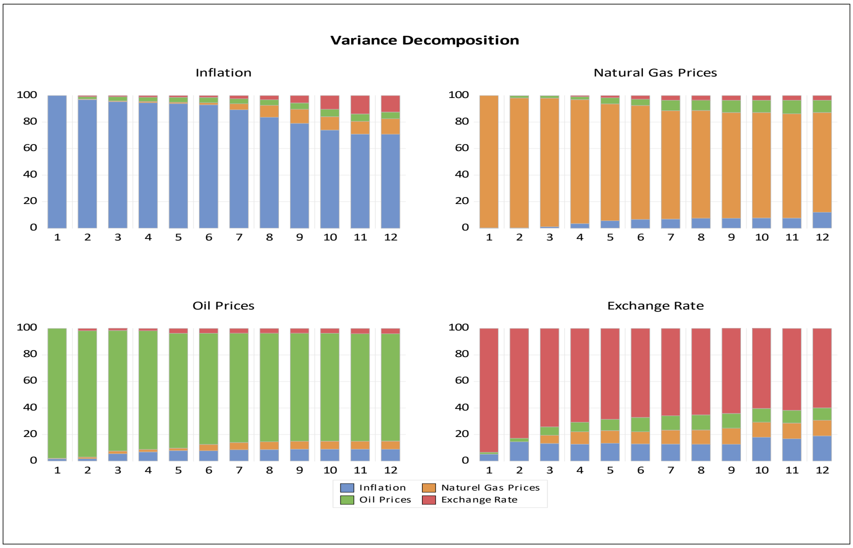


Figure 2. Causality, Impulse-Response Functions and Variance Decomposition (Azerbaijan)

In Azerbaijan, the effect of OP on the CPI starts to show its effect from the 2nd month of the year and this effect continues until the end of the year. NGP start to have an effect on the CPI as of the 4th month and this effect increases and continues until the end of the year. Especially in the last 5 months of the year, the effect of NGP on the CPI increases. The effect of the REER on the CPI starts from the 5th month and this effect is maximum in the last 3 months of the year. The effect of the CPI and OP on the REER in Azerbaijan is observed in every month of the year.

The course of the energy market shapes the economic dynamics of all countries, both energy exporters and energy importers. Since Azerbaijan is an energy exporter, its economy is also affected by fluctuations in energy prices. The supply and demand balance required for price formation in the commodity market works differently for the fossil energy market. The reason for this difference is that the supply of this type of energy is scarce and non-renewable. The lack of a substitute for these resources increases the importance of fossil energy and the price to be formed in the energy market (Akhundzada 3).

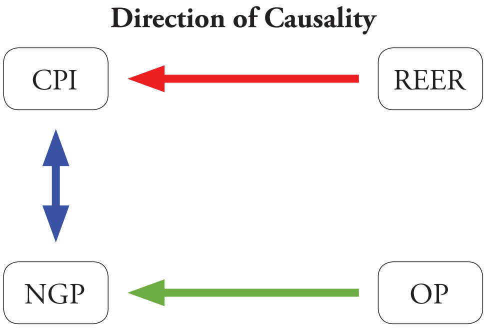
The dependence of the Azerbaijani economy on oil increases the importance of fluctuations in EP in terms of economic performance. In the Azerbaijani economy, transfer expenditures account for 98% of the budget allocated for the fund. The production and control of crude oil in Azerbaijan is provided by the State Oil Company (SOCAR) and Azerbaijan International Oil Company (AIOC) (Guliyev 1-4).

In the fall of 2014, falling oil prices in the global markets led to a fall in the value of the manat. Azerbaijan's currency, the manat, depreciated by 33.86% against foreign currencies. Against the US dollar, the rate of the manat went from 0.78 to 1.05 (Akhundzada 6). Depreciation of the currency can be beneficial for exports, as it makes prices more attractive for the local economy than abroad. However, this may have different consequences for countries with a low variety of exported goods. When considered together with import dependency, this situation makes inflation a chronic problem for the country's economy.

Azerbaijan's economy has faced various macroeconomic problems due to falling oil prices. The decline in revenues from the energy sector, which is one of the main export items, has led to problems such as balance of payments deficits, currency depreciation and rising inflation in Azerbaijan.

Kazakhstan

According to the causality test results for Kazakhstan, there is a unidirectional causality relationship from the REER to the CPI and from OP to NGP. The causality relationship between NGP and the CPI is bidirectional.


Direction of Causality
CPI
REER
NGP
OP

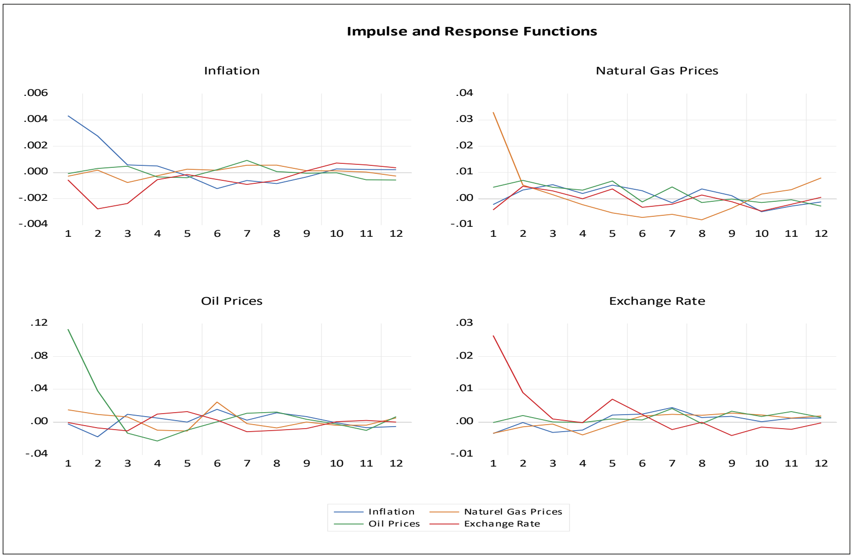

Impulse and Response Functions
Inflation
Natural Gas Prices
Oil Prices
Exchange Rate
Inflation
Naturel Gas Prices
Oil Prices
Exchange Rate

Figure 3. Causality, Impulse-Response Functions and Variance Decomposition (Kazakhstan)

In the first month of the year, there is no effect on the CPI in Kazakhstan economy in terms of variables. The REER, on the other hand, starts to show its effect as of the second month of the year and has a significant effect on the CPI until the end of the year. When the effects on the REER are analyzed, it is seen that the effect of all variables included in the analysis is very small, while the effect of NGP and the CPI is higher.

Kazakhstan is one of the world's leading geographies with proven oil reserves. According to British Petrolium reports, Kazakhstan ranks 12th in the world with 1.8% of the world's oil reserves in 2016. (BP, 12) Oil regions cover more than half of Kazakhstan's territory (1.7 million km2 out of 2.7 million km2) (Babak 51-52). Kazakhstan's oil sector consists of more than 250 oil deposits, with major oil deposits located mainly in Western Kazakhstan (Karenov 7). Approximately 88% of the exploitation of oil reserves is distributed among large companies. Among these companies, North Caspian Operating Company holds 45% and Tengizchevroil 25% (Dzhantureeva 20).

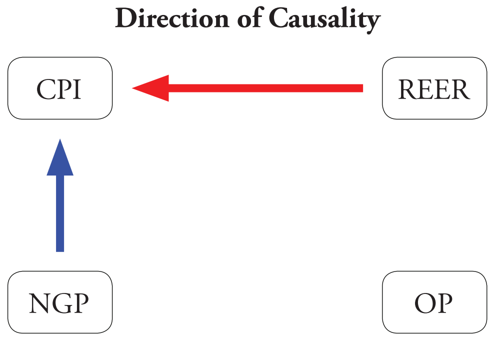
The state of Kazakhstan has been implementing strategic policies to ensure that domestic companies have a say in the extraction of crude oil in the country instead of foreign companies. The most important of these was the establishment of "KazMunaiGaz" in 2002. This completely domestic company represents Kazakhstan's interests in the oil and gas industry (Ölmezoğulları 680).

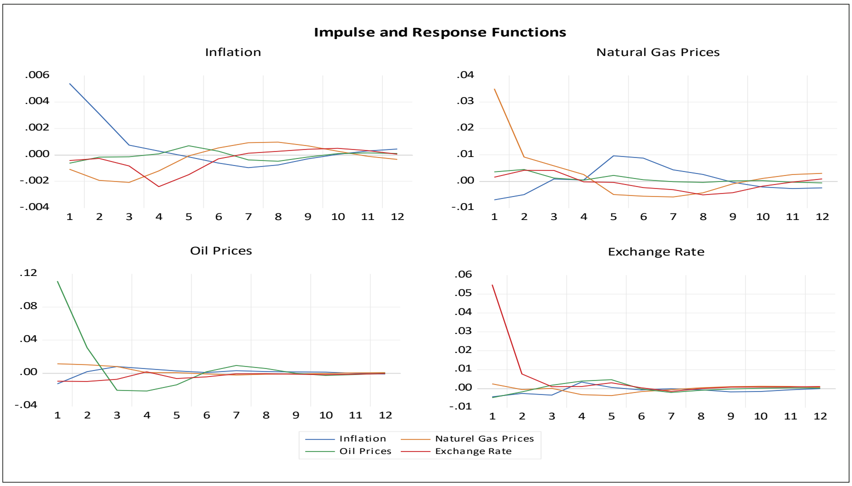
The fact that Kazakhstan's exports are mostly dependent on raw materials brings along the problem of macroeconomic instability. Increases in world oil prices positively affect the dynamics of Kazakhstan's economy by increasing the country's oil production and investment activities. At the same time, the increase in oil prices strengthens the real exchange rate of the national currency, which negatively affects the situation of domestic exporters. A decline in world oil prices almost inevitably leads to a decrease in real GDP and investment (Statistical Committee of Kazakhstan 2017).

The fall in oil prices led to the collapse of the tenge exchange rate, an export crisis and a sharp decline in the balance of payments of the Kazakhstan economy. This is because Kazakhstan's prosperity is based on the revenues from crude oil exports (Musin 236-240). In 2003, the Kazakhstan government started to implement the industrial development and innovation strategy in order to reduce dependence on oil and ensure the development of non-oil sectors. However, Kazakhstan has two main disadvantages that are extremely difficult to overcome. These are the distance from international markets and the small size of the domestic market. Remoteness from international markets has the effect of increasing the transportation costs of non-oil goods, while the small population has the effect of shrinking the domestic market. The small size of the domestic market is a factor that prevents the increase in direct investments in non-oil sectors (Brauer 193). The orientation of direct investments towards the oil sector is of great importance as a determining factor in the increase in the rate of oil production (Stiglitz, *Eşitsizliğin Bedeli* 14).

Uzbekistan

According to the results of causality tests for Uzbekistan, a unidirectional causality relationship was found from the REER to the CPI and from NGP to the CPI. There is no bidirectional causality relationship between the variables.


Direction of Causality
CPI
REER
NGP
OP


Impulse and Response Functions
Inflation
Natural Gas Prices
Oil Prices
Exchange Rate
Inflation
Naturel Gas Prices
Oil Prices
Exchange Rate

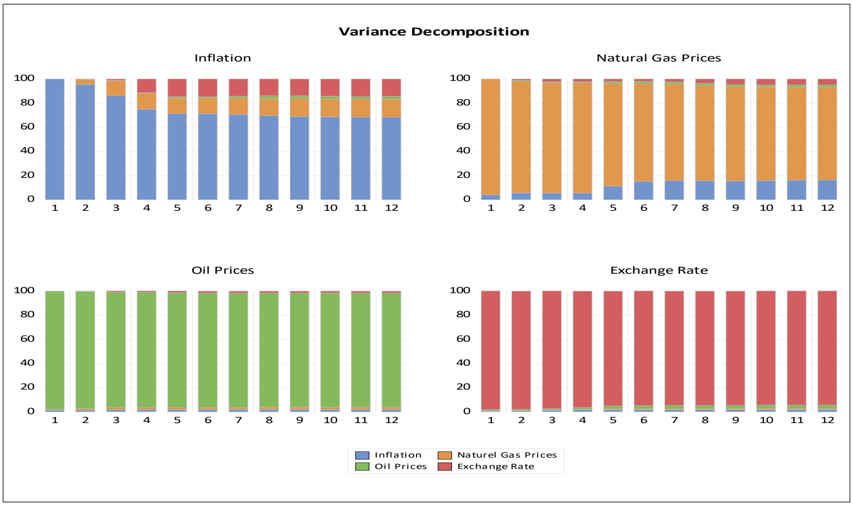


Figure 4. Causality, Impulse-Response Functions and Variance Decomposition (Uzbekistan)

In Uzbekistan, no variable has no effect on CPI in the first month of the year. However, NGP and the REER, which start to have an impact especially in the second and fourth months, continue to affect the CPI until the end of the year. The REER is only slightly affected by the CPI and OP.

Uzbekistan is the most populous country among the CIS countries (Amanov 69). Uzbekistan's economy is largely based on agriculture. Cotton production constitutes a large part of agricultural production. Uzbekistan is the second largest cotton exporter country after the USA (Kalyoncu and Amanov 45). Uzbekistan has a high potential in terms of natural resources and energy as well as in the agricultural sector. After gaining its independence, Uzbekistan has been implementing socioeconomic reforms to achieve energy independence. In this regard, the government supports the oil and gas industry and increases the production of liquid hydrocarbons in the country (Ibpus 42). In order to increase the efficiency of the gas and oil industry in Uzbekistan, Uzbekneftegaz was established, the Kokdumalak oil condensate field was opened, the Bukhara refinery was established, and a number of projects such as the Mubarek Natural Gas Refinery were completed (Suvanova et al. 262).

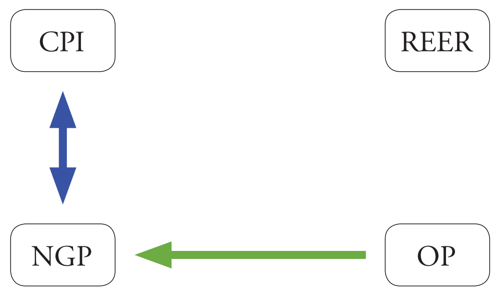
The declining level of oil production in Uzbekistan is due to the relatively low level of investment in this sector and the use of outdated technologies in production (Bridgman et al. 1373). In addition, Uzbekistan's only domestic crude oil pipeline connects the Fergana and Alty-Aryk refineries. Uzbekistan has almost no international oil pipeline infrastructure, except for a pipeline connecting the Shymkent refinery in Kazakhstan to the Chardzhou refinery in northeastern Turkmenistan. Declines in oil production have led the Uzbekistan government away from an inward-looking energy policy that encourages self-sufficiency and subsidized domestic market prices (Suvanova et al. 265).

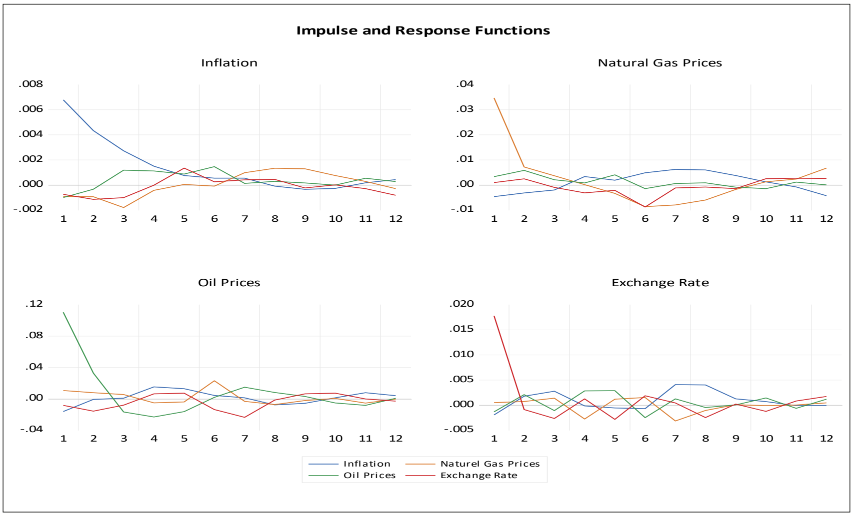
As Uzbekistan is a net exporter of natural gas and refined petroleum products, it has also been affected by significant declines in energy prices. In 1998, the government of Uzbekistan was forced to control the exchange rate and national currency prices of these important export commodities, which suffered from a lack of international price-competitiveness. Therefore, export tariffs for all types of goods and services were abolished as of November 1, 1997. This policy change is consistent with the government's objective of further liberalization of foreign economic activity. However, this policy change was found to have no effect on non-exporting domestic producers (Ganikhodjaev 207).

Kyrgyzstan

According to the findings of the causality test for Kyrgyzstan, there is a unidirectional causality from OP to NGP and a bidirectional causality between the CPI and NGP.

Direction of Causality





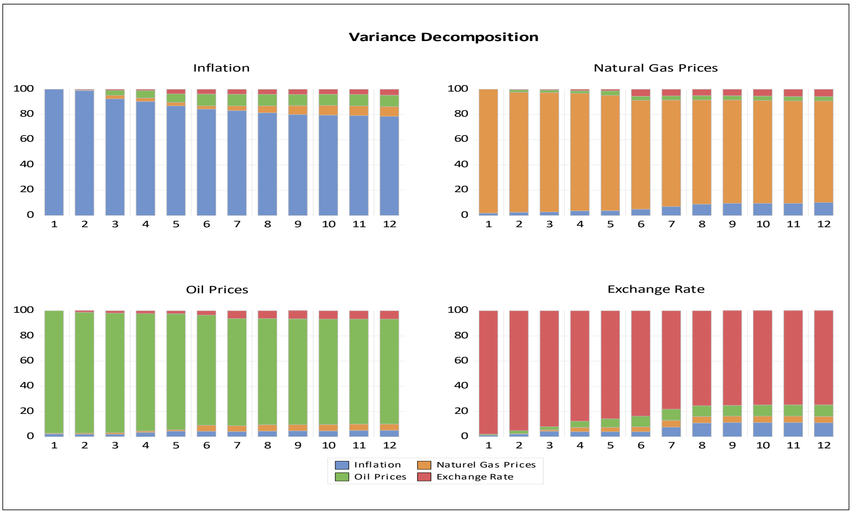


Figure 5. Causality, Impulse-Response Functions and Variance Decomposition (Kyrgyzstan)

In Kyrgyzstan, there is no effect on the CPI in the first month of the year. OP and the REER and OP, which start to have an impact as of the 3rd month of the year, make their impact felt until the end of the year. The effect of oil and natural gas prices on the CPI is felt more than the effect of the REER until the end of the year. The REER, on the other hand, has been under the influence of OP and the CPI especially since the 4th month of the year.

Although the economy of Kyrgyzstan has a mountainous terrain, the economy is based on livestock, agriculture, and forestry sectors (Çetin and Sevütekin 3). The top economic priorities after gaining independence were to reverse the rapid economic contraction process that started after the dissolution of the union and to reduce the high inflation caused by price liberalization (Saketaeva 59).

In the first period of independence, Kyrgyzstan experienced a halving of GDP. During this transition period, privatizations were made and the state partially relinquished its control over the economy. However, a strong and systematic economic mechanism could not be established, and economic thinking could not be fully adapted to the market economy. Kyrgyzstan adopted "open growth" as its post-independence economic policy. Its accession to the WTO in 1998, the first among the Central Asian states, is one of the proofs of this. Due to the open growth strategy, the country's import dependency started to increase (Ganiev and Damira 18). Within five years of Kyrgyzstan's independence, its output has doubled, and the inflation rate has reached hyperinflation levels. Therefore, tight monetary and fiscal policies have started to be implemented in the country to combat inflation (Çetin and Sevütekin 8-9).

Kyrgyzstan's economy has not yet achieved the economic diversification to realize a stable and long-term recovery. Except for the gold sector, only textile and garment production is realized, and industry is very limited outside these sectors (DEİK 9). Gold production is also important in the country, and the KUMTOR gold mine accounts for the majority of the revenues from this sector (DEİK 7).

Kyrgyzstan's reliance on KUMTOR, which has been driving GDP growth in recent years, stands as one of the biggest obstacles to the country's development (Sakataeva 128). The energy sector, which is the second sector in the country where foreign aid/foreign financing is channeled the most, has not been updated in 20 years except for the renewal and modernization of the existing energy system. Kyrgyzstan imports most of its oil needs. This situation leads to an increase in the external deficits of the Kyrgyz economy, which has very little production (Cusup et al. 51).

An overall assessment of the situation in Kyrgyzstan suggests that Kyrgyzstan's transition to a free-market economy was a step in the right direction, but this step alone is not sufficient for economic growth and development. The dependence of growth on demand from close neighbors, the vulnerability of the economy to external shocks, high inflation triggered by the increase in food and oil prices, the decrease in food and electricity production due to drought, energy restrictions have increased the negative effects of crises on the country's economy (Karluk 12-13).

Conclusion

The external dependence on energy seen in many developing countries is also valid for the Eurasian geography. Fluctuations in energy prices increase production costs in the short run and cause inflation in the long run. The resulting contraction in consumer demand, coupled with cost inflation, reduces the amount of production in these countries. This situation prevents the GDP in these countries from reaching the desired level. A prominent feature of developing countries is inadequate capital. Most of this capital is used to cover energy costs. Due to insufficient capital, exchange rate fluctuations increase in these economies that need foreign investments. According to the results of the analysis, the effect of exchange rate on inflation is felt more intensely in Türkiye and Kazakhstan compared to other countries.

The Eurasian geography is more affected by volatile market conditions because it has a developing economy and is an energy importer (Demir 33). Exchange rate and energy market fluctuations are important macroeconomic factors that rapidly affect domestic market pricing in developing countries. Developing countries may not be able to escape inflation and exchange rate pressure unless they take protective measures in the domestic market to protect themselves from the negative effects of the global economy (Stiglitz, "Making Naturel Resources" 317-339).

This study analyzes the relationship between ER, EP and inflation for the economies of Türkiye, Azerbaijan, Kazakhstan, Uzbekistan and Kyrgyzstan. According to the findings, there is a causality relationship from EP to inflation in all selected countries. The effects of external energy dependence and capital shortages in these countries are manifested in the form of exchange rate volatility and inflation. These results are instructive for policy makers in the selected countries.

Due to the nature of social sciences, our study has some scope and limitations as in every scientific study. First, due to data limitations, we were able to analyze the period 2010-2022, which covers a common time period for 5 countries. Methodologically, we utilize time series analysis to identify short – and long-term country-specific dynamics. In addition, linear dynamic relationships between energy, commodity and exchange rate markets have been analyzed. It is important to emphasize that such scope and limitations open the door for future research. In this regard, future studies may use samples that include more countries and a wider time span, utilize panel data tools instead of time series analysis, and focus on the detection of nonlinear asymmetric dynamics instead of linear relationships.

Conflict of Interest Statement

There is no conflict of interest with any institution or person within the scope of this study.

Notes

1 The economic structure of the region is heavily concentrated in the energy sector. It is noted that two important events have had a significant impact on the growing importance of this region. The first one is the collapse of the Soviet Union, which led to the end of Soviet domination over the region's resources. Since their independence from Russia in the 1990s, Central Asian countries have failed to achieve the desired level of economic growth and development. However, these countries have a very important driving force for economic growth, as they have approximately 4% of the world's oil reserves and 5% of the world's natural gas (Demirtepe 67). The other is the growing importance of the security issue in energy transit. In fact, the search for alternative energy sources to the increasingly destabilized Middle East has become more prominent. This has also led to the acceleration of international investments in new resources in the Eurasian region. In addition to these two events, the search for new energy reserves has become a necessity in order to meet the world's population and the increasing demand for energy, since oil and natural gas, whose reserves are expected to run out in the near future, are non-renewable energy resources (Narin 154).

2 These five countries and the time period were chosen based on the data availability and limitations of the selected countries.

3 To save space, the details of the bootstrap procedure are not provided here. See (Hatemi-J.; Balcilar et al., 2010) for details.

References

Abounoori, Abbas Ali, et al. "Oil Price Pass-Through into Domestic Inflation: The Case of Iran." *International Journal of Energy Economics and Policy,* vol. 4, no. 4, 2014, pp. 662-669.

Adıgüzel, Uğur, et al. "Oil Prices and Exchange Rates in Brazil, India and Türkiye: Time and Frequency Domain Causality Analiysis." *Siyaset, Ekonomi ve Yönetim Araştırmaları Dergisi,* vol. 1, no. 1, 2013, pp. 49-73.

Ağayev, Seymur. "Azerbaycan'da Fiyatlar Genel Düzeyi ve Döviz Kuru İlişkisi." *H.Ü. İktisadi ve İdari Bilimler Fakültesi Dergisi,* vol. 29, no. 1, 2011, pp. 1-19.

Ağazade, Seymur. "Petrol Fiyatları ve Kazakistan Reel Döviz Kuru: ARDL Sınır Testi Yaklaşımı." *bilig,* no. 94, 2020, pp. 217-248.

Ağazade, Seymur. "Reel Döviz Kuru ve Petrol Fiyatları İlişkisinde Asimetri: Azerbaycan Örneğinde Bir İnceleme." *UİİİD-İJEAS,* Özel Sayı, 2018, pp. 113-126.

Akhundzada, Gumru. "Enerji Fiyat Değişimlerinin Azerbaycan'ın Cari İşlemler Dengesi Açığına Etkisi." *Uluslararası Türk Dünyası Araştırmaları Dergisi,* vol. 6, no. 2, 2023, pp. 1-20.

Akram, Q. Farooq. "Oil Prices and Exchange Rates: Norwegian Evidence." *Econometrics Journal,* vol. 7, 2004, pp. 476-504.

Aleisa, Eisa, A., and Sel Dibooğlu. "Sources of Real Exchange Rate Movements in Suudi Arabia." *Journal of Economics and Finance,* vol. 26, no.1, 2002, pp. 101-110.

Altemur, Necati. "Petrol Fiyatları ve Makroekonomik Değişkenler Arasındaki İlişki: Türkiye Örneği." *Malatya Turgut Özal Üniversitesi İşletme ve Yönetim Bilimleri Dergisi,* vol. 4, no. 1, 2023, pp. 66-77.

Altıntaş, Halil. "Petrol Fiyatlarının Gıda Fiyatlarına Asimetrik Etkisi: Türkiye için NARDL Modeli Uygulaması." *Yönetim ve Ekonomi Araştırmaları Dergisi,* vol. 14, no. 4, 2016, pp. 1-24.

Amano, R. A., and S. van Norden. "Oil Prices and The Rise and Fall of The US Real Exchange Rate." *Journal of International Money and Finance*, no. 17, 1998, pp. 299-316.

Amanov, Shatlyk. *ABD'nin Avrasya Politikaları.* Gökkubbe Yayınları, 2007.

Babak, Vladimir. "Neftegazovyy Sektor Kazakhstana." *Orta Asya ve Kafkaz,* vol. 4, no. 46, 2006, pp. 50-66.

Balcılar, Mehmet et al. "Economic Growth and Energy Consumption Casual Nexus Viewed Through a Bootstrap Rolling Window." *Energy Economics*, vol. 32, no. 6, 2010, pp. 1398-1410.

Bass, Alexander. "Do Oil Shock Matter for Inflation Rate in Russia: An Empirical Study of Imported Inflation Hypothesis." *International Journal of Energy Economics and Policy,* vol. 9, no. 2, 2019, pp. 288-294.

Baum, Christopher, et al. "Nonlinear Effects of Exchange Rate Volatility on the Volume of Bilateral Exports." *Journal of Applied Econometrics,* no. 19, 2004, pp. 1-23.

Benhmad, François. "Modeling Nonlinear Granger Causality between the Oil Price and U.S. Dollar: A Wavelet Based Approach." *Economic Modelling,* no. 29, 2012, pp. 1505-1514.

Berument, M. Hakan, et al. "The Impact of Oil Price Shocks on the Economic Growth of Selected MENA Countries." *The Energy Journal*, vol. 31, no. 1, 2010, pp. 149-176.

Bigerna, Simona. "Energy Price Shocks, Exchange Rates and Inflation Nexus." *Energy Economics,* no. 128, 2023, pp. 1-18.

BP. "Statistical Review of World Energy, June 2017." 25.09.2023, https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

Brauer, Birgit. "Kazakhstan's Economic Challenges: How to Manage the Oil Boom?" *Transition Studies Review,* vol. 14, no. 1, 2007, pp. 188-194.

Bridgman, Benjamin, et al. "Threatening to Increase Productivity: Evidence from Brazil's Oil Industry." *World Development,* vol. 39, no. 8, 2011, pp. 1372-1385.

Bruegel. "Real Effective Exchange Rates." 10.10.2023, https://www.bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database.

Burbidge, John, and Alan Harrison. "Testing for the Effects of Oil-Price Rises using Vector Autoregressions." *International Economic Review,* vol. 25, no. 2, 1984, pp. 459-484.

Castro, Cesar, and Rebeca Jimenez-Rodriguez. "Dynamic Interactions between Oil Price and Exchange Rate." *PloS One,* vol. 15, no. 8, 2020, pp. 1-20.

Çetin, Işın, and Mustafa Sevüktekin. "Bir Geçiş Ülkesi Olan Kırgızistan Ekonomisinin Analizi: Gelecekten Beklentiler." *Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi,* no. 38, 2013, pp 1-21.

Chaudhuri, Kausik, and Betty C. Daniel. "Long-run Equilibrium Real Exchange Rates and Oil Prices." *Economics Letters,* no. 58, 1998, pp. 231-238.

Chen, Shiu-Sheng, and Hung-Chyn Chen. "Oil Prices and Exchange Rates." *Energy Economics,* no. 29, 2007, pp. 390-404.

Çınar, Burak. "Tarihte Üçüncü Güç ve Orta Asya Enerji Savaşları." *Güvenlik Stratejileri Dergisi,* vol. 4, no. 4, 2008, pp. 21-43.

Coudert, Virginie, et al. "Oil Price and The Dollar." *Energy Studies Review,* vol. 15, no. 2, 2008, pp. 45-58.

Cunado, J., and F. Perez de Gracia. "Oil Prices, Economic Activity and Inflation: Evidence for Some Asian Countries." *The Quarterly Review of Economics and Finance,* no. 45, 2005, pp. 65-83.

Cusup, Pirimbaev, et al. "Enerjinin Ekonomik Büyümeye Etkisi: Kırgızistan Ekonomisi için ARDL Sınır Testi." *Reforma,* vol. 3, no. 87, 2020, pp. 48-63.

Dai, Zhifeng, et al. "Dynamic Spillover Effects and Portfolio Strategies Between Crude Oil, Gold and Chinese Stock Markets Retaled to New Energy Vehicle." *Energy Economics,* no. 109, 2022, Article 105959, pp. 1-12.

DEİK (Dış Ekonomik İlişkiler Kurulu). Kırgızistan Ülke Bülteni. 10.10.2023 http://www.deik.org.tr/Contents/FileAction/2627.

Demir, Yusuf. "Küresel Enerji ve Gıda Fiyatlarının Türkiye'de Enflasyona Etkisinin Zamanla Değişen Nedensellik Analizliyle İncelenmesi." *Süleyman Demirel Üniversitesi Vizyoner Dergisi,* vol. 13, no. 33, 2022, pp. 189-203.

Demirtepe, M. Turgut. *Orta Asya ve Kafkasya'da Güç Politikası.* USAK Yayınları, Ankara.

Dickey, D., and W. Fuller. "Distribution of The Estimator for Autoregressive Time Series with a Unit Root." *Journal of the American Statistical Association,* no. 74, 1979, pp. 427-431.

Ding, Yueting, et al. "Resilience Assessment of Chine's Natural Gas System Under Supply Shortages: A System Dynamics Approach." *Energy,* no. 247, 2022, pp. 1-12.

Dolado, Juan. J., and Helmut Lütkepohl. "Making Wald Tests Work for Cointegrated VAR Systems." *Econometric Reviews*, vol. 15, no. 4, 1996, pp. 369-386.

Duygulu, Aylin Abuk. "Döviz Kuru İstikrarının Ekonomik İstikrar Açısından Değerlendirilmesi." *D.E.Ü İİBF Dergisi,* vol. 13, no. 1, 1998, pp. 107-118.

Dzhantureeva, Elvira. "Neftegazovıy Kompleks: Zapasy, Dobyça, Investitsii" *Kazakhstan Business Magazine,* no. 5, 2014, pp. 18-22.

Emami, Karim, and Mehdi Adippour. "Oil Income Shocks and Economic Growth in Iran." *Economic Modelling,* vol. 29, no. 5, 2012, pp. 1774-1779.

Energy Information Administration (EİA). "Sources and Uses." 10.10.2023, https://www.eia.gov/.

Farzanegan, Mohammad Reza, and Gunther Markwardt. "The Effects of Oil Price Shocks on the Iranian Economy." *Energy Economics,* vol. 31, no. 1, 2009, pp. 134-151.

Ganiev, Junus, and Baigonus Damira. "Kırgızistan'da Dış Açık Sorunu." *Reforma,* vol. 1, no. 77, 2018, pp. 18-26.

Ganikhodjaev, Saidazim. "Regulating System of Foreign Trade in Uzbekistan at the Transitional Period." *Economic journal of Hokkaido University*, no. 33, 2004, pp. 205-219.

Gisser, Micha, and Thomas H. Goodwin. "Crude Oil and the Macroeconomy: Tests of Some Popular Notions: Note." *Journal of Money, Credit and Banking,* vol. 18, no. 1, 1986, pp. 95-103.

Guliyev, Farid. "The Contract of the Century'20 Years After." *SSRN Electronic Journal*, 2014, https://doi.org/10.2139/ssrn.2498276.

Hatemi-J, Abdulnasser. "Export Performance and Economic Growth Nexus in Japan: A Bootstrap Approach." *Japan and Word Economy*, vol. 14, no. 1, 2002, pp. 25-33.

Husaini, Dzul Hadzwan, and Hooi Hooi Lean. "Asymmetric Impact of Oil Price and Exchange Rate on Disaggregation Price Inflation." *Resources Policy,* no. 73, 2021, pp. 1-11.

Ibpus. *Uzbekistan: Mineral, Mining Sector Investment and Business Guide*. USA International Business Publications, 2013.

IMF (International Monetary Fund). "IMF Data." 10.10.2023, https://www.imf.org/en/Data.

Indjehagopian, J.P, et al. "Dynamics of Heating Oil Market Prices in Europe." *Energy Economics,* no. 22, 2000, pp. 225-252.

Kalyoncu, Hüseyin, and Shatlyk Amanov. "Orta Asya Enerji Kaynakları ve Enerji Bağlamında ABD'nin Orta Asya Politikası." *Çağ Üniversitesi Sosyal Bilimler Dergisi,* vol. 7, no. 2, 2010, pp. 38-71.

Karenov, Rashit S. "Sovremennoe Sostoyanie i Prioritetnye Zadachi Razvitiya v Perspektive Neftyanoy Otrasli v Mire i Kazakhstane." *Karaganda Üniversitesi Vestnik Dergisi*, vol. 3, no. 79, 2015, pp. 5-18.

Karimli, Tural, et al. "Oil Price Pass-Through into Inflation: The Evidence from Oil Exporting Countries." *Graduate Institute of International and Development Studies International Economics Department Working Paper Series,* no. IHEIDWP01, 2016, pp. 1-24.

Karluk, S. Rıdvan. *Küresel Krizin Kırgızistan Ekonomisine Etkisi ve Türkiye Kırgızistan Ekonomik İlişkilerindeki Gelişmeler*. Eskişehir, 2014.

Kartal, Gökhan. "Çoklu Yapısal Kırılmalar Altında Enflasyon ile Uluslararası Petrol Fiyatları İlişkisi: Türkiye Örneği." *Mehmet Akif Ersoy Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* vol. 10, no. 1, 2023, pp. 28-56.

Statistical Committee of Kazakhstan. "Kazakistan 2016'da." 08.10.2023, http://www.stat.gov.kz.

Koçak, Sultan, et al. "Türkiye Ekonomisinde Petrol Fiyatları ve Enflasyon İlişkisi: Ampirik Analiz." *Journal of Life Economics,* vol. 4, no. 4, 2017, pp. 261-273.

Korhonen, Iikka, and Tuuli Juurikkala. "Equilibrium Exchange Rates in Oil-Exporting Countries." *Journal of Economics and Finance,* no. 33, 2009, pp. 71-79.

Kutan, Ali M., and Michael L. Wyzan. "Explaining The Real Exchange Rate in Kazakhstan, 1996-2003: Is Kazakhstan Vulnerable to The Dutch Disease?" *Economic Systems,* no. 29, 2005, pp. 242-255.

Kwiatkowski, Denis, et al. "Testing the Null Hypothesis of Stationary against the Alternative of a Unit Root." *Journal of Econometrics,* no. 54, 1992, pp. 159-178.

Mensi, Walid, et al. "Extreme Quantile Spillovers and Connectedness Between Oil and Chinese Sector Markets: A Portfolio Hedging Analysis." *The Journal of Economic Asymmetries,* no. 28, 2023, pp. 1-18.

Musin, Asılbek. "Strukturnoye Kachestvo Ekonomiki Kazakhstana Cherez Prizmu Sovremennykh Podkhodov k Sotsial'no-Ekonomicheskomu Razvitiyu." [Structural Quality of Kazakshstan's Economy through the Prism of Modern Approaches to Socio-Economic Development]. *Transport Business in Russia*, no. 6, 2012, pp. 236-240.

Narin, Müslüme. "Avrasya Bölgesindeki Türk Cumhuriyetlerinin Enerji Kaynakları ve İletim Hatlarının Türkiye'ye Katkıları." *Türk Dünyası İncelemeleri Dergisi*, vol. 6, no. 1, 2006, pp. 151-167.

Nazlioglu, Saban, et al. "Oil Prices and Real Estate İnvestment Trusts (REİTs): Gradual-Shift Casuality and Volatility Transmission Analysis." *Energy Economics*, no. 60, 2016, pp. 168-175.

Nazlioglu, Saban, et al. "Oil Prices and Monetary Policy in Emerging Markets: Structural Shifts in Causal Linkages." *Emerging Markets and Finance and Trade*, vol. 55, no. 1, 2019, pp. 105-117.

Öksüzler, Oktay, and Evren İpek. "Dünya Petrol Fiyatlarındaki Değişimin Büyüme ve Enflasyon Üzerindeki Etkisi: Türkiye Örneği." *ZKÜ Sosyal Bilimler Dergisi,* vol. 7, no. 14, 2011, pp. 15-34.

Ölmezoğulları, Nalan, and Gulnaz Aldibekova. "Kazakistan Ekonomisinde Petrolün Rolü." *Uludağ Üniversitesi Fen-Edebiyat Fakültesi Sosyal Bilimler Dergisi,* vol. 19, no. 35, 2018, pp. 669-705.

Olomola, Philp A., and Akintoye V. Adejumo. "Oil Price Shock and Macroeconomic Activities in Nigeria." *International Research Journal of Finance and Economics,* no. 3, 2006, pp. 28-34.

Özdamar, Gökhan. "Türkiye Ekonomisinde Döviz Kuru Geçiş Etkisi: ARDL Sınır Testi Yaklaşımı Bulguları." *Akdeniz İİBF Dergisi,* no. 32, 2015, pp. 66-97.

Özdemir, Abdullah, and Fatma Yüksel. "Türkiye'de Enerji Sektörünün İleri ve Geri Bağlantı Etkileri." *Yönetim ve Ekonomi,* vol. 13, no. 2, 2006, pp. 1-18.

Phillips, P.C.B., and P. Perron. "Testing for a Unit Root in Time Series Regression." *Biometrika,* no. 75, 1988, pp. 335-346.

Sakataeva, Rakhat. *Kırgızistan'ın Dış Borç Yapısının İncelenmesi ve Çözüm Önerileri.* Yüksek Lisans Tezi. İstanbul Üniversitesi Sosyal Bilimler Enstitüsü, 2014.

Stiglitz, Joseph E. *Eşitsizliğin Bedeli: Bugünün Bölünmüş Toplumu Geleceğimizi Nasıl Tehlikeye Atıyor?* Çev. O. İşler, İletişim Yayınları, 2018.

Stiglitz, Joseph E. "Making Naturel Resources into a Blessing rather than a Curse." *Covering Oil*, eds. Svetlana Tsalik and Anja Schiffrin, Open Society Institute, 2005, pp. 13-19.

Suvanova, Kurkam, et al. "Will Uzbekistan's Oil and Gas Industry Benefit from International Listing?" *Problems and Perspectives in Management,* vol. 14, no. 2, 2016, pp. 262-271.

Taşar, İzzet. "Asymmetric Relationship Between Oil Price and Exchange Rate: The Case of Romenia." *Fırat Üniversitesi Sosyal Bilimler Dergisi,* vol. 28, no. 1, 2018, pp. 143-154.

Toda, H. Y., and T. Yamamoto. "Statistical İnference in Vector Autoregressions with Possibly İntegrated Processes." *Journal of Econometrics,* no. 66, 1995, pp. 225-250.

Trehan, Bharat. "Oil Prices, Exchange Rates and the U.S. Economy: An Empirical Investigation." *Economic Review,* no. 4, 1986, pp. 25-43.

Uysal, Doğan, et al. "Enerji İthalatı ve Cari Açık İlişkisi: Türkiye Örneği." *Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi,* vol. 3, no. 1, 2015, pp. 63-78.

Yang, Fang, and Jie Dian. "Macro-Economic Impact Policies for Controlling Fossil Energy Consumption in China." *Energies,* vol. 15, no. 3, 2022, pp. 1-19.

Yaylalı, Muammer, and Fuat Lebe. "İthal Ham Petrol Fiyatlarının Türkiye'deki Makroekonomik Aktiviteler Üzerindeki Etkisi." *Marmara Üniversitesi İİBF Dergisi,* vol. 32, no. 1, 2012, pp. 43-68.

Zhang, Yonggang et al. "Nexus Between Oil Price Volatility and Inflation: Mediating Nexus from Exchange Rate." *Resources Policy,* no. 79, 2022, pp. 1-12.

Appendix Figure 1: Graphical Abstract of Empirical Strategy