BMIJ
ISSN: 2148-2586

bmij (2025) 13 (3):932-940
doi: https://doi.org/10.15295/bmij.v13i3.2584

Research Article

The relationship between oil prices and economic growth in European countries: Panel SUR model

Avrupa ülkelerinde petrol fiyatları ile iktisadi büyüme arasındaki ilişki: Panel SUR modeli

Fatih Volkan Ayyıldız[1]

[1] Assist. Prof. Dr., Ordu University, Ordu, Türkiye, f.volkanayyildiz@odu.edu.tr

ORCID: 0000-0001-5991-3574

Abstract

Oil prices are an essential input for economic activities. In the literature, the relationship between oil prices and economic growth has been primarily examined in the context of oil-producing and oil-importing countries. Among the European countries, there are significant oil-producing countries, including Norway, Italy, Denmark, and Romania. In this respect, this research examined the possible relationships between economic growth and oil prices in European countries from 1990 to 2023 using the Panel Unrelated Regression (SUR) model. The findings of the SUR model, where economic growth is the dependent variable, indicate that a 1% increase in oil prices results in a 0.86% increase in growth, which is statistically significant. The findings of the SUR model, where the change in oil prices is the dependent variable, indicate that a 1% increase in growth increases oil prices by approximately 0.12% under statistical significance. Dumitrescu & Hurlin Granger causality findings provide empirical evidence of bidirectional causality relationships reflecting the feedback effect between economic growth and oil prices. Therefore, the analysis results suggest that the increase in oil prices is a latent force supporting economic growth in European countries.

Keywords: Oil Prices, Economic Growth, Panel SUR Model

Jel Codes: E30, F43, C33

Öz

Petrol fiyatları iktisadi faaliyetler için önemli bir girdidir. Literatürde çoğunlukla petrol fiyatları büyüme ilişkisi petrol üreticisi ve petrol ithal edicisi ülkeler bazında incelenmiştir. Avrupa ülkeleri içinde Norveç, İtalya, Danimarka ve Romanya olmak üzere önemli petrol üreticisi ülkeler vardır. Bu itibarla, bu araştırmada 1990-2023 zaman aralığında Avrupa ülkelerinde iktisadi büyüme ve petrol fiyatları arasındaki olası ilişkiler Panel Görünürde İlişkisiz Regresyon (SUR) modeli kullanılarak gerçekleştirilmiştir. İktisadi büyümenin bağımlı değişken olduğu SUR modeli bulguları, istatistiksel anlamlılık altında petrol fiyatlarındaki %1'lik bir artışın büyümeyi %0.86 artırdığını açıklamaktadır. Petrol fiyatlarındaki değişimin bağımlı değişken olduğu SUR modeli bulguları ise istatistiksel anlamlılık altında büyümedeki %1'lik bir artışın, petrol fiyatlarını yaklaşık olarak %0.12 artırdığına işaret etmektedir. Dumitrescu & Hurlin Granger nedensellik bulguları, iktisadi büyüme ile petrol fiyatları arasında geri besleme etkisini yansıtan çift yönlü nedensellik ilişkilerinin ampirik kanıtlarını sunmaktadır. Dolayısıyla analiz sonuçları Avrupa ülkeleri için petrol fiyatlarındaki artışın iktisadi büyümeyi destekleyici gizli bir güç olduğunu desteklemektedir.

Anahtar Kelimeler: Petrol Fiyatları, İktisadi Büyüme, Panel SUR Modeli

JEL Kodları: E30, F43, C33

Submitted: 16/05/2025

Revised: 24/06/2025

Accepted: 30/06/2025

Online Published: 25/09/2025

Citation: Ayyıldız, F.V., The relationship between oil prices and economic growth in European countries: Panel SUR model, bmij (2025) 13 (3):932-940, doi: https://doi.org/10.15295/bmij.v13i3.2584

Introduction

The provision of energy is one of the primary factors that contribute to the expansion and development of nations. Additionally, according to Flavin and Lenssen (1994), energy is one of the fundamental driving forces that contribute to the expansion of the economic system. The significance of energy in the process of expansion has grown even more apparent with the advent of mass manufacturing during the Industrial Revolution, as stated by Ayyıldız (2023). Following World War I, a significant shift occurred in the energy sector, as oil began to replace coal as the primary source of energy. This shift had profound implications for the global economy and geopolitics. Alterations in the patterns of energy usage are still being implemented. Although there has been an increase in international collaboration for the transition to clean energy usage, driven by the Kyoto Protocol and the Paris Climate Agreement, non-renewable energy sources continue to account for the majority of energy consumption. Oil, which is derived from fossil fuels, is the most prominent kind of energy among these categories.

The price of oil is primarily determined by various factors, the most important of which are political and geographical factors, as well as microeconomic dynamics that affect the supply and demand of oil. When determining the pricing of oil throughout the world, it is necessary to take into consideration three distinct types of oil. To begin, there is the Texas Intermediate (WTI) oil, which originates from Central America. This is the first of them. Oil from Oman, which is extracted from the Middle East, is the second, while Brent oil, which is extracted from the North Sea, is the third. Both of these oils are extracted from the same region. In the context of more than half of the oil transactions that are executed throughout the world, Brent oil is utilised as a key component. To put it another way, Brent oil is the sort of oil that is used the most commonly all over the world, and as a consequence, the prices of Brent oil are utilised via this research (Jackson et al.,2019; Özturk & Kılıç,2018; Kamacı & Göktaş,2020).

Oil prices were significant worldwide throughout the 20th century. The events that transpired in the mid-century confirmed this unequivocally. During the period after World War II, the dramatic rise in the price of oil and other energy items was among the most severe supply shocks experienced by economies worldwide. Four significant oil shocks occurred between 1960 and 1999. The first of these occurred in 1973–1974, when the Organisation of the Petroleum Exporting Countries (OPEC) initially imposed an oil embargo and subsequently significantly increased the price of crude oil. As a result, the price of a barrel of oil went from $3.4 to $13.4. Following the Iranian Revolution, which disrupted oil supply, the price increased from $20 to $30 during the 1978–1979 period. In 1990, when Iraq invaded Kuwait, prices jumped from $16 to $26. This was the third one that occurred after the conflict. As a result of the most recent oil shock, prices have increased from $12 to $24 in 1999. This is the last point in the timeline (Tasnım,2019) According to BP Stat (2024) data, oil prices in U.S. dollars per barrel were $50.42 in 2000, $42.06 in 2001, $42.39 in 2002, $47.75 in 2003, $61.73 in 2004, $85.07 in 2005, $98.46 in 2006, $106.38 in 2007, $137.64 in 2008, $87.59 in 2009, $111.08 in 2010, $150.71 in 2011, $148.20 in 2012, $142.12 in 2013, and $127.35 in 2014. The prices were approximately $67.35 in 2015, $55.52 in 2016, $67.37 in 2017, $ 86.30 in 2018, $76.53 in 2019, $49.26 in 2020, $79.74 in 2021, $105.49 in 2022, and $82.64 in 2023. According to the U.S. Energy Information Administration (EIA, 2025) data, Brent crude oil prices averaged $81 per barrel in 2024.

Among the scholars who have contributed to the body of literature, there are a variety of perspectives about the connection between the price of oil and economic development. Based on this circumstance, the thesis that jumps out is that the primary factor that determines whether a nation or group of countries either imports or exports oil is the primary determinant. In addition to causing financial crises, unemployment, a decrease in oil imports and investments, and high inflation in a variety of sectors, those who argue that oil prices reduce growth have an impact on a wide range of macroeconomic dimensions, including terms of trade, real national income, and balance of payments in energy-importing nations. There is a correlation between high oil prices and a fall in the national GDP of countries that import oil. Even though oil consumption is unaffected primarily by increases in oil prices, the national income continues to decline. As a result of the fact that oil is a fundamental economic input, oil-producing nations tend to form cartels, they can price discriminate, and prices tend to move upwards. Those who argue that oil prices increase growth in the economy say that the profit obtained from exports will be reflected positively on the national income. In this context, nations that are members of OPEC, as well as countries like China and the United States of America, are chosen to serve as sample groups in research.

According to the data provided by BP Stat (2024), Norway produced 1906 thousand barrels of oil per day in 2022 and 2022 thousand barrels of oil per day in 2023; Italy produced 94 thousand barrels of oil per day in 2022 and 90 thousand barrels of oil per day in 2023; Denmark produced 66 thousand barrels per day in 2022 and 1,000 barrels in 2023; Romania produced 66 thousand barrels per day according to

the data provided by 2022; and Romania produced 63 thousand barrels of oil per day in 2023. According to estimates, Norway will account for around 2.1% of the world's oil output in 2023, while Italy, Denmark, and Romania will each account for approximately 0.1%. The European countries, which comprise the nations of the continent, were responsible for approximately 2.6% of the world's oil output in 2023. As a result, the sample group included all 27 countries that make up the European Union. These countries were often overlooked in studies due to the emphasis placed on specific countries or groupings of countries, despite containing particularly significant oil-producing nations.

Literature

Oil is an essential input in the production process. This situation has ensured that fluctuations in oil prices are determinants of macroeconomic variables. The first studies on the effect of oil prices, especially on growth, were published in the literature towards the end of the 20th century. The pioneer studies on this subject belong to Burno and Sachs (1982) and Hamilton (1983).

Burno and Sachs (1982) conducted analyses using input price models in the United Kingdom from 1960 to 1978. As a result of their studies, they concluded that the increase in oil prices caused economic contraction. Hamilton (1983) conducted groundbreaking research examining the relationship between shifts in oil prices and economic expansion. Hamilton concluded that fluctuations in oil prices had a causal influence on the level of total production and caused external pressures on the macroeconomic structure as a whole. This conclusion was reached after analysing the recessionary process that occurred in the United States (U.S.) between World War II and the oil shock of 1973.

Mork (1989) investigated the effect of oil prices on economic growth in the U.S. sample by expanding the Sims method applied by Hamilton. As a result of his study, he found an inverse relationship between oil prices and growth, similar to Hamilton's result. Mory (1993) investigated the effect of oil price fluctuations on U.S. economic growth in 1950-1990 with asymmetric causality analysis. As a result of his study, he concluded that oil prices affected macroeconomic variables and that upward fluctuations in oil prices hurt growth. Finn (1995) employed an analysis method that examined Solow residuals based on correlations in the U.S. economy from 1960 to 1989, concluding that upward fluctuations in energy prices, particularly in oil prices, hindered economic growth. Brown and Yucel (1999) investigated the effects of oil price fluctuations on macroeconomic variables in the U.S. economy in 1965:01-1997:12 with the VAR analysis method. As a result of his studies, he found that the increase in oil prices harmed economic growth, which in turn led to both an increase in the federal funds rate and a rise in the price level.

Abeysinghe (2001) investigated the direct and indirect effects of oil prices on the economy in 12 countries in 1982Q1-2000Q2 with the VARX model. As a result of his study, he found a relationship between oil shocks and investor confidence and that the effect of fluctuations in oil prices on growth, especially in the USA, was insignificant. Papapetrou (2001) tested the relationship between oil prices, interest rates, and employment in Greece in 1989:01-1996:06 with VAR analysis. He concluded that the upward increase in interest rates and oil prices harmed growth. Lorde et al. (2009) investigated the effects of oil price fluctuations on macroeconomic variables such as government revenue, government expenditure, export, and import in the Caribbean island country of Trinidad and Tobago from 1996 to 2005 using VAR analysis. As a result of their study, they concluded that oil prices are an essential determinant of macroeconomic variables.

Du et al. (2010) investigated the effects of oil prices on growth and inflation in China in 1995:01-2008:12 using VAR analysis. As a result of their study, it was found that China is not a significant global power in determining oil prices and that oil prices are a crucial parameter affecting growth and inflation. Bouzid (2012) analysed the effects of oil prices on growth in Tunisia in 1960-2009 using the VECM model and Johansen cointegration tests. As a result of their study, they found that the increase in oil prices in the long term caused economic contraction in Tunisia.

Van Eyden et al. (2019) investigated the effect of oil prices on economic growth in 17 OECD countries during 1870-2013 using panel GMM analysis. As a result of their study, they found that the increase in oil prices hurt economic growth. Using FMOLS analysis, Prasad et al. (2007) investigated the effect of oil prices on growth in the Fiji Islands during the period 1970-2005. As a result of their study, they concluded that the increase in oil prices would increase the output level and therefore have a positive impact on growth. Berument et al. (2010) investigated the effect of oil shocks on growth in MENA countries using VECM analysis. However, the trend varied by country, generally starting in the 1970s and ending in the early 2000s. As a result of their study, they found that oil prices had a positive and statistically significant effect on growth.

Özsağır et al (2011) investigated the VAR analysis in the case of Türkiye in the period 1987-2007. As a result of their study, they concluded that fluctuations in oil prices contributed to growth. Aktuğ et al. (2019) investigated the effect of oil prices and oil production on Iraq's growth in 1995-2017 using tables consisting of data and correlation analysis of coefficients between variables. As a result of their study, they found that increases in oil prices and oil production increased growth. Ayadi (2005) investigated the effects of oil price fluctuations on growth and industrial output in the period 1980-2004 by using VAR analysis. As a result of their study, they found that oil price fluctuations affected industrial production, and the effect of the increase in oil prices on growth was statistically insignificant. Tranget al (2017) analysed the impact of oil price fluctuations on growth and unemployment in Vietnam in the period 2000-2015 with the VECM model. As a result of their study, they found that the effects of upward fluctuations in oil prices on unemployment and growth were statistically insignificant.

Özbek and Naimoğlu (2021) analysed the effects of oil prices on growth in the period 1988:07-2019:08 in Türkiye using KPSS and Fourier KPSS tests. As a result of their study, they found that the relationship between oil prices and growth in Türkiye was positive. Yıldırım and Konat (2023) analysed the relationship between oil prices and economic growth in Türkiye, utilising the RALS cointegration method for the period from 1987 to 2019. Their findings revealed that there is no long-term relationship between oil prices and economic growth in Türkiye. Osmanov et al. (2023) used FMOLS and DMOLS analyses to investigate the impact of oil prices on growth in Azerbaijan in the 2007Q1-2021Q4 period. They found that oil prices had a positive effect on growth and that there was a unidirectional causality between oil prices and growth.

According to the findings of the studies that academics have carried out on the topic of the connection between the price of oil and economic growth, it has been observed that the discussion over this topic is still ongoing. Several researchers, including Mork (1989), Mory (1993), Finn (1995), Brown and Yucel (1999), Abeysinghe (2001), Papapetrou (2001), Lorde et al. (2009), Du et al. (2010), Bouzid (2012), and Van Eyden et al. (2019), have discovered that there is a negative correlation between oil output and economic growth. Based on the findings of Prasad et al. (2007), Berument et al. (2010), Özsağır et al. (2011), and Aktuğ et al. (2019), it has been established that there exists a positive correlation between oil prices and growth. However, Ayadi (2005) and Trang et al. (2017) have discovered that oil prices do not have any impact on economic growth.

Econometric analysis

This study investigates the potential relationships between economic growth and oil prices in European countries from 1990 to 2023. The analysis employed the Seemingly Unrelated Regression (SUR) model, which is proposed for addressing heterogeneity and cross-sectional dependence in panel time series. The findings of the SUR model, where economic growth is the dependent variable, explain that a 1% increase in oil prices increases economic growth(G) by 0.86% with statistical significance. The findings of the SUR model, where the change in oil prices is the dependent variable, indicate that a 1% increase in G increases oil prices by approximately 0.12% under statistical significance. Evaluating both model findings shows that the economic growth model is stronger. The root mean square error values of the models indicate that the accuracy performances of the models are pretty high. Dumitrescu & Hurlin's Granger causality findings for heterogeneous panels provide empirical evidence of bidirectional causality relationships between economic growth and oil prices, reflecting the feedback effect. The possible relationships between economic growth and oil prices are examined using data from European countries from 1990 to 2023, with the SUR model. The mathematical expressions of the model setups within the scope of the purpose are as follows:

$$lnG_{i,t} = \beta_0 + \beta_1 lnPF_{i,t} + \xi_{i,t}$$

$$lnPF_{i,t} = \beta_0 + \beta_1 lnG_{i,t} + \xi_{i,t}$$

In models (1) and (2), G indicates economic growth (per capita), and PF indicates the change in oil prices (USD per barrel). The G data set is compiled from the World Bank's World Development Indicators website (2025), and the PF data set is compiled from British Petroleum's website (2024). The variables are included in the logarithmic model to prevent excessive transaction differences in the analysis. In this context, the model is fully logarithmic. However, β0 is the constant parameter coefficient; β1 is the parameter coefficient related to energy prices; and ξ is the error term. The subscript indicates the cross-sectional units of the European countries (Germany, Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, France, Croatia, Netherlands, Ireland, Spain, Sweden, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Poland, Portugal, Romania, Slovakia, Slovenia and Greece).

Before starting the analysis, the descriptive characteristics of the variables were examined, and the findings are summarised in Table 1. In this context, it is seen that the average value of G is approximately 4.39, and the average value of oil prices is approximately 1.62. The small standard deviation values in the datasets indicate that they are close to the cluster average and indicate the expected situation. It means no excessive difference between the variables in the minimum and maximum values. However, it is reported that the number of observations (N*T) is a balanced panel time series of 918 values. These findings provide a baseline understanding of the data, which is essential for interpreting the analysis results.

Table 1: Descriptive Statistics

Variable	Average	Standard Deviation	Minimum	Maximum	Observations
lnG total	4.391431	0.7827798	0.5679143	6.893098	N = 918
between		0.653127	3.462558	6.255904	n = 27
inside		0.4489103	1.203337	5.560666	T= 34
lnPF all	1.624269	0.2947934	1.104339	2.047935	N = 918
between		0	1.624269	1.624269	n = 27
inside		0.2947934	1.104339	2.047935	T = 34

Table 2 contains the findings of the Spearman correlation analysis, which was conducted to predict the degree and direction of possible relationships between variables. Upon evaluating the findings, it is evident that there is a positive correlation between economic growth and oil prices at the 1% significance level. However, the degree of the relationship is not substantial.

Table 2: Correlation Matrix

Correlation	lnG	lnPF
lnG	1.0000	-
lnPF	0.3236 10.3504* 0.0000**	1.0000

Note: * notation is 1% significance level.

In the first stage of the analysis, the necessary tests were conducted to determine the parameter homogeneity and cross-sectional dependency to decide on the model selection. In this context, first of all, Swamy's (1971) S test was used to check the homogeneity or heterogeneity of the parameters. When the findings in Table 3 were examined, the H0 basic hypothesis was rejected in the established model, and it was accepted that the parameters were not homogeneous and varied from unit to unit. A similar finding was confirmed for the G variable, but not for the PF variable.

Table 3: Parameter Homogeneity Findings

Variable	Chi2	Prob > chi2
lnG	chi2(26) = 5375.81	0.0000*
lnPF	chi2(26) = 0.00	1.0000
Full panel for Model 1	chi2(52) = 16179.73	0.0000*
Full panel for Model 2	chi2(52) = 1312.09	0.0000*

Table 4: Cross-Sectional Dependency Findings

Test	Statistics	P-value
LM	9462	0.0000*
LM adj*	1106	0.0000*
LM CD*	96.68	0.0000*

Note: p is the probability value ; * notation is 1% significance level.

After determining that the established model was heterogeneous, a cross-sectional dependency test was performed, and the findings are given in Table 4. The findings of the Lagrange Multiplier (LM)

developed by Breusch and Pagan (1980) suggested that, for the case of T>N, explained the existence of cross-sectional dependency. Therefore, the basic hypothesis H0 was rejected at a 95% confidence level, and it was understood that there was a correlation between the units. SUR analysis is applied in line with the model preference in the second analysis stage. Findings regarding parameter homogeneity and cross-sectional dependence indicate that the panel SUR estimator is reliable for model preference.

Findings regarding the panel SUR model are summarised in Table 5. In this context, the model findings, where economic growth is the dependent variable, show that a 1% increase in oil prices increases economic growth by 0.86% under statistical significance ($p < 0.01$). The explanatory power of the model is approximately 0.69. In the model where the change in oil prices is the dependent variable, a 1% increase in economic growth increases oil prices by approximately 0.12% under statistical significance ($p<0.01$). The coefficient of determination (R2) is approximately 0.67. Evaluating both model findings together indicates that the first model is stronger. In this regard, the change in oil prices has a greater impact on economic growth. However, it is observed that the RMSE values explaining the root mean square error are pretty low in both models. Therefore, the low RMSE values indicate that the observed and simulated variables are close. Thus, the accuracy performance of the models is relatively high.

Table 5: SUR Model Findings

Models	**Coefficient**	**Standard error**	**Z-statistic**	**P>z**	**[95% Confidence interval]**
Model 1: Dependent variable = lnG					
lnPF	0.859239	0.0829245	10.36	0.000*	[0.69671 1.021768]
Constant coefficient	2.995796	0.1368896	21.88	0.000*	[2.727497 3.264095]
R2	0.688589				
RMSE	0.7402613				
Model 2: Dependent variable = lnPF					
lnG	0.1218625	0.0117609	10.36	0.000*	[0.0988117 0.1449134]
Constant coefficient	1.089118	0.0524602	20.76	0.000*	[0.986298 1.191938]
R2	0.673244				
RMSE	0.278781				

Note: * notation is 1% significance level.

To obtain information about the possible causal relationships between the variables and the direction of these relationships, the Dumitrescu & Hurlin (2012) Granger causality test was performed in the last stage of the analysis. The test is applied to both balanced and unbalanced panel time series. However, it is recommended for heterogeneous panels (Şahin, 2022). When the findings summarised in Table 6 are examined, it is seen that there is a feedback-effective, bidirectional causality relationship between economic growth and changes in oil prices.

Table 6: Causality Test Results

Ho hypothesis	**W-statistic**	**Z-statistic**	**P-value**
lnG ≠ lnPF	17.7879	10.7630	0.0000*
H0: lnPF is not the cause of lnG.			
lnPF ≠ lnG	32.1518	28.3550	0.0000*
H0: lnG is not the cause of lnPF.			

Note: Lag length is chosen according to the Akaike information criterion. * Notation is 1% significance level.

Figure 1 visualises the findings of the Dumitrescu & Hurlin (2012) Granger causality test between variables.

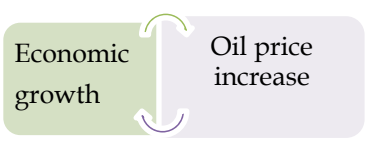

Figure 1: Causality Test between Variables

Conclusion and recommendations

Empirical evidence on the relationship between oil prices and growth is primarily supportive of the view that increases in oil prices will lead to economic contraction for oil-importing countries. In contrast, increases in oil prices will lead to a rise in growth for oil-producing countries due to the positive effects of price increases. The literature supports this view. About this particular setting, the majority of the nations that are included in the analysis are either members of OPEC, other oil-producing countries, or oil-importing countries. For this study, a sample group of European countries was chosen. These countries include oil-producing nations such as Norway, Italy, Denmark, and Romania. That being said, this particular facet is typically disregarded in the field of academic literary studies. Additionally, the Panel SUR analysis technique, which is a method that researchers choose comparatively less, was utilised. The purpose of this approach was to contribute to filling this gap in the literature, both in terms of the sample and the method for doing the analysis.

The purpose of this study is to develop two models employing the Panel SUR analysis approach in European nations between 1990 and 2023. According to the model's findings, which examined the relationship between growth and oil prices, it was discovered that a one per cent increase in oil prices led to a 1.8 per cent increase in growth for European nations throughout the relevant time period. The second model, in which the price of oil is the dependent variable, reveals that there has been a 0.12% increase in oil prices. The results of Model 1 are statistically more robust than those of Model 2, even though both models provide statistically significant results. The conclusion that was reached as a consequence of the causality study was that there is a link that goes in both directions between the price of oil and economic growth. In general, the findings are in agreement with the research conducted by Prasad et al. (2007), Berument et al. (2010), Özsağır et al. (2011), and Aktuğ et al. (2019) in the existing body of literature.

It is essential to emphasise that the oil demand will only decrease in intensity, and the fact that oil plays a crucial role in economic activities and can drive growth for oil-producing countries is undeniable. This is despite international agreements, such as the Paris Climate Agreement and the Kyoto Protocol, which aim to increase cooperation in reducing the demand for energy based on fossil fuels.

Peer-review:

Externally peer-reviewed

Conflict of interests:

The author has no conflict of interest to declare.

Grant Support:

The author declared that this study has received no financial support.

References

Abeysinghe, T. (2001). Estimation of the direct and indirect impact of oil price on growth. *Economics Letters,* 73(2), 147-153.

Ayyıldız, F. V. (2023). Panel kantil regresyon yaklaşımıyla G-7 ülkelerinde birincil enerji tüketiminin iktisadi büyümeye etkisi. *Erciyes Akademi*, 37(1), 225-241.

Aktuğ, S. S., Dağ, M. ve Star, H. R. (2019). The impact of oil price on economic growth: an investigation on Iraqı economy. *Research Studies Anatolia Journal*, 2(6): 273-285.

Ayadi, O. F. (2005). Oil price fluctuations and the Nigerian economy. *OPEC Review*, 29(3), 199-217.

Berument, M. H., Ceylan, N. B., & Dogan, N. (2010). The impact of oil price shocks on the economic growth of selected MENA1 countries. *The Energy Journal*, 31(1), 149-176.

Bouzid, A. (2012). The relationship of oil prices and economic growthin Tunisia: A vector error correction model analysis. *The Romanian Economic Journal*, XV (43), 3-22.

BP-British Petroluem (2024) Statiscal review of energy [Online] https://www.bp.com/en /global/corporate/energy-economics.html Accessed 10/03/2025

Breusch, T. S., & Pagan, A. R. (1980). The lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, 47 (1), 239-253.

Brown, S. P. A., & Yucel, M. K. (1999). Oil prices and U.S. aggregate economic activity: a question of neutrality. *Economic and Financial Review*, *Federal Reserve Bank of Dallas,* Second Quarter,16–23.

Bruno, M., & Sachs, J. (1982). Input price shocks and the slowdown in economic growth: the case of UK manufacturing. *The Review of Economic Studies*, 49(5), 679-705.

Cunado, J., & de Gracia, F. P. (2003). Do oil price shocks matter? Evidence for some European countries. *Energy Economics*, 25(2), 137-154.

Du, L., Yanan, H. and Wei, C. (2010). The Relationship Between Oil Price Shocks and China's Macroeconomy: An Empirical Analysis. *Energy Policy*, 38(8), 4142-4151.

Dumitrescu, E.-I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. Economic Modelling, 29, 1450-1460.

EIA-U.S. Energy Information Administration (2025) [Online] https://www.eia.gov /todayinenergy/detail.php?id=64304 Accessed 15/03/2025

Finn, M. G. (1995). Variance properties of solow's productivity residual and their cyclical implications. *Journal of Economic Dynamics and Control*, 19(5- 7), 1249-1281.

Flavin, C., & Lenssen, N. (1994). Powering the future toward a sustainable electricity industry. *Solar Today,* 8(5),3-14.

Jackson, R. B., Friedlingstein, P., Andrew, R. M., Canadell, J. G., Le Quéré, C., & Peters, G. P. (2019). Persistent fossil fuel growth threatens the Paris agreement and planetary health. *Environmental Research Letters*, 14(12), 121001.

Kamacı, A., & Göktaş, S. (2020). Petrol fiyatları ile ekonomik büyüme ilişkisi: Türkiye orneği. *Bartın Universitesi İktisadi ve İdari Bilimler Fakultesi Dergisi*, 11(22), 547-556.

Lorde, T., Jackman, M. and Thomas, C. (2009). The macroeconomic effects of oil price fluctuations on a small open oil-producing country: The case of Trinidad and Tobago. *Energy Policy*, 37(7), 2708-2716.

Mork, K. A. (1989). Oil and the macroeconomy when prices Go Up and Down: An extension of Hamilton's results. *Journal of Political Economy*, 97(3), 740-744.

Mory, J. F. (1993). Oil Prices and Economic Activity: Is the Relationship Symmetric? *Energy Journal*, 14(4), 151-162.

Özsağır, A., Erkan, B., Şentürk, M. ve Kara, O. (2011). Ham petrol fiyatlarındaki volatilitenin gayri safi yurtiçi hasıla büyümesi üzerindeki etkileri: Türkiye örneği. *Yönetim ve Ekonomi Dergisi*, 18(11), 19-28.

Osmanov, E., Gökçe, N., & Emsen, Ö. S. (2023). Petrol fiyatları ile ekonomik büyüme arasındaki ilişkiler: Azerbaycan ekonomisi üzerine incelmeler. *Ekonomi Bilimleri Dergisi*, 15(2), 178-201.

Özbek, S., & Naimoğlu, M. (2021). Petrol fiyatlarındaki artış ekonomik büyüme üzerinde etkili mi? Türkiye ekonomisi üzerine ampirik bir tahmin. *Uluslararası Ekonomi ve Yenilik Dergisi*, 7(2), 183-198.

Öztürk, S., & Kılıç, N. Ö. (2018). Petrol fiyatları ve iktisadi büyüme: OECD ülkeleri üzerine bir analiz. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 11(2), 138-149.

Papapetrou, E. (2001). Oil price shocks, stock market, economic activity and employment in Greece. *Energy Economics*, 23(5), 511-532.

Prasad, A., Narayan, P. K. and Narayan, J. (2007). Exploring the oil price and real GDP nexus for a small island economy, the Fiji islands. *Energy Policy*, 35(12), 6506-6513.

Swamy, P. (1971). *Statistical inference in random coefficient regression models*. New York: Springer

Şahin, G. (2022). Environmental impact analysis based on the STIRPAT model in coal exporting countries. *Dumlupınar University Journal of Social Sciences*, 73, 196–216.

Tasnım, D. (2019). *The impact of oil price changes on the economic growth of selected OPEC countries* (Master's Thesis). İstanbul University Social Sciences Institute, İstanbul.

Trang, N. T. N., Tho, T. N., & Hong, D. T. T. (2017). The impact of oil price on the growth, inflation, unemployment and budget deficit of Vietnam. *International Journal of Energy Economics and Policy,* 7(3), 42-49.

Van Eyden, R., Difeto, M., Gupta, R. and Wohar, M.E. (2019). Oil price volatility and economic growth: evidence from advanced economies using more than a century's data. *Applied Energy*, 233, 612-621.

Worlbank (2025) World Development Indicators [Online] https://data.worldbank.org/indicator /NY.GDP.MKTP.CD Accessed 15/03/2025

Yıldırım, A., & Konat, G. (2023). Exploring the relationship between oil prices and economic growth in Türkiye. *Bingöl Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 7(2), 103-117.