IJEEP

INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY

EJ EconJournals ISSN: 2146-4553

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2025, 15(4), 465-471.

Asymmetric Relationship between Oil Prices, Agricultural Production, and Industrial Production in Kazakhstan: Application of the NARDL Method

Karlygash Sovetovna Baisholanova[1], Aida Mazhidovna Dauzova[2], Halim Kazan[3], Kundyz Myrzabekkyzy[4], Raikhan Musamatovna Tazhibayeva[5], Akmaral E. Sarsenova[6]*, Zheniskul A. Utebayeva[7], Murat Nurgabylov[6]

[1]Al-Farabi Kazakh National University, Almaty, Kazakhstan, [2]Almaty Humanitarian-Economic University, Almaty, Kazakhstan, [3]Faculty of Economics, Istanbul University, Istanbul, Turkey, [4]Faculty of Economics, Management and Law, Khoja Akhmet Yassawi, International Kazakh-Turkish University, Turkestan, Kazakhstan, [5]International University of Tourism and Hospitality, Turkestan, Kazakhstan, [6]Faculty of Economics and Business, International Taraz University Named after Sherkhan Murtaza, Taraz, Kazakhstan, [7]A. Baitursynov Kostanay Regional University, Kostanay, Kazakhstan. *Email: sarsenovaakmaral777@yandex.kz

Received: 06 February 2025 **Accepted:** 27 May 2025 **DOI:** https://doi.org/10.32479/ijeep.19731

ABSTRACT

Two important factors contributing to oil revenues in Kazakhstan are the agricultural and industrial production sectors. This study examines the asymmetric effects of variability in these sectors on oil revenues. The analysis was conducted using the Nonlinear Autoregressive Distributed Lags (NARDL) model. In this model, oil revenues are represented as a ratio of oil revenues to GDP, while industrial and agricultural productions are represented by the industrial production index and the agricultural production index, respectively. The asymmetric effect refers to the differing impacts that positive or negative shocks in industrial or agricultural production have on oil revenues. Using annual data from 1992 to 2023, the study found that industrial production had statistically significant effects on oil revenues in the short term; however, this effect did not persist in the long term. In contrast, agricultural production demonstrated significant effects on oil revenues in both the short and long term, with notable seasonal differences in the impacts of short-term positive and negative shocks. Additionally, the error correction model indicated that both production sectors had asymmetric effects that led to deviations from expected oil revenues. In conclusion, the findings of this research highlight the significant role that production sectors play in explaining fluctuations in oil revenues.

Keywords: Kazakhstan, Oil Price, Agricultural Production, Industrial Production, NARDL, Wald Test
JEL Classifications: C13, C20, C22

1. INTRODUCTION

With Kazakhstan's independence on December 16, 1991, the country began its transition to a free-market economy and implemented extensive economic reforms (Taibek et al., 2023; Sabenova et al., 2024; Yesbolova et al., 2024). These reforms included fundamental structural changes such as ensuring price stability, controlling inflation, privatizing state assets, and enacting monetary reforms (Sultanova et al., 2024). By the 2000s, these transformations enabled the Kazakh economy to achieve stable growth, positioning the country as a notable economic model among other former USSR nations that gained independence (Xiong et al., 2015; Ibyzhanova et al., 2024; Dyussembekova et al., 2023). Kazakhstan's economy is largely based on its natural resource reserves, with oil and natural gas revenues playing a crucial role in the country's macroeconomic performance.

Kazakhstan's economy is largely based on its natural resources. Kazakhstan holds 3% of the world's oil reserves, 1.1% of natural gas reserves, and 3.3% of coal reserves (Mudarissov and Lee, 2014; Xiong et al., 2015; Dyussembekova et al., 2023; Baimagambetova et al., 2025; Lukhmanova et al., 2025). While oil revenues create significant opportunities for macroeconomic stability and public finance, they also introduce vulnerabilities. Fluctuations in oil prices can greatly impact public revenues and budget balances, potentially leading to structural issues known as "Dutch disease," where excessive dependence on the energy sector can hinder the development of other critical industries (Hamilton, 1983; Kilian, 2009; Corden and Neary, 1982). This over-reliance on energy revenues poses a long-term threat to sustainable economic development by stifling the growth of diverse economic sectors.

Industrial production is vital for economic stability and long-term development. The industrial production index serves as a key indicator for understanding economic fluctuations (Issayeva et al., 2023). However, changes in energy prices can increase production costs and exert pressure on the industrial sector (Baumeister and Peersman, 2013). Although Kazakhstan's industrial sector is characterized by energy-intensive industries, sub-sectors such as machinery manufacturing, metal processing, and chemicals also contribute significantly to the economy. Yet, challenges such as insufficient long-term investment planning, infrastructure issues, and dependence on foreign investment hinder balanced growth in the sector. Since industrial production is closely linked to oil and natural gas revenues, shifts in oil prices lead to fluctuations in the industrial sector. Supply chain disruptions and reliance on imported inputs further threaten the sustainability of industrial production (Issayeva et al., 2023). To reduce economic vulnerabilities, diversification of the industrial sector and a shift toward technology-based production are critical policy priorities.

Similarly, agricultural production is crucial for Kazakhstan's economy. The country possesses vast agricultural lands and pastures, which provide great agricultural potential. However, this potential has not been fully realized due to a decline in agricultural investments since independence (FAO, 2020; Liang et al., 2020; Aidarova et al., 2024). In 1990, the agricultural sector accounted for 34.9% of GDP, but this share fell to 10.9% by 1997 (Abdibekov et al., 2024). This decline poses long-term risks to the nation's food security and foreign trade balance. Agricultural production is particularly vulnerable to climatic conditions and water resources, making it sensitive to changes in weather (Sartbayeva et al., 2023; Talimova et al., 2025). Structural challenges such as inadequate irrigation infrastructure and outdated agricultural techniques further limit productivity. Despite reforms aimed at increasing production, particularly in the grain, cotton, and livestock sectors, productivity issues persist. Modernizing agricultural practices and integrating technological advancements into the sector are essential for Kazakhstan to secure food availability and enhance its competitiveness in the global agricultural market (FAO, 2020; Liang et al., 2020).

The aim of this study is to examine the asymmetric relationship between oil revenues, agricultural production, and industrial production in Kazakhstan, utilizing the Nonlinear Autoregressive Distributed Lag (NARDL) method for analysis. By evaluating the effects of fluctuations in oil revenues on the agricultural and industrial sectors, this study will provide important insights for developing sustainable growth strategies for the Kazakh economy. Additionally, it aims to offer policy recommendations for the long-term development of the economy, by detailing these relationships within the context of existing literature. The study will also address the long-term implications of structural transformations in the economy and the strategies that policymakers can adopt to ensure economic diversification.

2. LITERATURE REVIEW

Numerous academic studies have explored various dimensions of the Kazakh economy using different statistical methods. While it is not feasible to cover all in detail, this section will highlight specific research relevant to the present study.

Olasunkanmi and Oladele (2018) analyzed the effects of changes in oil prices on agricultural commodity prices in Nigeria using the NARDL method. Their study examined the asymmetric effects of positive and negative oil price shocks on agricultural commodity prices. The findings indicate that increases in oil prices lead to rising agricultural prices, whereas decreases do not result in a proportional decline. This phenomenon can be attributed to factors such as cost structures, market dynamics, and policy effects. The study emphasizes the non-linear nature of the energy-agriculture price interaction and suggests that policymakers develop more informed strategies to mitigate the impact of price fluctuations.

Abdlaziz et al. (2016) examined the long-term relationship between oil prices and food prices in Indonesia, also using the NARDL method. The study analyzed the asymmetric effects of oil price fluctuations on food prices. The findings showed that while increases in oil prices significantly drive food prices up, decreases do not correspondingly lower them. This discrepancy is explained by factors such as production costs, market structures, and inflation dynamics. The study highlights the importance of understanding nonlinear price pass-through and its implications for policymakers in managing interactions between energy and agricultural markets.

Mahmood (2022) investigated the impact of crude oil price fluctuations on public expenditures in Iraq from 1970 to 2021, employing the NARDL model. The research focused on the asymmetric effects of rising and falling oil prices on public spending. The findings demonstrate that increases in oil prices substantially increase public expenditures, while decreases do not result in a similar reduction. This behavior is attributed to the flexibility of fiscal policies, expenditure dependencies, and budget deficits. The study underscores the nonlinear effects of oil price shocks on public finances in energy-dependent economies, providing critical insights regarding the sustainability of budget policies.

Udemba and Yalçıntaş (2021) analyzed the impact of foreign direct investment (FDI), natural resources, and economic growth on environmental performance using the NARDL method. Their study examined both short-term and long-term asymmetric relationships among these variables. The findings reveal that while increases in FDI and natural resource use lead to greater environmental degradation, decreases in these variables do not contribute substantially to environmental improvement. The study emphasizes the need for careful consideration of economic growth and resource management policies in the context of environmental sustainability.

Talimova et al. (2025) conducted a study titled "An Investigation on the Effects of Oil Price, Industrial Production, and Agricultural Production on Inflation in Kazakhstan Using the Toda-Yamamoto Model with Structural Breaks." It examines the impact of oil prices, industrial production, and agricultural production on the inflation in Kazakhstan. The authors analyzed macroeconomic data using the Toda-Yamamoto model, which incorporates structural breaks. The findings indicate that oil prices have a direct and statistically significant effect on inflation. Additionally, a bidirectional causality relationship was identified between industrial production and inflation. While it was determined that agricultural production influences inflation in the short term, its impact is not significant in the long term.

Abdibekov et al. (2024) studied the effects of energy consumption, agricultural production, and industrial production on economic growth in Kazakhstan using the ARDL bounds test method. They analyzed both long-term and short-term relationships based on data from 2000 to 2022. The findings reveal that energy consumption and industrial production have a significant and positive impact on economic growth. Agricultural production was found to contribute to economic growth in the short term, although its long-term impact is limited. This study provides valuable insights into the growth dynamics of the Kazakh economy and offers strategic recommendations for policymakers regarding the energy and production sectors.

Lastly, Sartbayeva et al. (2023) examined the relationship between renewable energy consumption, economic growth, and the agro-industrial complex in Kazakhstan. The study employed econometric methods to analyze both long- and short-term dynamics. The findings indicate that renewable energy consumption positively affects economic growth, while the impact of the agro-industrial complex on growth varies based on sectoral dynamics. The study emphasizes the need to increase investments in renewable energy to help Kazakhstan achieve its sustainable development goals and contributes to existing literature by exploring the interaction between energy and agro-industrial policies.

3. METHODS

This study employs the Asymmetric Autoregressive Distributed Lags (NARDL) model to assess the impact of agricultural and industrial production on oil revenues in Kazakhstan, both in the short and long term. This approach offers greater flexibility than the classical ARDL model, allowing for a separate analysis of the effects of positive and negative changes in independent variables on the dependent variable. Consequently, it provides a detailed examination of asymmetric relationships between economic variables.

Developed by Shin et al. (2014), the NARDL model expands on the linear assumptions of the traditional ARDL model, acknowledging that the effects of increases and decreases in independent variables on the dependent variable may differ. The ARDL method can be used with variables that are stationary at the level (I[0]) or stationary in the first difference (I[1]). It is suitable for small samples with limited observations and capable of analyzing both long-term and short-term asymmetric relationships. The method begins by decomposing independent variables into their positive and negative components using the cumulative sum method.

The asymmetric ARDL model can be defined mathematically as follows:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{j=0}^{p} \left(\theta_j^{+} \Delta X_{t-j}^{+} + \theta_j^{-} \Delta X_{t-j}^{-} \right) + \phi Y_{t-1}$$
$$+\lambda^{+} X_{t-1}^{+} + \lambda^{-} X_{t-1}^{-} + \varepsilon_t \quad (1)$$

Thus, it allows for the testing of asymmetric effects between variables based on coefficients derived from the positive X_t^{+} and negative X_t^{-} components.

Within the framework of the NARDL model, the Bounds Test (developed by Pesaran et al., 2001) is employed to determine the existence of a long-term relationship with the following equation:

$$H_0 : \lambda^{+} = \lambda^{-} = \phi = 0 \quad (2)$$

As the test statistic, the F-statistic is calculated and is compared against critical values from the Pesaran table. If the resulting F-statistic:

- Exceeds the upper limit, cointegration exists
- İs below the lower limit, no cointegration is present
- Falls between the two limits, the situation is unstable.

The Wald test is utilized to ascertain whether the long-term and short-term coefficients estimated through the NARDL model are different. This test evaluates whether the differences between the effects of positive and negative shocks are statistically significant. If the null hypothesis is rejected, the existence of asymmetric relationships between the variables is acknowledged.

Prior to model estimation, the Augmented Dickey-Fuller (ADF) test was conducted to determine the stationarity of the series.

The optimal lag lengths for the model are identified based on information criteria such as AIC, SBC, or HQC. After establishing the optimum lag length, the NARDL model is estimated, yielding both short-term and long-term coefficients. Long-term coefficients are calculated using the following ratio.

Like the ARDL model, a series of diagnostic tests are applied to the NARDL model to evaluate its reliability and robustness:

- Autocorrelation test: Breusch-Godfrey LM test
- Heteroscedasticity test: Breusch-Pagan-Godfrey test
- Normality test: Jarque-Bera test
- Model stability: CUSUM and CUSUMSQ tests.

If these diagnostic tests confirm that the model meets its hypothesis, it is deemed valid.

4. DATA AND FINDINGS

Two critical factors regarding oil revenues in Kazakhstan are the agricultural and industrial production sectors. This study aims to analyze the asymmetric effect of these two economic sectors on oil revenues. In the research model, oil revenues are represented by the ratio of oil revenues to GDP, while industrial and agricultural productions are represented by their respective indices. The asymmetrical effect is defined as how positive or negative shocks in industrial or agricultural production affect oil revenues. The analysis utilizes annual data covering the period from 1992 to 2023, sourced from https://old.stat.gov.kz and https://data.worldbank.org (Access date: Feburary 01, 2025). A summary of the research variables and their definitions is provided in Table 1.

The analysis begins with descriptive statistics and graphical findings for each variable, explaining the historical development of oil revenues, industrial production, and agricultural production in Kazakhstan. The stationarity of the time series was assessed using the ADF unit root test, with stationary series employed in the model based on the test results. Finally, the findings derived from the research model analysis were evaluated.

Table 2 presents descriptive statistics and distribution statistics for the research variables over the analysis period. The mean of the agricultural production index was calculated to be 81, with a standard deviation of 26.95. The median value was 74.22, while the minimum and maximum values were 30.35 and 129.35, respectively, over the 32-year period. The average value of the ratio of oil revenues to GDP was 13.31, with a median of 13.51. The lowest value for this ratio was 2.25, and the highest was 24.70 during the same period. For the industrial production index, the mean was 102.46, and the median was 102.90. In comparison to the agricultural production index, industrial production levels are higher. The lowest industrial production index value recorded was 85.70, and the highest was 122.10 over the 32 years. According to the Jarque-Bera test statistics, all three variables are distributed in accordance with normal distribution.

Table 1: Variable definitions and sources

Variable	Definition	Source
AGP	Crop production index	https://data.worldbank.org
OIR	Oil rents (% of GDP)	https://data.worldbank.org
IIP	Indices of industrial production	https://old.stat.gov.kz

Table 2: Descriptive statistics findings for the variables

Statistics	AGP	OIR	IIP
Mean	81.00833	13.30886	102.4563
Median	74.21500	13.50966	102.9000
Maximum	129.3500	24.70221	122.1000
Minimum	30.35000	2.252188	85.70000
Standard deviation	26.95493	6.261320	7.524795
Skewness	0.026863	0.117763	−0.23675
Kurtosis	1.905476	2.003679	3.853702
Jarque-Bera	1.601159	1.397503	1.270679
Probability	0.449069	0.497206	0.529755

In the analysis of econometric and financial series, the preliminary step is to perform a unit root test to determine whether the series are stationary. The results of the ADF unit root test for the series are presented in Table 3. At the 5% significance level, it is observed that both the industrial production index and the agricultural production index are stationary at level, while oil revenues are stationary at the first difference.

Findings regarding the criteria showing whether the NARDL model is compatible are given in Table 4. According to the Breusch-Godfrey test, there is no autocorrelation problem. The Breusch-Pagan-Godfrey test indicates that there is no heteroscedasticity issue. Additionally, the Jarque-Bera test shows that the residuals are normally distributed, and the Ramsey RESET test confirms that there is no model identification error, also known as a functional form error.

As in the ARDL model, in addition to diagnostic test values, the CUSUM and CUSUMSQ tests (Brown et al., 1975) are used to examine whether the model contains structural breaks for the NARDL model. According to Graph 1, the research model does not include structural breaks and gives stable results.

Table 5 outlines the results of the bounds test procedure, used to examine whether there is an asymmetric cointegration relationship between the variables in the long term. The null hypothesis of this method states that there is no long-term asymmetric relationship among the variables. But the findings indicate a long-term relationship between oil revenues and both the agricultural and industrial production indices. This suggests the need for a

Table 3: ADF unit root test findings for the variables

Variable code	Level		1st difference	
	t-Statistics	P	t- Statistics	P
AGP	−5.87265	0.0002	−11.1253	0.0000
OIR	−2.43764	0.1402	−6.40475	0.0000
IIP	−3.05598	0.0407	−3.63684	0.0113
Test critical values				
1% level	−3.66166		−3.68919	
5% level	−2.96041		−2.97185	
10% level	−2.61916		−2.62512	

ADF: Augmented dickey-fuller

Table 4: NARDL diagnostic test findings

Variables/Tests	Statistics	P
Breusch-Godfrey serial correlation LM test	F-statistic: 5.310706	Probability F (2.1): 0.2933
Heteroskedasticity test: Breusch-Pagan-Godfrey	F-statistic: 1.170958	Probability F (23.3): 0.5212
Ramsey reset test	F-statistic: 3.694487	Probability F (1.2): 0.1945
Test of normality	Jarque-Bera: 0.697708	Probability 0.705496

Table 5: NARDL bounds test findings

Test statistic	Value	Significant (%)	I (0)	I (1)
F-statistic	6.051593	10	2.525	3.56
k	4	5	3.058	4.223
-		1	4.28	5.84

Graph 1: CUSUM and CUSUMQ graphs for the NARDL model

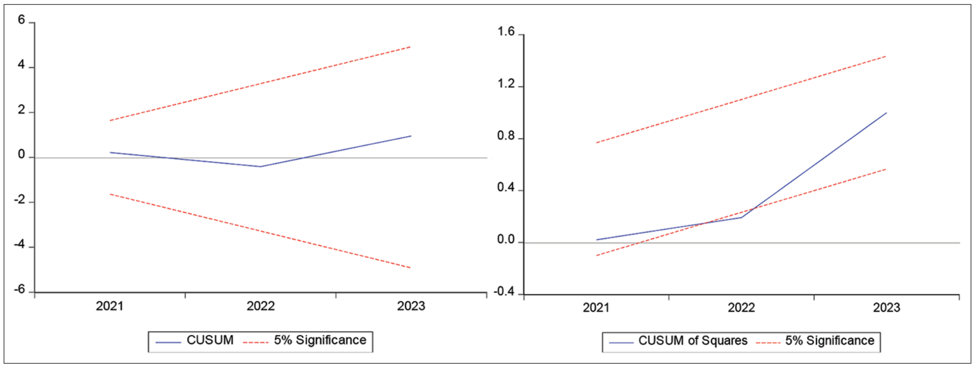


Table 6: Nonlinear autoregressive distributed lag model and long-term estimation findings

Variable	Coefficient	SE	T-statistic	P
Prediction findings for the model				
C	48.58554	31.02575	1.565975	0.2153
DOIR(−1)	−4.1943	0.915774	−4.58007	0.0195
IIP-POS(−1)	−0.12521	0.357137	−0.35059	0.7491
IIP-NEG(−1)	0.517307	0.341306	1.515669	0.2269
AGP-POS(−1)	0.877581	0.4064	2.159403	0.1196
AGP-NEG(−1)	1.098172	0.573116	1.916141	0.1512
D(DOIR(−1))	2.423972	0.681506	3.556787	0.0379
D(DOIR[−2])	1.132754	0.429056	2.640108	0.0776
D(DOIR[−3])	0.806361	0.213424	3.778204	0.0325
D(IIP-POS)	0.498775	0.309451	1.611803	0.2054
D(IIP-POS[−1])	1.595206	0.319215	4.997284	0.0154
D(IIP-POS[−2])	−0.31585	0.489226	−0.64562	0.5645
D(IIP-NEG)	−0.62174	0.594656	−1.04555	0.3726
D(IIP-NEG[−1])	−2.72699	0.683007	−3.99262	0.0281
D(IIP-NEG[−2])	−1.5886	0.558217	−2.84585	0.0653
D(IIP-NEG[−3])	−1.11293	0.307178	−3.62307	0.0362
D(AGP-POS)	−0.19441	0.144855	−1.34213	0.2721
D(AGP-POS[−1])	−0.40617	0.226405	−1.79399	0.1707
D(AGP-POS[−2])	−0.52957	0.116902	−4.53007	0.0201
D(AGP-POS[−3])	0.324535	0.208809	1.554215	0.2180
D(AGP-NEG)	0.035842	0.178448	0.200855	0.8537
D(AGP-NEG[−1])	−0.88491	0.204295	−4.33153	0.0227
D(AGP-NEG[−2])	0.231205	0.238989	0.96743	0.4047
D(AGP-NEG[−3])	−0.38517	0.206782	−1.86267	0.1594
Long-term prediction findings				
IIP-POS	−0.02985	0.086206	−0.34628	0.7520
IIP-NEG	0.123336	0.075498	1.633638	0.2008
AGP-POS	0.209232	0.088571	2.362299	0.0992
AGP-NEG	0.261825	0.125768	2.08181	0.1288
C	11.5837	7.047459	1.64367	0.1988

EC: DOIR−(−0.0299*IIP_POS+0.1233*IIP_NEG+0.2092*AGP_POS+0.2618*AGP_NEG+11.5837), SE: Standard error

detailed examination of the short- and long-term relationships of agricultural and industrial production on oil revenues.

Table 6 presents the NARDL analysis findings regarding the relationships between the industrial production index, the agricultural production index, and oil revenues. When looking at the long-term effects of production indices (both positive and negative shocks) on oil revenues, it is found that positive shocks in the agricultural production index are statistically significant at the 10% level. Specifically, a positive shock of 1 unit in the agricultural production index is expected to increase oil revenues by 0.209 units. However, negative shocks in the agricultural production

Table 7: Findings of the nonlinear autoregressive distributed lag error correction regression model

Variable	Coefficient	SE	T-statistic	P
D(DOIR[−1])	2.423972	0.334001	7.257372	0.0054
D(DOIR[−2])	1.132754	0.214926	5.270444	0.0133
D(DOIR[−3])	0.806361	0.096329	8.37087	0.0036
D(IIP-POS)	0.498775	0.075163	6.635927	0.0070
D(IIP-POS[−1])	1.595206	0.116681	13.67155	0.0008
D(IIP-POS[−2])	−0.31585	0.152512	−2.071	0.1301
D(IIP-NEG)	−0.62174	0.164712	−3.77472	0.0326
D(IIP-NEG[−1])	−2.72699	0.2716	−10.0404	0.0021
D(IIP-NEG[−2])	−1.5886	0.274525	−5.78673	0.0103
D(IIP-NEG[−3])	−1.11293	0.13584	−8.19292	0.0038
D(AGP-POS)	−0.19441	0.04682	−4.15236	0.0254
D(AGP-POS[−1])	−0.40617	0.094832	−4.28303	0.0234
D(AGP-POS[−2])	−0.52957	0.069071	−7.66711	0.0046
D(AGP-POS[−3])	0.324535	0.044412	7.307328	0.0053
D(AGP-NEG)	0.035842	0.058301	0.614783	0.5822
D(AGP-NEG[−1])	−0.88491	0.086795	−10.1954	0.0020
D(AGP-NEG[−2])	0.231205	0.099491	2.323884	0.1027
D(AGP-NEG[−3])	−0.38517	0.051657	−7.45626	0.0050
CointEq(−1)*	−4.1943	0.426251	−9.84	0.0022
R^2	0.995262	Mean dependent variable		−0.1224
Adjusted R^2	0.984601	SD dependent variable		7.952078
SE of regression	0.986798	Akaike info criterion		3.00231
Sum squared resid	7.790166	Schwarz criterion		3.914195
Log likelihood	−21.5312	Hannan-Quinn criterion		3.273461
Durbin-Watson stat	2.307256			

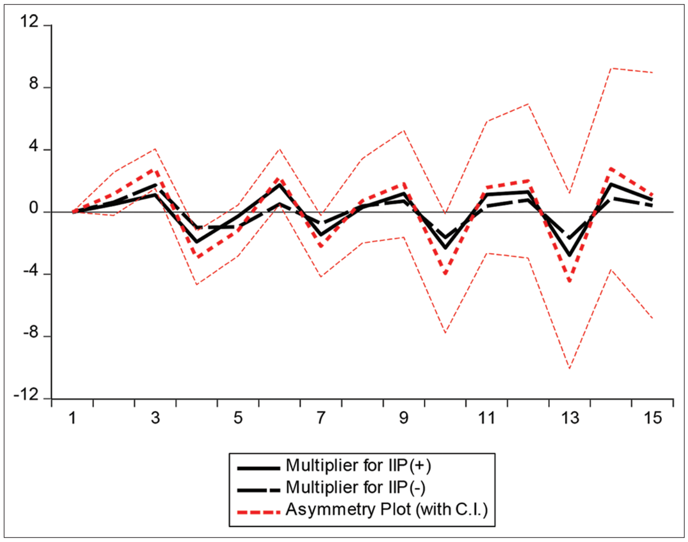
SE: Standard error, SD: Standard deviation

index and any shocks, regardless of direction, in the industrial production index do not have a long-term effect on oil revenues.

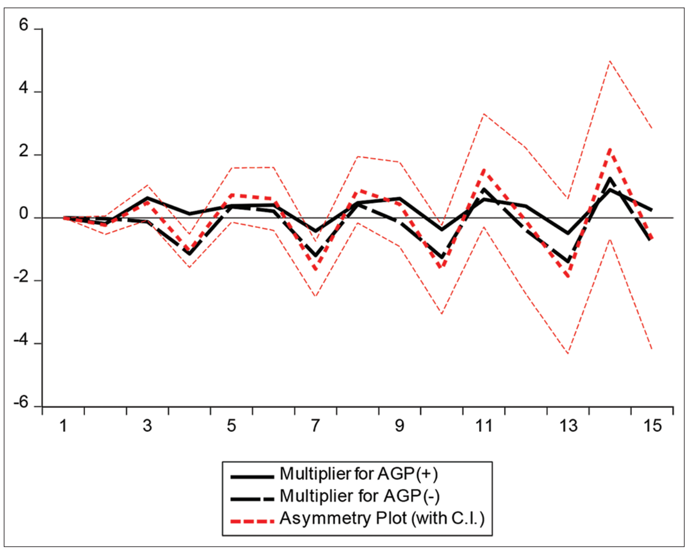
Examining the short-term effects of the production indices on oil revenues (through the error correction model) reveals that the one-period lagged value of oil revenues has a negative effect, while longer-term lags have a positive and significant effect. A one-period lagged value of positive shocks in the industrial production index has a positive effect on oil revenues, while the lagged values of negative shocks have a negative effect. For the agricultural production index, negative shocks decrease oil revenues in one period, while positive shocks decrease oil revenues over two periods.

Table 7 presents the findings of the NARDL model error correction form. Within this model, the impact of the current and two-period lagged values of negative shocks from the agricultural production

Graph 2: Dynamic multiplier graph for IIP



Graph 3: Dynamic multiplier graph for



index and the two-period lagged value of positive shocks from the industrial production index on oil revenues is found to be statistically insignificant. In contrast, the effects of the other variables and the error correction term are found to be statistically significant. The error correction term, which falls between −1 and 0, indicates convergence towards the equilibrium value that occurs in waves of decreasing magnitude. An error correction term value of < −2 or > 0 indicates a departure from the equilibrium state (Alam and Quazi, 2003). In this context, the calculated error correction term of −4.1943 suggests that shocks in agricultural and industrial production are pushing oil revenues towards an imbalanced state.

The asymmetric effect of the industrial production index on oil revenues is illustrated in Graph 2. The graph indicates that the positive and negative effects fluctuate over the analysis period, generally remaining close to zero.

The asymmetric effect of the agricultural production index on oil revenues is illustrated in Graph 3. The graph indicates that the positive effects are consistently greater than the negative effects throughout the analysis period.

Table 8: NARDL model Wald test findings

Variable	χ^2	P
IIP		
W-SR	50.15159	0.0000
W-LR	20.14363	0.0000
AGP		
W-SR	1.150689	0.2834
W-LR	1.330838	0.2487

According to the Wald test statistics presented in Table 8, both the short-term and long-term asymmetric effects of industrial production on oil revenues are statistically significant. In contrast, both asymmetric effects of agricultural production are not significant. This suggests that while the asymmetric effect of the industrial production index on oil revenues varies in the short and long term, the differences in the asymmetric effects of the agricultural production index are not statistically significant.

5. CONCLUSION AND RECOMMENDATIONS

It is a well-known fact that all production activities require energy, which in many cases translates to a need for oil. Consequently, any fluctuations or shocks in production -regardless of the sector- will naturally impact oil revenues. This makes the hypothesis that industrial and agricultural production, which is also important in terms of the structure of production sector, has an impact on oil revenues, scientifically worthy of investigation. The study finds that while the asymmetric effect (positive or negative shock) of industrial production on oil revenues is significant in the short term, this effect does not persist in the long term. Conversely, both the short-term and long-term effects of agricultural production are found to be significant. Notably, the short-term asymmetric effect of agricultural production is variable: positive shocks appear to lead to a decrease in oil revenues after one period, while negative shocks lead to a decrease after two periods. Therefore, it is essential to analyze the impact of agricultural production on oil revenues in Kazakhstan in conjunction with other economic variables. Additionally, the error correction model indicates that both agricultural and industrial production have an asymmetric effect on oil revenues, suggesting a deviation from equilibrium.

The findings of this study underline the importance of industrial and agricultural production in explaining the variability in oil revenues. For more comprehensive results, it would be beneficial to incorporate additional variables that influence oil revenues into the model. This would provide valuable insights for both the econometric literature and the economic management of the country.

REFERENCES

Abdibekov, S.U., Gridneva, Y.E., Kaliakparova, G.S., Amankeldi, N.A., Perneyeva, G.A., Kulbay, B.S., Myrzabekkyzy, K. (2024), The relationship between energy consumption, agricultural and ındustrial production, and economic growth: ARDL border value approach in the case of Kazakhstan. International Journal of Energy Economics and Policy, 14(3), 79-86.

Abdlaziz, R.A., Rahim, K.A., Adamu, P. (2016), Oil and food prices co-integration nexus for Indonesia: A non-linear autoregressive distributed lag analysis. International Journal of Energy Economics and Policy, 6(1), 82-87.

Aidarova, A.B., Mukhamediyeva, G., Yessentayeva, A.A., Utemissova, G., Tastanbekova, K., Mustafayeva, B., Myrzabekkyzy, K. (2024), Relationship between oil exports, renewable energy consumption, agriculture ındustry, and economic growth in selected OPEC countries: A panel ARDL analysis. International Journal of Energy Economics and Policy, 14(6), 344-352.

Alam, I., Quazi, R. (2003), Determinants of capital flight: An econometric case study of Bangladesh. International Review of Applied Economics, 17(1), 85-103.

Available from: https://data.worldbank.org [Last accessed on 2025 Feb 01].

Available from: https://old.stat.gov.kz [Last accessed on 2025 Feb 01].

Baimagambetova, L., Baibulekova, L., Aliyeva, Z.T., Aidarova, A.B., Mashirova, T., Balapanova, E., Nurpeissova, A., Bolganbayev, A. (2025), Analysis of the effects of energy consumption, employment, mining, natural resource ıncome, and foreign direct ınvestments on economic growth in the central Asian turkic republics using panel causality tests. International Journal of Energy Economics and Policy, 15(3), 204-213.

Baumeister, C., Peersman, G. (2013), The role of time-varying price elasticities in accounting for volatility changes in the crude oil market. Journal of applied econometrics, 28(7), 1087-1109.

Brown, R.L., Durbin, J., Evans, J.M. (1975), Techniques for testing the constancy of regression relationships over time. Journal of the Royal Statistical Society Series B: Statistical Methodology, 37(2), 149-163.

Corden, W.M., Neary, J.P. (1982), Booming sector and de-industrialisation in a small open economy. The Economic Journal, 92(368), 825-848.

Dyussembekova, Z., Aidarova, A.B., Balapanova, E., Kuatova, D., Seitkhamzina, G., Bolganbayev, A. (2023), The effect of freight and passenger transportation and energy production on economic growth in the framework of macro-economic indicators: The case of Kazakhstan. International Journal of Energy Economics and Policy, 13(6), 74-80.

FAO. (2020), The State of Food and Agriculture 2020: Overcoming Water Challenges in Agriculture. Rome: FAO. Available from: https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1333955 [Last accessed on 2025 Feb 01].

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

Ibyzhanova, A., Sultanova, Z., Aliyeva, Z.T., Tastanbekova, K., Abdibekov, S.U., Mustafayeva, B., Myrzabekkyzy, K. (2024), The effect of energy production and foreign trade on the economic growth of Turkic Republics: A study using panel data analysis method. International Journal of Energy Economics and Policy, 14(2), 126-134.

Issayeva, G., Dyussembekova, Z., Aidarova, A.B., Makhatova, A.B., Lukhmanova, G., Absemetova, D., Bolganbayev, A. (2023), The relationship between renewable energy consumption, CO_2 emissions, economic growth, and industrial production index: The case of Kazakhstan. International Journal of Energy Economics and Policy, 13(6), 1-7.

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

Liang, Y., Zhen, L., Zhang, C., Hu, Y. (2020), Consumption of products of livestock resources in Kazakhstan: Characteristics and influencing factors. Environmental Development, 34, 100492.

Lukhmanova, G., Urazymbetov, B., Sarsenova, A., Zaitenova, N., Seitova, V., Baisholanova, K., Bolganbayev, A. (2025), Investigating the relationship between energy consumption and economic growth using toda-yamamoto causality test: The case of Kazakhstan and Azerbaijan. International Journal of Energy Economics and Policy, 15(1), 374-383.

Mahmood, S.A. (2022), Using the (NARDL) model to measure the impact of crude oil price fluctuations on public spending in Iraq for the period. American Journal of Economics and Business Management, 5(6), 75-87.

Mudarissov, B.A., Lee, Y. (2014), The relationship between energy consumption and economic growth in Kazakhstan. Geosystem Engineering, 17(1), 63-68.

Olasunkanmi, O.I., Oladele, K.S. (2018), Oil price shock and agricultural commodity prices in Nigeria: A non-linear autoregressive distributed lag (NARDL) approach. African Journal of Economic Review, 6(2), 74-91.

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

Sabenova, B., Talimova, L., Kanabekova, M., Zhakipbekova, D.S., Seitova, G., Maulenkulova, G.E., Bolganbayev, A. (2024), The relationship between the return of energy companies listed on the kazakhstan stock exchange and the exchange rate, KASE ındex, and gold return: ARDL bounds value approach. International Journal of Energy Economics and Policy, 14(5), 131-140.

Sartbayeva, G., Balapanova, E., Mamytkanov, D.K., Talimova, L., Lukhmanova, G., Myrzabekkyzy, K. (2023), The relationship between energy consumption (renewable energy), economic growth and agro-industrial complex in Kazakhstan. International Journal of Energy Economics and Policy, 13(6), 227-233.

Shin, Y., Yu, B., Greenwood-Nimmo, M. (2014), Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. İn: Festschrift in honor of Peter Schmidt: Econometric Methods and Applications. New York: Springer. p281-314.

Sultanova, Z., Pazilov, G.A., Baibulekova, L., Kassymbekova, G., Lukhmanova, G., Issayeva, G., Myrzabekkyzy, K. (2024), Comparative analysis of the volatility structures of the stock prices of energy companies traded on the Kazakhstan stock exchange and international gold and oil prices. International Journal of Energy Economics and Policy, 14(1), 21-30.

Taibek, Z., Kozhamkulova, I., Kuralbayev, A., Spanova, B.K., Myrzabekkyzy, K. (2023), Analysis of the effect of oil and energy production on health and education expenditures in Kazakhstan with autoregressive distributed lag method. International Journal of Energy Economics and Policy, 13(2), 215-221.

Talimova, L., Sembekov, A.K., Kuchukova, N., Assilova, A.S., Omarova, G., Tlesova, A., Myrzabekkyzy, K. (2025), An ınvestigation on the effects of oil price, ındustrial production and agricultural production on ınflation in Kazakhstan Using the toda-yamamoto model with structural breaks. International Journal of Energy Economics and Policy, 15(2), 538-546.

Udemba, E.N., Yalçıntaş, S. (2021), Interacting force of foreign direct invest (FDI), natural resource and economic growth in determining environmental performance: A nonlinear autoregressive distributed lag (NARDL) approach. Resources Policy, 73, 102168.

Xiong, C., Yang, D., Huo, J., Zhao, Y. (2015), The relationship between energy consumption and economic growth and the development strategy of a low-carbon economy in Kazakhstan. Journal of Arid Land, 7(5), 706-715.

Yesbolova, A.Y., Abdulova, T., Nurgabylov, M., Yessenbekova, S., Turalina, S., Baytaeva, G., Myrzabekkyzy, K. (2024), Analysis of the effect of renewable energy consumption and industrial production on CO_2 emissions in Turkic republics by panel data analysis method. International Journal of Energy Economics and Policy, 14(1), 480-487.