Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

Beyond Oil Prices: A Comparative Analysis of the Indirect Effects of Energy Prices on Economic Growth in Türkiye and Russia

Abdallah Abukalloub[1], Dilara Berrak TARHAN[2], Ayşe GÜNGÖR[3]

[1]Nigde Omer Halisdemir University, Institute of Social Sciences, Department of Economics, Türkiye
[2]Ankara Medipol University, Faculty of Economics, Administrative and Social Sciences, Department of International Trade and Finance, Türkiye
[3]Giresun University, Kadir Karabaş School of Applied Sciences, Department of Logistics Management, Türkiye

Author Email: abdkalloub@gmail.com[1], dilara.tarhan@ankaramedipol.edu.tr[2], ayse.gungor@giresun.edu.tr[3]

ORCID: 0009-0000-1697-5206[1], 0000-0002-4303-5292[2], 0009-0006-3916-9657[3]

Abstract. This study examines the impact of energy prices on economic growth through a comparative analysis of Türkiye and Russia. The analysis uses annual data covering the period 2000-2024. The primary empirical assessment employs a multiple linear regression (OLS) model, with panel data techniques used as complementary methods to analyze long-run relationships and test the robustness of the findings. Brent crude oil prices are used as a proxy for energy prices, and the GDP growth rate serves as the indicator of economic growth. Unemployment, inflation, exchange rate, trade volume, and gross capital formation are included in the model as control variables. The findings indicate that Brent oil prices have a negative and statistically significant effect on economic growth. Moreover, the adverse effects of unemployment and exchange rate fluctuations on growth are stronger, whereas gross capital formation contributes positively to economic growth. The results of the interaction model reveal that the effect of oil prices does not differ significantly between the two countries. In conclusion, the impact of energy prices on economic growth is not direct but is shaped by macroeconomic conditions and varies with country-specific structural characteristics.

Keywords: Energy prices, Economic Growth, Brent petrol, Türkiye, Russia.

1 Introduction

Energy prices are a fundamental determinant of a wide range of macroeconomic variables in modern economies, from production costs and external trade balances to inflation and investment decisions. In this context, oil prices stand out not only as a strategic commodity in the global economic system but also as a critical indicator shaping the dynamics of economic growth. Fluctuations in oil prices can generate diverse economic outcomes, depending on countries' energy structures, levels of external dependence, and macroeconomic vulnerabilities.

Theoretically, the relationship between energy prices and economic growth can be explained through two main transmission channels: the cost channel and the revenue channel. This dual-channel framework provides the conceptual basis for distinguishing between energy-importing and energy-exporting economies in empirical analysis [1].

In energy-importing economies, energy prices operate predominantly through a cost channel. Increases in oil prices raise production costs, reduce firms' profitability, and generate inflationary pressures, thereby constraining economic growth [2]. These effects are often reinforced through exchange rate depreciation and current account imbalances.

In contrast, in energy-exporting economies, energy prices function through a revenue channel. Rising oil prices increase export revenues, strengthen fiscal balances, and expand government spending capacity, which may stimulate economic growth in the short run [3]. However, this mechanism may also create structural challenges such as resource dependence and limited economic diversification [4].

Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

Accordingly, the energy-growth nexus should be understood as a country-specific, multi-channel process rather than a uniform relationship.

The selection of Türkiye and Russia is not limited to their classification as energy-importing and energy-exporting economies. Rather, the two countries represent structurally distinct macroeconomic systems that differ in their exposure to external shocks, exchange rate dynamics, and the role of energy in fiscal and growth processes. Türkiye is characterized by high dependence on energy imports, current account sensitivity, and exchange rate volatility, which amplify the transmission of energy price shocks through cost and financial channels. In contrast, Russia's economy relies heavily on energy export revenues, with oil and natural gas playing a central role in fiscal stability and economic performance, while also creating structural dependence and vulnerability to global commodity price fluctuations. Therefore, the comparative framework of this study is grounded in differences in macroeconomic structure and transmission mechanisms, rather than solely in the importer–exporter dichotomy.

In this regard, Türkiye and Russia represent two distinct economic structures for analyzing the relationship between energy prices and economic growth. While Türkiye, due to its high dependence on energy imports, appears more sensitive to oil price shocks, Russia, as an energy exporter, exhibits a growth structure largely driven by oil and natural gas revenues. Examining these two countries within the same analytical framework allows for a more comprehensive and comparative assessment of the direction and magnitude of the impact of energy price shocks on economic growth.

Although a substantial body of literature examines the relationship between energy prices and economic growth, a significant portion of these studies focuses on single-country analyses or treats energy-importing and energy-exporting countries as separate analytical units. Moreover, comparative studies that evaluate the impact of oil prices on economic growth alongside macroeconomic variables such as exchange rates, unemployment, inflation, trade volume, and investment remain relatively limited. This highlights the need for more comprehensive analyses that consider not only the direct effects of energy prices on growth but also the multiple transmission mechanisms through which these effects materialize.

Addressing this gap, the present study investigates the impact of Brent crude oil prices on economic growth in Türkiye and Russia over the period 2000-2024 from a comparative perspective. In the analysis, the GDP growth rate is used as the indicator of economic growth, Brent oil prices serve as the main explanatory variable, and the unemployment rate, inflation, exchange rate, trade volume, gross capital formation, and deposit interest rate are included as control variables. Additionally, an interaction model is constructed to test whether the impact of oil prices on growth differs between the two countries.

The primary objective of this study is to empirically identify the similarities and differences in the effects of oil prices on economic growth in energy-importing and energy-exporting economies. In this respect, the study aims not only to contribute to the energy economics literature by providing a comparative analysis but also to enhance the understanding of economic vulnerabilities to energy price shocks and to inform policy development processes.

2 Literature Review

The relationship between energy prices and economic growth is shaped by different transmission mechanisms in energy-importing and energy-exporting economies. Because energy is a fundamental input in production, increases in oil and natural gas prices can affect growth through production costs, inflation, investment behavior, external trade balances, and exchange rates. However, the direction and magnitude of this effect vary by countries' energy supply structures, levels of external dependence, and macroeconomic vulnerabilities. Accordingly, the literature does not treat the energy price–growth nexus as a unidirectional and homogeneous mechanism, but rather as a multi-layered process sensitive to country-specific characteristics.

Research in this field typically falls into three main strands. The first strand focuses on the direct relationship between energy prices and macroeconomic variables such as growth, inflation, industrial production, and the external balance. The second strand examines the structural implications of energy import dependence or export-oriented growth models. The third strand addresses the time-varying and indirect dimensions of the energy–growth relationship, including oil price shocks, volatility, the energy transition, and policy responses. This classification is particularly useful for jointly analyzing Türkiye and Russia, as Türkiye's vulnerabilities are largely driven by energy import dependence, whereas Russia is exposed to price shocks in a different way due to its energy-revenue-based growth model.

The literature on Türkiye generally indicates that the impact of energy prices on growth is predominantly negative and operates through cost channels. Akşehirli (2024) examines the effects of oil prices on aggregate and sectoral growth in Türkiye for the period 2010Q1-2023Q3 using a nonlinear ARDL framework. The study finds that increases in oil prices reduce total GDP and industrial value added, whereas price decreases stimulate growth. The study also shows that the effects are asymmetric, meaning that oil price increases and decreases do not affect growth with the same magnitude or through identical mechanisms. This finding suggests that linear models may not fully capture the impact of price shocks in energy-importing economies [5].

Similarly, Çemrek and Bayraç (2023) analyze the effects of oil and natural gas prices on GDP, the industrial production index, and CPI in Türkiye for the period 2010-2020 using Johansen cointegration and Granger causality tests. Their findings indicate a long-run negative relationship between energy prices and GDP, as well as unidirectional causality from energy prices to GDP. The study also emphasizes that energy prices significantly influence not only growth but also industrial production and the general price level, highlighting their systemic role in the macroeconomic framework [6].

In contrast, Şakar et al. (2025) focus on energy import dependence rather than oil prices directly. Using the Johansen approach and a UVAR model for the period 1974-2021, they find no long-run relationships among energy dependence, energy intensity, and real GDP, but identify a short-run negative relationship from energy intensity to real GDP. This result underscores that growth constraints in Türkiye are not solely driven by price shocks but also stem from the broader import-dependent structure of the energy system. Therefore, the impact of energy prices should not be interpreted independently of structural dependence [7].

Taken together, these studies on Türkiye highlight three common conclusions. First, energy prices and energy dependence generally suppress growth. Second, this effect operates through multiple channels, including inflation, industrial production, the external balance, and investment decisions. Third, much of the literature relies on single-country analyses, limiting the ability to systematically compare importer and exporter dynamics within a unified framework.

The literature on Russia has a distinct structure. The central debate concerns whether rising oil prices, while supporting growth, fiscal revenues, and export performance in the short term, may leave the economy more vulnerable and less diversified in the long run. Mitrova (2022) emphasizes the energy sector's central role in the Russian economy, noting that Russia continues to follow a fossil-fuel-based "business-as-usual" trajectory, in which energy revenues play a dominant role in growth, public finances, and external performance. This perspective highlights that, in Russia, energy prices function not only as cost variables but also as strategic sources of income and fiscal capacity [3].

Using a structural VAR approach for the period 2004Q1–2021Q3, Zeynalov and Tiron (2022) analyze the effects of oil price shocks on industrial production, exchange rates, inflation, and interest rates in Russia. Their findings demonstrate that oil price shocks have strong and measurable effects on macroeconomic indicators, with the monetary transmission channel appearing more sensitive than the fiscal channel. Oil price increases support industrial production while generating significant responses in exchange rates, inflation, and interest rates. The study also reveals a high degree of dependence of the Russian economy on oil price volatility, which directly influences business cycles and monetary policy transmission mechanisms [8].

Extending this perspective, Andreyev and Nelyubina (2024) analyze the relationship between energy prices and growth in the context of energy transition and climate policy scenarios. Using a macroeconomic general equilibrium model with rational expectations developed by the Bank of Russia, they show that increases in oil and gas export revenues may support GDP under certain scenarios but may also lead to contraction in non-oil and non-gas sectors. This finding suggests that the positive relationship between energy revenues and growth in Russia should not be interpreted superficially, as it involves sectoral reallocation and structural dependency challenges [9].

Similarly, Malakhov and Nesytykh (2022) examine the long-term macroeconomic costs and benefits of the global low-carbon transition for Russia using a scenario-based approach. Their findings indicate that Russia's reliance on the energy sector, particularly on external energy demand, may entail long-term costs as the global low-carbon transition accelerates. Thus, the impact of energy prices on growth in Russia cannot be explained solely by short-term revenue gains but must also be understood in relation to future demand conditions, the trajectory of the energy transition, and the economy's capacity for diversification [10].

At this point, a clear distinction emerges between the Turkish and Russian literatures. While studies on Türkiye predominantly focus on the cost, inflationary, and external balance pressures arising from energy price increases, the Russian literature emphasizes both the growth-supporting effects of energy revenues and the associated risks of structural dependency and lack of diversification. In other words, energy prices are largely conceptualized as a "cost shock" in the Turkish context and as a "revenue shock and structural dependency" in the Russian context. This distinction provides a strong theoretical basis for comparing the two countries within a unified empirical framework.

Nevertheless, three major gaps can be identified in the existing literature. First, studies that directly compare energy-importing and energy-exporting economies, such as Türkiye and Russia, within the same econometric framework remain limited. Second, many studies focus on the relationship between oil prices and a single macroeconomic variable, without jointly incorporating complementary variables such as exchange rates, unemployment, inflation, trade volume, and investment. Third, interaction terms or comparative modeling strategies that explicitly test whether effects differ across countries are not sufficiently widespread.

Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

Furthermore, much of the literature focuses either on short-term dynamics or on long-term structural relationships. Yet the relationship between energy prices and growth spans both short-term price shocks and long-term structural transformations. Although nonlinear ARDL models for Türkiye and structural VAR or general equilibrium models for Russia offer valuable insights, studies that simultaneously assess short-term empirical relationships and long-term trends within a unified, comparative framework remain scarce.

In this context, the present study aims to address these gaps by analyzing Türkiye and Russia within the same empirical framework. The impact of Brent oil prices on economic growth is examined alongside macroeconomic variables such as unemployment, inflation, exchange rates, trade volume, and gross capital formation. In doing so, the study compares importer vulnerability and exporter dependence within a single model and uses an interaction approach to test whether oil price effects differ across countries. Accordingly, it contributes to the literature by offering a comparative and multivariate perspective to a field that has been largely dominated by single-country and single-channel analyses.

3 Methodology

This study uses a comparative empirical framework to examine the impact of energy prices on economic growth, drawing on data from Türkiye and Russia for the period 2000-2024. The primary analytical approach is a multivariate linear regression model, with panel data techniques used as complementary tools to test long-run relationships and assess the robustness of the findings.

In the analysis, Brent crude oil prices are used as a proxy for energy prices, and the GDP growth rate serves as an indicator of economic growth. The model also incorporates macroeconomic control variables, including the unemployment rate, inflation, exchange rate, trade volume, gross capital formation, and deposit interest rate. These variables are included to account for indirect transmission channels through which energy prices may influence economic growth.

Brent crude oil prices are employed as a proxy for energy prices due to their role as a global benchmark in international energy markets. Oil prices are widely used in the literature to represent overall energy price dynamics, as they are highly correlated with other major energy sources such as natural gas and coal [2]. In addition, Brent prices provide consistent and comparable data across countries and over long time periods, which is essential for cross-country empirical analysis. However, it should be acknowledged that this proxy does not fully capture the heterogeneity of national energy structures, particularly in countries such as Russia where natural gas plays a dominant role. Therefore, the results should be interpreted as reflecting global energy price movements rather than a comprehensive measure of all energy components.

The data used in the study are secondary, with the primary source being the World Bank's World Development Indicators (WDI) database. Brent oil price data are obtained from the World Bank's commodity price statistics. All variables are annual and cover the period from 2000 to 2024.

It should be noted that the panel dataset is limited in its cross-sectional dimension, as it includes only two countries over a relatively long time period. Therefore, the analysis is designed as a focused comparative study rather than a conventional large-N panel investigation.

In this context, the panel structure is primarily used to capture time-series variation within each country and to facilitate the application of cointegration techniques within a controlled comparative framework. Accordingly, the econometric analysis should be interpreted as a comparative time-series approach rather than a generalizable panel model.

To address potential limitations related to the small sample size, a parsimonious model specification is adopted, particularly in the long-run analysis, to avoid overparameterization and enhance estimation reliability. In this framework, panel-based methods are employed as complementary and supportive tools rather than as a basis for broad cross-sectional generalization.

Within the scope of the analysis, Türkiye is considered an energy-importing country, whereas Russia is treated as an energy-exporting country. Accordingly, the study aims to compare the effects of energy price shocks on economic growth across countries with different economic structures.

The empirical analysis begins with descriptive statistics to summarize the variables' overall characteristics. Pearson correlation analysis is then conducted to examine linear relationships among variables. At this stage, the presence of high correlations among independent variables is also assessed to identify potential multicollinearity issues.

The baseline multivariate linear regression model employed in the study is specified as follows:

$$GDP_t = \beta_0 + \beta_1 Brent_t + \beta_2 Unemp_t + \beta_3 Inf_t + \beta_4 Exch_t + \beta_5 Trade_t + \beta_6 GCF_t + \beta_7 Int_t + \varepsilon_t$$

In this model, economic growth is the dependent variable, and the Brent oil price is the primary explanatory variable. The remaining variables are included as macroeconomic factors that may influence economic growth. The Brent oil price is treated as a global variable common to all observations, whereas the other variables reflect country-specific macroeconomic conditions.

Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

In the regression analysis, the overall significance of the model is evaluated using the F-test, while the statistical significance of individual coefficients is examined through t-tests. Additionally, Variance Inflation Factor (VIF) values are analyzed to detect potential multicollinearity problems. Although some variables exhibit relatively high correlations, the VIF values remain within acceptable thresholds and do not indicate severe multicollinearity. In addition, the stability of coefficient signs and statistical significance across different model specifications supports the robustness of the estimated relationships.

In addition to the baseline regression analysis, panel data techniques are employed to test the existence of long-run relationships among the variables and to ensure econometric consistency. First, the stationarity properties of the variables are examined using the Im-Pesaran-Shin (IPS) panel unit root test. Subsequently, the Kao and Pedroni panel cointegration tests are applied to determine the presence of long-run relationships among the variables. The results indicate the existence of a long-run equilibrium relationship.

Following the identification of cointegration, the Fully Modified Ordinary Least Squares (FMOLS) method is used to estimate long-run coefficients reliably. The FMOLS estimator is preferred because it corrects for potential issues such as autocorrelation and heteroskedasticity in cointegrated series, thereby providing more consistent estimates.

The econometric strategy adopted in this study is structured as a sequential and complementary framework rather than a set of independent parallel analyses. The baseline OLS model is employed to capture short-run relationships and identify the immediate effects of energy prices and macroeconomic variables on economic growth. Subsequently, panel unit root and cointegration tests are conducted to determine whether a long-run equilibrium relationship exists among the variables.

Following the confirmation of cointegration, the FMOLS estimator is applied to obtain consistent long-run coefficients by correcting for potential issues such as endogeneity, autocorrelation, and heteroskedasticity. In this way, OLS, panel cointegration techniques, and FMOLS are integrated within a unified econometric framework, where each method serves a distinct but complementary role in the overall analysis.

To examine whether the impact of oil prices on economic growth differs between countries, an interaction model is also constructed. In this model, a country dummy variable is included, and an interaction term between Brent oil prices and the country variable is generated:

$$GDP_t = \beta_0 + \beta_1 Brent_t + \beta_2 Country_t + \beta_3 (Brent_t \times Country_t) + \beta_4 Unemp_t + \beta_5 Exch_t + \varepsilon_t$$

However, the interaction model reveals a high degree of multicollinearity and a relatively low explanatory power. Therefore, the final evaluation of the study is based on the baseline regression model and the FMOLS long-run estimates, which provide more stable and reliable results.

Given that different econometric approaches are employed, model specifications are adjusted depending on the type of analysis. In the baseline OLS model, a comprehensive set of control variables—including unemployment, inflation, exchange rate, trade volume, gross capital formation, and deposit interest rate—is included to capture multiple transmission channels through which energy prices affect growth.

In contrast, a more parsimonious specification is adopted in the panel cointegration and FMOLS estimations. To enhance statistical stability, avoid overparameterization due to the limited sample size, and reduce multicollinearity, only the most theoretically and empirically relevant variables are retained. Accordingly, the FMOLS model includes Brent oil prices, unemployment rate, and exchange rate.

These variables are selected for the long-run analysis because they are found to be statistically significant in the baseline regression results and represent key macroeconomic factors influencing economic growth. Other control variables are retained in the OLS model to capture short-term dynamics but are excluded from the long-run estimations to improve model reliability.

Finally, different statistical software packages are used in the implementation of the analyses. Descriptive statistics, correlation analysis, and multiple linear regression are conducted using IBM SPSS Statistics, while panel data analyses—including unit root tests, cointegration tests, and FMOLS estimations—are performed using the Stata software package.

4 Results and Discussion

4.1 Descriptive Statistics

Table 1. Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Dev.
GDP	50	-7.800	11.811	4.259	4.156
Inflation	50	2.878	72.309	15.781	16.086
Unemployment	50	2.430	14.026	8.353	2.816
Brent	50	24.420	111.970	66.759	27.447
Exchange Rate	50	0.625	92.552	25.669	26.155

Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

Trade	50	39.508	79.898	52.461	7.766
GCF	50	18.694	38.602	25.901	4.768
Deposit Rate	50	3.769	74.699	16.902	16.574

Note: The number of observations for all variables is 50.

An examination of the descriptive statistics presented in Table 1 indicates that the growth performance of the Turkish and Russian economies exhibited substantial fluctuations over the period 2000-2024. Although the average economic growth rate is 4.26%, the minimum value of -7.80% and the maximum value of 11.81% suggest that the period was characterized by significant episodes of economic contraction and expansion.

The inflation variable stands out with a high average (15.78%) and a relatively large standard deviation (16.09), reflecting considerable price instability, particularly in the Turkish economy. Similarly, the exchange rate variable, with a high mean (25.67) and substantial standard deviation (26.16), indicates that exchange rate volatility constitutes a major macroeconomic factor.

The unemployment rate averages 8.35% and exhibits comparatively lower variability. In contrast, Brent oil prices display a high average level (66.76 USD) accompanied by a large standard deviation, pointing to pronounced fluctuations in energy prices throughout the period.

Trade volume (as a percentage of GDP) and gross capital formation (as a percentage of GDP) average 52.46% and 25.90%, respectively, and emerge as structural factors supporting economic growth. On the other hand, the high standard deviation of the deposit interest rate suggests the presence of significant volatility in financial markets.

Overall, the high volatility observed particularly in inflation, exchange rates, and oil prices indicates that the analyzed period is characterized by macroeconomic instability.

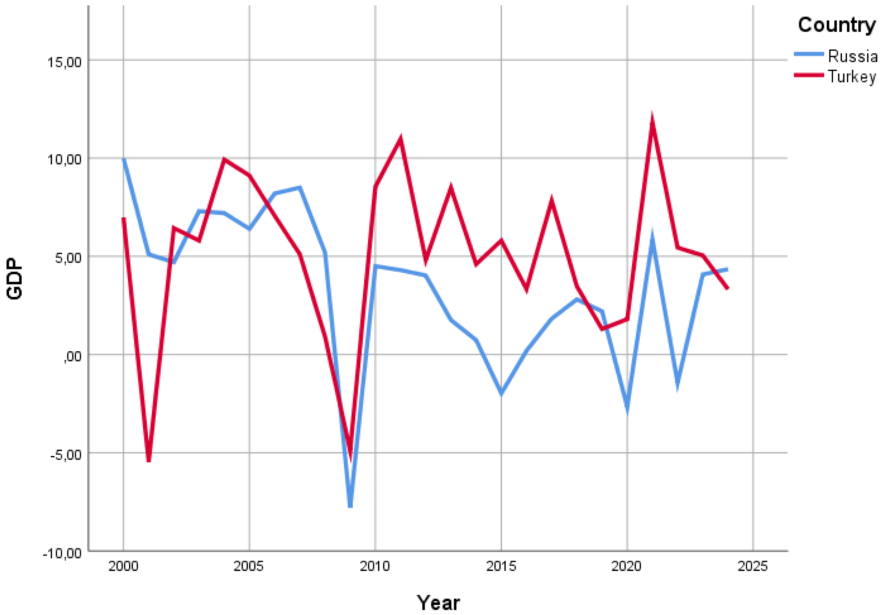

Figure 1. The Evolution of Economic Growth in Türkiye and Russia (2000-2024)

Figure 1 presents a comparative depiction of the evolution of economic growth rates in Türkiye and Russia over the period 2000-2024. An examination of the figure reveals that the growth performance of both countries exhibits a fluctuating pattern throughout the period.

In particular, significant declines in growth rates are observed in both countries during periods of global economic crises. However, Türkiye's growth rates appear to be generally higher but more volatile, whereas Russia demonstrates relatively lower growth rates with comparatively more stable performance in certain periods.

Moreover, the presence of similar trends in the growth rates of both countries at various points in time suggests that global economic conditions and external shocks exert common effects on both economies. Nevertheless, the divergences observed in certain years indicate that structural differences between the two countries play a decisive role in shaping their growth dynamics.

Overall, the findings suggest that economic growth exhibits considerable volatility over the analyzed period, highlighting the importance of examining the influence of macroeconomic variables on growth.

4.2 Correlation Analysis

Table 2. Correlation Matrix

Variable	GDP	Inflation	Unemployment	Brent	Exchange Rate	Trade	GCF	Deposit Rate
GDP	1.000	-0.002	0.199	0.020	-0.308*	0.303*	0.301*	-0.063
Inflation	-0.002	1.000	0.182	-0.177	-0.233	0.411**	0.221	0.786**
Unemployment	0.199	0.182	1.000	-0.188	-0.842**	0.476**	0.473**	0.347*
Brent	0.020	-0.177	-0.188	1.000	0.057	-0.056	0.419**	-0.177
Exchange Rate	-0.308*	-0.233	-0.842**	0.057	1.000	-0.299*	-0.394**	-0.420**
Trade	0.303*	0.411**	0.476**	-0.056	-0.299*	1.000	0.386**	0.074
GCF	0.301*	0.221	0.473**	0.419**	-0.394**	0.386**	1.000	0.270
Deposit Rate	-0.063	0.786**	0.347*	-0.177	-0.420**	0.074	0.270	1.000

Note: p < 0.05, ** p < 0.01.

An examination of the correlation matrix presented in Table 2 indicates that economic growth (GDP) exhibits statistically significant relationships with several macroeconomic variables. In particular, a negative and statistically significant relationship is identified between exchange rate and economic growth ($r = -0.308$, $p < 0.05$), suggesting that increases in exchange rates may exert adverse effects on economic growth. In contrast, trade volume ($r = 0.303$, $p < 0.05$) and gross capital formation ($r = 0.301$, $p < 0.05$) are positively and significantly correlated with economic growth, highlighting the supportive role of trade and investment activities.

On the other hand, no statistically significant relationship is observed between Brent oil prices and economic growth ($r = 0.020$). This finding suggests that the impact of oil prices on economic growth may not be direct but may operate through indirect transmission mechanisms.

An examination of the relationships among independent variables reveals the presence of some high correlation coefficients. Notably, a strong negative correlation is observed between unemployment and exchange rate ($r = -0.842$, $p < 0.01$). Similarly, a high positive correlation is found between inflation and deposit interest rate ($r = 0.786$, $p < 0.01$). These findings point to a potential multicollinearity problem in the model and should therefore be carefully considered in the regression analysis.

Overall, the results of the correlation analysis indicate that economic growth is more strongly associated with exchange rate, trade, and investment variables, whereas the direct effect of oil prices appears to be limited.

Although the correlation analysis indicates that the relationship between Brent oil prices and economic growth is statistically insignificant, the regression results reveal a negative and significant effect of oil prices on growth. This apparent discrepancy can be explained by the fundamental differences between bivariate correlation and multivariate regression analysis. Correlation analysis captures only the simple linear association between two variables without accounting for the influence of other macroeconomic factors. In contrast, the regression model controls for multiple variables such as unemployment, exchange rate, inflation, trade, and investment, thereby isolating the partial effect of oil prices on economic growth.

This suggests that the impact of oil prices on economic growth is not direct but operates through indirect transmission channels. When these channels are controlled for in the regression framework, the underlying negative effect of oil prices becomes statistically observable. Therefore, the findings should not be interpreted as contradictory but rather as complementary evidence supporting the hypothesis that energy prices influence growth through a multivariate macroeconomic structure.

4.3 Econometric Pre-Tests

Table 3. Panel Unit Root Test Results (IPS Test)

Variable	t-bar	p-value	Result
GDP	-4.3175	0.0005***	Stationary
Brent	-2.0520	0.1828	Non-stationary

Inflation	-2.2286	0.1404	Non-stationary
Unemployment	-2.3635	0.1086	Non-stationary
Exchange Rate	6.1688	1.0000	Non-stationary
Trade	-2.1339	0.1546	Non-stationary
GCF	-2.5823	0.0594*	Weakly stationary
Deposit Rate	-0.8688	0.8404	Non-stationary

Note: *** p < 0.01.

The IPS panel unit root test results indicate that GDP is stationary at level, whereas most of the explanatory variables, including Brent oil prices, inflation, exchange rate, trade, and deposit interest rate, are non-stationary. Gross capital formation appears to be weakly stationary at the 10% significance level. These findings reveal a mixed order of integration among the variables. In particular, the presence of non-stationary regressors raises the possibility of spurious regression if long-run relationships are not properly accounted for. Therefore, panel cointegration tests are conducted to examine whether a long-run equilibrium relationship exists among the variables.

Table 4. Panel Cointegration Test Results (Kao and Pedroni Tests)

Kao Test			
Test Type	Statistic	p-value	Result
Modified DF t	-1.0131	0.1555	Not significant
Dickey-Fuller t	-2.8476	0.0022***	Cointegration exists
Augmented DF t	-0.9471	0.1718	Not significant
Unadjusted Modified DF t	-7.8920	0.0000***	Cointegration exists
Unadjusted DF t	-5.7802	0.0000***	Cointegration exists
Pedroni Test			
Test Type	Statistic	p-value	Result
Modified PP t	-1.1457	0.1260	Not significant
Phillips-Perron t	-3.8933	0.0000***	Cointegration exists
Augmented Dickey-Fuller t	-4.1542	0.0000***	Cointegration exists

The results of the Kao and Pedroni panel cointegration tests presented in Table 4 clearly indicate the existence of a long-run relationship among the variables used in the analysis. Within the Kao test framework, the Dickey-Fuller t-statistic is found to be statistically significant ($p < 0.01$), supporting the cointegration hypothesis.

The Pedroni test results further confirm this finding, as both the Phillips-Perron and Augmented Dickey-Fuller statistics are significant at the 1% level, indicating that the variables move together in the long run.

These results demonstrate that a long-term equilibrium relationship exists among the variables included in the model and that the estimated regression model does not suffer from a spurious regression problem. Therefore, the use of the FMOLS method for estimating long-run coefficients is methodologically appropriate and valid.

4.4 Long-Run Analysis

Table 5. FMOLS Long-Run Coefficient Estimation Results

Independent Variable	**Coefficient (β)**	**t-statistic**	**Significance**
Brent	-0.04	-5.92	***
Unemployment	-2.02	-12.48	***
Exchange Rate	-0.17	-13.69	***

Note: *** p < 0.01.

The long-run coefficients estimated using the FMOLS method, as presented in Table 5, indicate a statistically significant relationship between energy prices and economic growth. The findings reveal that Brent oil prices have a negative and significant effect on economic growth ($\beta = -0.04$; $t = -5.92$), suggesting that increases in energy costs exert downward pressure on growth in the long run.

The unemployment rate emerges as the variable with the strongest negative impact on economic growth ($\beta = -2.02$; $t = -12.48$). This result indicates that adverse developments in the labor market substantially weaken overall economic performance.

Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

Similarly, the exchange rate variable is found to have a negative and statistically significant effect on economic growth (β = -0.17; t = -13.69). This suggests that increases in exchange rates may undermine macroeconomic stability and, consequently, negatively affect growth.

Overall, the long-run analysis demonstrates that economic growth is influenced not only by energy prices but also strongly shaped by unemployment and exchange rate dynamics.

4.5 Multiple Linear Regression Results and Interaction Model

Table 6. Multiple Linear Regression Results

Independent Variable	B	Std. Error	Beta	t	p	Tolerance	VIF
Constant	2.088	5.608	—	0.372	0.712	—	—
Brent	-0.054	0.026	-0.359	-2.084	0.043	0.517	1.936
Inflation	-0.084	0.081	-0.324	-1.030	0.309	0.156	6.428
Unemployment	-1.426	0.485	-0.966	-2.940	0.005	0.142	7.023
Exchange Rate	-0.141	0.041	-0.888	-3.450	0.001	0.232	4.310
Trade	0.229	0.121	0.428	1.898	0.065	0.302	3.309
GCF	0.423	0.165	0.485	2.556	0.014	0.427	2.341
Deposit Rate	-0.018	0.077	-0.072	-0.234	0.816	0.165	6.063

Model Summary

R	R^2	Adjusted R^2	Std. Error	F	p	N
0.596	0.355	0.247	3.606	3.301	0.007	50

Note: The dependent variable is GDP.

This result may seem inconsistent with the correlation findings; however, as explained in Section 4.2, this difference reflects the distinction between bivariate and multivariate analysis. An examination of the multiple linear regression results presented in Table 6 indicates that the model is statistically significant overall ($F = 3.301$; $p < 0.01$). The R^2 value of 0.355 suggests that approximately 35% of the variation in economic growth is explained by the independent variables. The adjusted R^2 value of 0.247 indicates a moderate level of explanatory power.

In terms of individual variables, Brent oil prices are found to have a negative and statistically significant effect on economic growth (β = -0.054; $p < 0.05$). This finding suggests that increases in oil prices may adversely affect economic growth, particularly in energy-importing economies.

The unemployment rate also exerts a strong and negative impact on economic growth (β = -1.426; $p < 0.01$), indicating that increases in unemployment significantly weaken economic performance. Similarly, the exchange rate variable has a negative and highly significant effect on growth (β = -0.141; $p < 0.01$), implying that exchange rate increases may undermine macroeconomic stability and hinder growth.

In contrast, gross capital formation (GCF) has a positive and statistically significant effect on economic growth (β = 0.423; $p < 0.05$), suggesting that higher levels of investment support economic expansion. The trade variable also exhibits a positive coefficient but is only marginally significant ($p = 0.065$).

On the other hand, inflation and deposit interest rate variables are not statistically significant, indicating that their effects on economic growth may operate through indirect or more complex mechanisms.

With respect to multicollinearity, although some variables (particularly unemployment, inflation, and deposit rate) exhibit relatively high VIF values, the overall level of multicollinearity does not appear severe enough to invalidate the model's interpretability.

Although some variables exhibit relatively high VIF values, the overall pattern of results remains stable, and no substantial coefficient instability is observed. This suggests that multicollinearity does not critically distort the estimated relationships.

Overall, the regression results indicate that economic growth is more strongly explained by exchange rate, unemployment, and investment variables, while oil prices exert a relatively limited but statistically significant effect.

In addition to the baseline regression, an interaction model was estimated to explore whether the impact of oil prices on economic growth differs between Türkiye and Russia. The results of this supplementary analysis indicate no statistically significant difference across countries. However, due to multicollinearity issues and relatively low explanatory power, the interaction model is not considered a core specification of the study. Therefore, its results are interpreted with caution and are not used as the primary basis for the conclusions. The detailed estimation results are reported in Appendix A.

Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

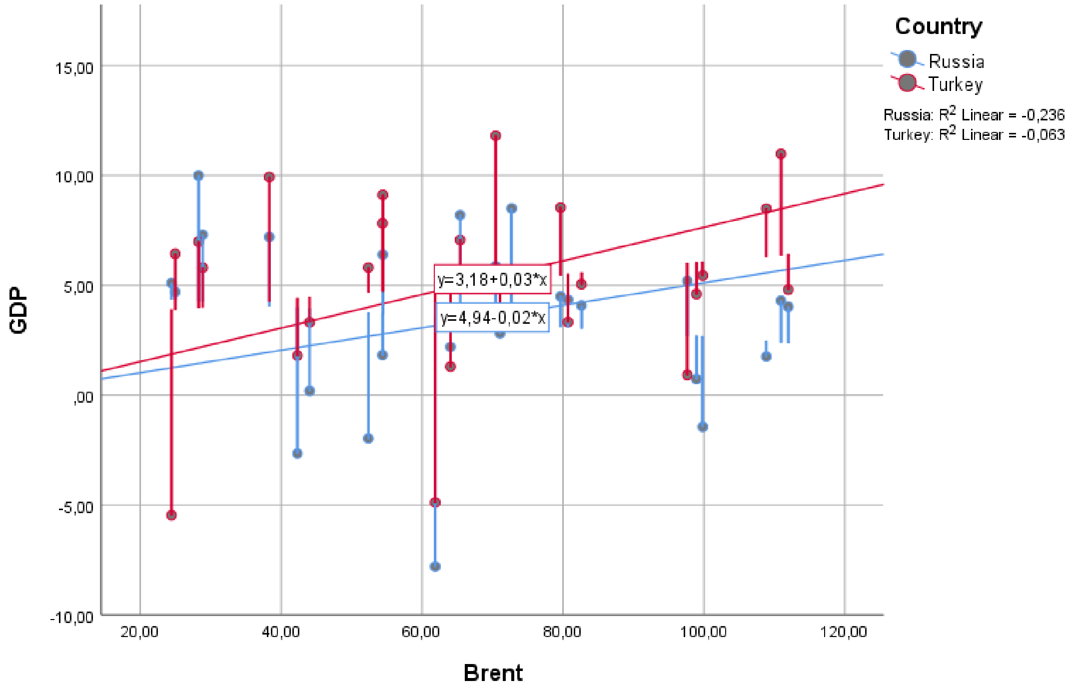

Figure 2. The Relationship Between Brent Oil Prices and Economic Growth: Türkiye and Russia

Figure 2 presents a comparative analysis of the relationship between Brent oil prices and economic growth for Türkiye and Russia. An examination of the figure indicates that the relationship between oil prices and growth exhibits a weak pattern for both countries. The regression line for Türkiye shows a slight positive slope, whereas the relationship for Russia appears more limited and closer to a horizontal trend.

However, the wide dispersion of data points suggests that the relationship between oil prices and economic growth is neither strong nor consistent. This observation supports the findings obtained from the correlation analysis, which indicate a weak association between the two variables.

Although some differences in slope between the two countries can be observed, the lack of statistical significance of the interaction term in the regression analysis suggests that these differences cannot be robustly generalized. In this context, the impact of oil prices on economic growth appears to be indirect rather than deterministic, and largely shaped by country-specific macroeconomic conditions.

5 Conclusion

This study provides a comparative analysis of how Brent oil prices affect economic growth in Türkiye and Russia over the period 2000-2024. The findings reveal that the effect of energy prices on economic growth is not a simple, linear, unidirectional relationship but a multidimensional, indirect mechanism shaped by various macroeconomic variables.

The empirical results indicate that Brent oil prices have a negative and statistically significant effect on economic growth. This finding confirms that, particularly in energy-importing economies, increases in oil prices may exert downward pressure on growth through channels such as rising production costs, inflation, and external imbalances. However, the results also demonstrate that unemployment and exchange rate variables have stronger and more decisive effects on economic growth. This suggests that growth dynamics are not solely determined by energy prices but are also closely linked to labor market conditions and financial stability factors. Furthermore, the positive effect of gross capital formation highlights the critical importance of investment-oriented policies for economic performance.

The results of the interaction model, constructed to test cross-country differences, indicate that the impact of oil prices on economic growth does not differ significantly between Türkiye and Russia. This finding suggests that the theoretically expected divergence between energy-importing and energy-exporting economies cannot be strongly confirmed within the scope of the analyzed period and model specification. Nevertheless, the presence of multicollinearity and the relatively low explanatory power of the interaction model require that these results be interpreted with caution.

Overall, the findings suggest that the impact of energy prices on economic growth is closely tied to country-specific structural characteristics, macroeconomic stability, and the nature of economic policies implemented. In this context, policy implications should be interpreted in light of the indirect transmission mechanisms identified in the empirical analysis. Since the effects of energy prices operate primarily through macroeconomic channels such as exchange rate dynamics, labor market conditions, and investment levels, policymakers should prioritize strengthening macroeconomic stability and resilience. In particular, policies aimed at stabilizing exchange rates, reducing unemployment, and supporting productive investment are essential for mitigating the adverse effects of energy price shocks. Within this framework, investments in renewable energy and improvements in energy efficiency should be understood as structural policy tools that reduce external dependency and enhance macroeconomic stability, rather than as isolated energy policies.

This study contributes to the literature by offering a comparative empirical analysis of the relationship between energy prices and economic growth across an energy-importing and an energy-exporting economy. However, the analysis is subject to certain limitations in data scope and methodological choices. A specific limitation of this study is the use of Brent crude oil prices as a proxy for overall energy prices. Although oil prices are widely used as a global benchmark and reflect general energy market dynamics, they do not fully capture the diversity of energy structures across countries, particularly in cases where natural gas plays a dominant role, such as in Russia. Therefore, the findings should be interpreted as reflecting global energy price movements rather than a comprehensive representation of all energy components.

Another limitation of this study is the relatively small sample size, particularly in the cross-sectional dimension of the panel. Because the analysis is based on only two countries, the findings should be interpreted as context-specific rather than broadly generalizable. In addition, although multiple econometric techniques are employed to enhance robustness, the results should be understood within the constraints of a small-sample comparative framework.

Future research may benefit from using longer time series, broader country samples, and alternative econometric approaches, such as panel data models, cointegration techniques, or nonlinear methods, to provide a more comprehensive understanding of the energy price–growth nexus. In addition, incorporating composite energy price indices or disaggregated energy components (e.g., oil and natural gas separately) may yield deeper insights, particularly in comparative analyses of energy-exporting economies.

6 Acknowledgment

Language editing and proofreading of this manuscript were assisted by Grammarly. The tool was used solely for grammar and language improvements, and the scientific content of the study is entirely the responsibility of the authors.

References

[1] I. Berk and H. Yetkiner, “Energy prices and economic growth in the long run: Theory and evidence,” *Renewable and Sustainable Energy Reviews*, vol. 36, pp. 228–235, Aug. 2014, doi: 10.1016/j.rser.2014.04.051.

[2] J. Hamilton, “Causes and Consequences of the Oil Shock of 2007-08,” Cambridge, MA, May 2009. doi: 10.3386/w15002.

[3] T. Mitrova, “Energy and the Economy in Russia,” in *The Palgrave Handbook of International Energy Economics*, Cham: Springer International Publishing, 2022, pp. 649–666. doi: 10.1007/978-3-030-86884-0_32.

[4] J. Frankel, “The Natural Resource Curse: A Survey,” Cambridge, MA, Mar. 2010. doi: 10.3386/w15836.

[5] N. Akşehirli, “ENERJİ İTHALATÇISI BİR ÜLKE İÇİN ENERJİ FİYATLARININ TOPLAM VE SEKTÖREL BÜYÜMEYE ASİMETRİK ETKİLERİ: TÜRKİYE ÖRNEĞİ,” *Nişantaşı Üniversitesi Sosyal Bilimler Dergisi*, vol. 12, no. Özel Sayı, pp. 13–30, Dec. 2024, doi: 10.52122/nisantasisbd.1448152.

[6] H. N. BAYRAÇ and F. ÇEMREK, “Türkiye’de Petrol ve Doğalgaz Fiyatlarının Makro Ekonomik Göstergeler Üzerindeki Etkileri,” *BİLTÜRK Journal of Economics and Related Studies*, Oct. 2023, doi: 10.47103/bilturk.1320482.

[7] Şakar, İldeniz, and Gonca Akgün Güngör. "ENERJİDE DIŞA BAĞIMLILIĞIN EKONOMİK BÜYÜME ÜZERİNE ETKİSİ: TÜRKİYE ÜZERİNE BİR İNCELEME." *Ekonomi ve Yönetim Araştırmaları Dergisi* 14.1 (2025): 2-40.

[8] Zeynalov, Ayaz, and Kristina Tiron. "Macroeconomic performance of oil price shocks in Russia." *arXiv preprint arXiv:2211.04954* (2022).

[9] Andreyev, Mikhail, and Alyona Nelyubina. *Energy transition scenarios in Russia: Effects in macroeconomic general equilibrium model with rational expectations*. No. wps122. Bank of Russia, 2024.

[10] V. A. Malakhov and K. v. Nesytykh, “Russia’s Long-Term Macroeconomic Losses and Benefits from the Low-Carbon Development of the World and Domestic Energy Industry,” *Stud Russ Econ Dev*, vol. 33, no. 4, pp. 392–401, Aug. 2022, doi: 10.1134/S1075700722040050.

Salus Publica: Journal of Community Service
Vol 4, Issue 2, August 2026, Pages 377-389
ISSN: 2987-9299 (Media Online)
DOI: https://doi.org/10.58905/saluspublica.v4i2.624

Appendix A: Interaction Model Summary for Cross-Country Comparison

Independent Variable	B	Std. Error	Beta	t	p	VIF
Constant	19.027	7.969	—	2.388	0.021	—
Brent	-0.116	0.075	-0.764	-1.550	0.128	12.727
Country Dummy	-4.808	3.390	-0.584	-1.418	0.163	8.890
Brent × Country	0.075	0.046	0.995	1.651	0.106	19.027
Unemployment	-0.580	0.468	-0.393	-1.238	0.222	5.267
Exchange Rate	-0.098	0.046	-0.620	-2.151	0.037	4.349

Model Summary

R	R²	Adjusted R²	Std. Error	F	p	N
0.400	0.160	0.065	4.020	1.677	0.160	50

Note: The interaction model is constructed to test cross-country differences