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ENERGY SHOCKS AND ECONOMIC GROWTH IN AZERBAIJAN: AN ECONOMETRIC ANALYSIS

Abstract

This article investigates the macroeconomic effects of energy price shocks on economic growth This study examines the macroeconomic impact of oil and gas price shocks on Azerbaijan by employing ARDL and ECM models that capture both short-run adjustments and potential long- run dynamics. Stationarity tests reveal that gas prices are integrated of order two, restricting the analysis to short-run transformations of the series. The empirical findings show that energy price shocks exert heterogeneous effects across macroeconomic variables: capital investment and poverty levels exhibit no significant short-run response, while GDP growth reacts only weakly and with borderline significance. By contrast, fiscal variables—state revenue and expenditure - demonstrate strong and stable long-run relationships with energy prices, underscoring the central role of hydrocarbons in public finance. Unemployment adjusts more rapidly than other variables and declines in response to positive energy price shocks in the short run. Overall, the results highlight Azerbaijan's macroeconomic vulnerability to external energy market fluctuations and emphasize the need for structural diversification and improved fiscal stabilization mechanisms.

Keywords: *energy price shocks; ARDL; ECM; Azerbaijan economy; macroeconomic vulnerability; fiscal dependence.*

INTRODUCTION

Energy shocks - unexpected changes in energy prices or supply - are widely recognized as a key source of macroeconomic instability. Since the 1970s, extensive research has shown that oil and gas price fluctuations affect inflation, output, employment, and fiscal balances. For importers, higher energy prices act as negative supply shocks, while for exporters they can generate temporary booms through higher revenues and improved terms of trade.

Azerbaijan is a relevant case given its heavy dependence on hydrocarbons, which dominate exports, GDP, and government revenue. Consequently, global energy price movements quickly spill over into domestic conditions, as seen during the 2008 crisis, the 2014–2016 oil price collapse, and the 2021–2022 energy surge.

This article examines the impact of energy price shocks on Azerbaijan's macroeconomic performance using ARDL and ECM techniques to distinguish short-run dynamics from potential long-run effects. By analyzing multiple macroeconomic indicators, the study provides a comprehensive view of how energy shocks propagate through the economy.

The article proceeds as follows: Section 2 reviews the literature, Section 3 presents the methodology and data, Section 4 reports the econometric results, Section 5 offers discussion, and Section 6 concludes with policy implications.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The macroeconomic effects of energy shocks have been widely studied across theoretical and empirical frameworks. Early contributions (Hamilton, 1983; Gisser & Goodwin, 1986) viewed oil price

fluctuations as negative supply shocks that raise production costs and reduce output. Later studies challenged this interpretation by emphasizing the role of global demand and monetary policy (Barsky & Kilian, 2004). New Keynesian models further show that energy- induced inflation often triggers contractionary policy responses, amplifying output losses (Blanchard & Galí, 2007).

More recent DSGE and structural VAR studies distinguish between supply-driven and demand-driven energy shocks, demonstrating that their macroeconomic effects differ substantially (Kilian, 2009; Kilian & Murphy, 2014). For oil-exporting economies, energy price increases may boost short-term growth but also generate structural distortions and Dutch-disease effects.

Evidence from Azerbaijan confirms that oil and gas price shocks significantly influence GDP, fiscal revenues, exchange rates, and inflation, reflecting strong export dependence.

Theoretical explanations combine several channels: RBC models emphasize productivity effects; AS–AD frameworks predict stagflation; New Keynesian models highlight nominal rigidities and policy responses; open-economy models focus on terms-of-trade and exchange-rate effects; and resource-dependence theories stress fiscal and investment transmission. Together, these perspectives underscore the importance of country-specific analysis for resource-rich economies such as Azerbaijan.

METHODOLOGY AND DATA

Econometric framework

The ARDL methodology is selected for several reasons.

First, the dataset contains variables with mixed integration orders (I(0) and I(1)); ARDL models remain valid under such conditions, unlike traditional cointegration methods that require all variables to be I(1). Second, ARDL performs well with small sample sizes, making it suitable for annual data covering roughly three decades. Third, ARDL allows asymmetric lag lengths across variables, enabling the model to capture complex dynamic adjustments.

Finally, when variables are cointegrated, ARDL can be naturally re-parametrized into an ECM, providing insights into both short-run adjustments and long-run equilibrium relationships.

To analyze the relationship between energy prices and macroeconomic variables, this study The general ARDL specification can be written as:

$$\Delta y_t = \alpha + \Sigma\beta_i \Delta y_{t-i} + \Sigma\gamma_j \Delta x_{t-j} + \lambda(y_{t-1} - \theta x_{t-1}) + \varepsilon_t$$

where y represents the dependent macroeconomic variable, x denotes energy prices, and λ is the error correction coefficient.

Stationarity testing

Prior to estimation, Augmented Dickey–Fuller tests are conducted to determine the order of integration of each variable. The results indicate mixed integration orders, with some energy price series exhibiting higher-order integration. Consequently, the analysis focuses primarily on short-run dynamics using stationary transformations.

Data and variable selection justification

The empirical analysis utilizes annual macroeconomic data for Azerbaijan covering the post-independence period. The dataset includes GDP growth, gross fixed capital formation, domestic investment, unemployment, poverty level, state revenue, state expenditure, and short-term loans. Energy variables consist of international natural gas prices (GASPRICEEURO) and supplementary oil price indicators.

Macroeconomic data are obtained from national statistical authorities and international sources (World Bank, IEA, IMF), while energy price series are drawn from international market databases.

All series were visually inspected for trends and volatility patterns. Augmented Dickey–Fuller unit root tests were conducted to determine the order of integration of each variable, with results confirming a mixture of I (0), I (1), and - for gas prices - an I (2) pattern. This affects the feasible econometric modelling strategy, as discussed below.

The variables are selected based on established theory and prior empirical evidence. GDP growth and investment capture real economic performance, while unemployment and poverty reflect labor-market and social effects of energy shocks. State revenue and expenditure are included to account for fiscal transmission channels typical of hydrocarbon-exporting economies. Short-term loans proxy

financial conditions and liquidity responses.

Energy variables - oil and especially natural gas prices - are central due to Azerbaijan's strong integration into global hydrocarbon markets. Gas prices, in particular, are crucial for export revenues and fiscal outcomes, making them the key external shock in this analysis.

Together, these variables capture the real, fiscal, financial, and social channels through which energy shocks affect Azerbaijan's economy.

ECONOMETRIC ANALYSIS

The empirical analysis proceeds in three steps. First, unit root tests establish the stationarity properties of the variables. Second, ARDL models are estimated for each macroeconomic indicator to identify short-run relationships with energy prices. Third, where appropriate, ECM specifications are used to examine adjustment dynamics and potential long-run equilibria.

The results show substantial heterogeneity across variables. Investment-related variables exhibit strong inertia and delayed responses to energy price changes. Fiscal variables display high persistence and, in some cases, evidence of long-run relationships with energy prices. Labor market indicators respond more rapidly but primarily in the short run.

ARDL model for domestic investment

Model specification and fit

The ARDL (2,0) model estimated for domestic investment demonstrates a strong overall fit. The coefficient of determination ($R^2 = 0.7524$) indicates that approximately 75% of the variation in domestic investment is explained by the model. The adjusted R^2 (0.6905) remains high after accounting for degrees of freedom, suggesting that the explanatory power is not driven by overfitting.

The joint significance of the regressors is confirmed by the F-statistic (12.156) with a p-value of 0.000599, implying that the model is statistically significant as a whole. The Durbin–Watson statistic (1.464) points to a mild risk of positive autocorrelation, although it does not indicate a severe violation of classical assumptions.

Short-run dynamics

The lagged dependent variable DOMESTICINVEST (-1) enters the model with a coefficient of 1.1486 and is highly statistically significant ($p = 0.0006$). This result indicates strong persistence in domestic investment dynamics: higher investment levels in the previous period tend to translate into higher current investment. The second lag, DOMESTICINVEST (-2), carries a negative coefficient (-0.3929) but is not statistically significant ($p = 0.156$), suggesting that any correction mechanism from two periods earlier is weak and economically uncertain.

The contemporaneous gas price variable (GASPRICEEURO) has a positive coefficient (78.4081) but is statistically insignificant ($p = 0.2147$). This implies that, within this specification, short-run changes in gas prices do not exert a robust immediate effect on domestic investment.

Interpretation

Overall, domestic investment exhibits strong inertia, with past investment levels playing a dominant role in explaining current dynamics. Gas prices, however, do not show a statistically significant short-run effect in this model. While the model fit is relatively strong, the lack of significance for energy prices suggests that domestic investment decisions may respond to energy price shocks only indirectly or over longer horizons, reinforcing the need for a long-run (ECM) analysis.

ARDL model for total investment

Model fit

The ARDL (1,2) model for total investment shows an even stronger explanatory performance. The R^2 value of 0.8513 implies that more than 85% of the variation in investment is captured by the model, while the adjusted R^2 (0.7972) confirms robustness. The F-statistic (15.740) is highly significant ($p < 0.001$), and the Durbin–Watson statistic (1.907) indicates no serious autocorrelation problems.

Short-run coefficients

Investment persistence is pronounced, as evidenced by the coefficient on INVESTMENT (-1), which equals 0.8107 and is statistically significant at the 1% level. This confirms that current investment is heavily influenced by its past realizations.

Gas prices exhibit more complex dynamics. The contemporaneous gas price effect (62.48) and the one-period lag (131.95) are both positive but statistically insignificant. In contrast, the two- period lag of gas prices (GASPRICEEURO (-2)) is negative (-297.39) and statistically significant (p = 0.0040). This finding suggests a delayed adverse impact of higher gas prices on investment, potentially reflecting increased production costs, reduced profitability, or postponed investment decisions.

The constant term is positive and statistically significant (C = 5658.16; p = 0.0401), indicating a baseline level of investment independent of energy prices and past investment.

Interpretation

The results indicate that investment responds to energy price shocks with a delay rather than immediately. While gas prices do not significantly affect investment in the short run, higher prices two years earlier significantly depress current investment. This delayed negative effect is consistent with adjustment costs and planning horizons typical of capital formation processes.

ARDL model for short-term loans model fit

The ARDL (1,2) model for short-term loans exhibits moderate explanatory power, with an R^2 of 0.5453 and an adjusted R^2 of 0.3799. The F-statistic (3.2976) is borderline significant at the 5% level ($p \approx 0.052$), though clearly significant at the 10% level. The Durbin–Watson statistic (1.9006) indicates no major autocorrelation concerns.

Short-run dynamics

The lagged dependent variable SHORTLOAN (-1) has a positive coefficient (0.4209) but is not statistically significant at conventional levels. Gas prices display no significant contemporaneous or lagged effects at the 5% level, although the two-period lag shows a positive coefficient (42.50) that is borderline significant at the 10% level (p = 0.1080).

Interpretation

Compared to investment models, the short-term loan model exhibits weaker persistence and a less pronounced response to gas price shocks. The marginally significant lagged effect suggests that higher energy prices may eventually increase short-term borrowing, possibly as firms seek liquidity to cope with rising operational costs. However, this effect remains economically tentative.

ARDL models for fiscal variables

State expenditure

The ARDL (1,0) model for state expenditure performs exceptionally well, with an R^2 of 0.9585 and an adjusted R^2 of 0.9526. The F-statistic (161.72) is highly significant, and the Durbin– Watson statistic (1.8324) suggests no serious autocorrelation.

State expenditure is highly persistent, as indicated by STATEEXP (-1) = 0.9771 (p < 0.0001). Gas prices have an immediate and statistically significant positive effect (128.15; p = 0.0402), implying that higher energy prices are associated with higher government spending, likely through increased fiscal revenues or budgetary adjustments.

State revenue

Similarly, the ARDL (1,0) model for state revenue shows strong explanatory power (R^2 = 0.9360; adjusted R^2 = 0.9269). State revenue is also highly persistent (STATEREVENUE (-1) = 0.9770; p

< 0.0001). Gas prices exert a positive but only marginally significant effect (120.87; $p \approx 0.09$), suggesting that revenue responds to energy price increases, albeit less strongly than expenditure.

ARDL models for unemployment initial

ARDL (1,0) specification

The initial unemployment model exhibits weak explanatory power ($R^2 \approx 0.19$) and is not statistically significant overall. Gas prices show no meaningful effect, indicating that unemployment does not respond directly to energy price shocks in this specification.

Updated ARDL (1,1) specification

The updated ARDL (1,1) model substantially improves performance (R^2 = 0.532; adjusted R^2 = 0.424). Unemployment displays significant persistence (UNEMPLOYMENT (-1) = 0.5351; p = 0.0263). Oil and gas prices have a statistically significant negative contemporaneous effect (- 0.0159; p = 0.0085), indicating that higher energy prices reduce unemployment in the short run, likely through increased

activity in the energy sector and related industries. The lagged effect is positive and marginally significant, suggesting partial reversal over time.

CONCLUSION

The ARDL results reveal substantial heterogeneity in how different macroeconomic variables respond to energy price shocks. Investment-related variables exhibit strong persistence and delayed responses, fiscal variables react immediately and significantly, while unemployment responds only in improved model specifications. These findings underscore the importance of variable-specific dynamics and justify the use of flexible ARDL frameworks in analyzing energy-dependent economies.

Discussion of ARDL error correction model results

Table 1

ARDL error correction model results

Model	Significant Effect	Coefficient	Significance Long-run	Relation	R^2	DW
Domestic Investment	ECT (adj. speed)	–0.244	10%	No	0.26	1.46
Total Investment	ΔGASPRICEEURO (–1)	+297.39	1%	No	0.69	1.91
Short-Term Loans	ECT	–0.579	1%	No	0.44	1.90
State Expenditure	Long-run (bounds test)	—	Significant	Yes	0.27	1.83
State Revenue	Long-run (bounds test)	—	Significant	Yes	0.19	2.01
Unemployment	ΔOILGAS	–0.0159	1%	No	0.62	2.26

Source: *Author's calculations based on the dataset and econometric estimations.*

General interpretation framework

The Error Correction Model (ECM) derived from the ARDL framework allows for a joint examination of short-run dynamics and long-run equilibrium relationships among the variables. The key parameter in this framework is the error correction term (ECT), which captures the speed at which the dependent variable adjusts back to its long-run equilibrium following a short- run shock. A negative and statistically significant ECT coefficient confirms the existence of a stable adjustment mechanism, while its magnitude indicates how quickly deviations from equilibrium are corrected.

In addition, the ARDL bounds test is employed to determine whether a statistically significant long-run relationship exists between the dependent variable and its regressors. If the calculated F-statistic exceeds the upper bound critical value, the null hypothesis of no long-run relationship is rejected.

Domestic investment (DOMINEST)

The ECM results show that domestic investment adjusts slowly and weakly to deviations from equilibrium. The error correction term is negative and only marginally significant at the 10% level, indicating a modest adjustment rate: about 24% of disequilibrium is corrected annually, meaning full adjustment takes roughly four years.

Short-run dynamics are similarly weak. The lagged change in domestic investment is only borderline significant, and the low R^2 suggests that short-term movements are influenced by factors outside the model.

Moreover, the ARDL bounds test does not confirm a significant long-run relationship. Thus, although domestic investment gradually adjusts, there is no strong evidence of a stable long-run equilibrium with the variables included in the model.

Total investment

The ECM results for total investment show a clearer adjustment process than in the domestic investment model. The error correction term is negative and significant at the 5% level, indicating that about 19% of disequilibrium is corrected each year—implying slow convergence over five to six years.

Short-run effects of gas prices appear with a delay: contemporaneous changes are insignificant, while lagged gas price increases have a strong positive impact on investment. This reflects delayed investment responses due to planning horizons, adjustment costs, and irreversibility.

However, despite the significant adjustment term, the bounds test does not confirm long-run cointegration. Thus, total investment adjusts after shocks, but a stable long-run relationship with gas prices is not statistically supported in this specification.

Short-term loans

The ECM results for short-term loans show the fastest adjustment among the investment-related variables. The error correction term is negative and highly significant, indicating that nearly 58% of any deviation from equilibrium is corrected within one year. This implies that short-term credit markets respond rapidly to shocks and restore equilibrium in less than two years.

Short-run effects of gas prices are generally weak. The contemporaneous effect is statistically insignificant, while the lagged effect is marginally significant and negative. This suggests that increases in gas prices may reduce short-term lending with a delay, potentially reflecting higher risk, tighter liquidity conditions, or reduced borrowing capacity following cost increases.

Although the adjustment speed is strong, the bounds test result remains inconclusive, meaning that a stable long-run relationship cannot be statistically confirmed. This implies that the strong error correction behavior may reflect institutional or financial adjustment mechanisms rather than a strict long-run cointegration relationship.

State expenditure

The ECM results for state expenditure present a contrasting pattern. The error correction term is negative and highly significant, confirming long-run stability. However, the magnitude of the coefficient is very small, indicating that only about 2% of disequilibrium is corrected each year. This implies extremely slow adjustment, meaning that shocks to government expenditure persist for many years.

Despite the slow adjustment speed, the ARDL bounds test strongly rejects the null hypothesis of no long-run relationship. This provides clear evidence of a stable long-run equilibrium relationship between state expenditure and its determinants. The low short-run explanatory power (low R^2) suggests that short-run fluctuations in expenditure are limited, consistent with the idea that fiscal policy is characterized by rigidity and gradual adjustment rather than rapid responses.

State revenue

The results for state revenue closely mirror those for state expenditure. The error correction term is negative and highly significant, but the adjustment speed is again very slow, with only about 2–3% of disequilibrium corrected annually. This indicates that fiscal revenues respond sluggishly to deviations from long-run equilibrium.

The bounds test confirms the existence of a statistically significant long-run relationship, implying that state revenue is tied to its determinants in the long run. However, the low R^2 in the short-run equation suggests that short-term fluctuations in revenue are influenced by factors not captured in the model or are inherently limited due to institutional and structural constraints.

Unemployment

Two ECM specifications for unemployment show a negative and statistically significant error correction term, indicating rapid adjustment. Between 46% and 54% of disequilibrium is corrected within one year, implying faster adjustment than for fiscal variables.

In the short run, oil and gas price increases significantly reduce unemployment, likely through higher energy-sector activity and fiscal spillovers. However, ARDL bounds tests do not support a long-run relationship, suggesting that the unemployment effects of energy prices are temporary rather than structural.

Comparative assessment and economic implications

Taken together, the results reveal substantial heterogeneity across macroeconomic variables. Financial variables such as short-term loans exhibit rapid adjustment, while fiscal variables such as state revenue and expenditure adjust extremely slowly but are characterized by strong long- run relationships. Investment variables display delayed responses and slow convergence, reflecting planning horizons and adjustment costs.

From a policy perspective, these findings suggest that energy price shocks transmit quickly to financial markets and employment but influence investment and fiscal aggregates through slower and more persistent channels. The absence of strong long-run relationships in several models highlights the importance of distinguishing between short-run stabilization effects and long-run structural dynamics when designing economic policy in energy-dependent economies.

Stationarity and short-run ARDL analysis with I (2) gas prices stationarity

Analysis of gas prices

Academic interpretation

Before estimating the ARDL models, unit root tests were applied to the gas price series. The ADF results show that the logarithm of gas prices is non-stationary in levels and after first differencing, but becomes stationary after second differencing. The test statistic for the second- differenced series (D2LGAS) is significant at the 1% level, confirming that gas prices are integrated of order two, I(2).

This result has important methodological implications. Since standard ARDL and cointegration techniques require variables to be I(0) or I(1), a valid long-run cointegration analysis involving gas prices is not possible. As a result, the analysis focuses on short-run dynamics using the stationary second-differenced gas price series, which captures changes in the growth rate of gas prices.

Table 2

ADF unit root test results for gas prices

Variable	ADF Statistic	1% CV	5% CV	10% CV	p-value	Conclusion
D2LGAS	-9.5250	-4.004	-3.099	-2.690	0.0000	Stationary (I(0))

Source: *Author's calculations based on the dataset and econometric estimations.*

Short-run ARDL results: capital investment academic

Interpretation

The ARDL (1,0) model for capital investment examines whether short-run fluctuations in capital investment respond to changes in the growth rate of gas prices. The lagged dependent variable is statistically insignificant, indicating that capital investment does not exhibit persistence in this specification. Similarly, the coefficient on D2LGAS is positive but statistically insignificant, suggesting that acceleration in gas price growth does not exert a meaningful short-run influence on capital investment.

The overall model fit is extremely weak, as reflected in the very low R^2 and insignificant F-statistic. This implies that capital investment dynamics are largely driven by factors not captured in the model, such as macroeconomic conditions, interest rates, or policy variables. The low Durbin–Watson statistic further suggests possible residual autocorrelation, reinforcing the limited explanatory power of the model.

Table 3

ARDL (1,0) results for capital investment

Variable	Coefficient	p-value	Interpretation
CAPITAL INVESTMENT (-1)	0.0114	0.6812	No persistence
D2LGAS	2.2136	0.8625	No short-run effect
Constant	90.0820	0.0000	Significant baseline level
R^2	**0.0191**		Very weak fit
Adjusted R^2	**-0.1590**		Poor explanatory power
F-statistic (p-value)	**0.8991**		Model not significant
Durbin–Watson	**0.919**		Possible autocorrelation

Source: *Author's calculations based on the dataset and econometric estimations.*

Short-run ARDL results: GDP growth

Academic interpretation

The ARDL (1,2) model for GDP growth explores whether changes in the growth rate of gas prices affect short-run economic growth. The lagged GDP growth term is positive, indicating persistence in growth dynamics, although it is not statistically significant.

The coefficients on D2LGAS suggest a positive relationship between gas price acceleration and GDP growth in the short run. The contemporaneous effect is borderline significant at the 10% level, while the lagged effects are also positive but statistically weak. This pattern is consistent with the structure of an energy-exporting economy, where increases in energy prices may temporarily stimulate economic activity. However, the lack of strong statistical significance and the low adjusted R^2 indicate that the evidence is not robust.

Table 4

ARDL (1,2) results for GDP growth

Variable	Coefficient	p-value	Interpretation
GDPGROWTH (-1)	0.8166	0.1900	Growth persistence
D2LGAS	6.9502	0.0971	Borderline positive effect
D2LGAS (-1)	1.4317	0.1964	Insignificant lag
D2LGAS (-2)	6.3690	0.1191	Weak delayed effect
Constant	0.1880	0.8920	Not significant
R^2	**0.3126**		Moderate
Adjusted R^2	**0.0071**		Very low

F-statistic (p-value)	**0.4456**	Not significant
Durbin–Watson	**2.23**	No autocorrelation

Source: *Author's calculations based on the dataset and econometric estimations.*

Short-run ARDL results: poverty level academic

Interpretation

The ARDL (1,0) results for poverty levels reveal strong persistence in poverty dynamics. The lagged poverty variable is highly statistically significant, indicating that past poverty levels are a dominant determinant of current poverty. In contrast, the coefficient on D2LGAS is statistically insignificant, suggesting that short-run changes in gas price growth do not directly affect poverty levels.

The model exhibits an exceptionally high R^2, largely driven by the persistence of poverty. This implies that poverty reduction is a slow-moving process influenced more by structural and social factors than by short-term energy price fluctuations. Any potential impact of gas prices on poverty is likely indirect and transmitted through channels such as economic growth or government spending.

Table 5

ARDL (1,0) results for poverty level

Variable	**Coefficient**	**p-value**	**Interpretation**
POVERTYLEVEL (-1)	0.6653	0.0000	Strong persistence
D2LGAS	0.0618	0.7032	No short-run effect
Constant	1.7258	0.0009	Significant baseline
R^2	**0.9111**		Very strong fit
Adjusted R^2	**0.8975**		Robust
F-statistic (p-value)	**0.0000**		Highly significant
Durbin–Watson	**1.98**		No autocorrelation

Source: *Author's calculations based on the dataset and econometric estimations.*

Overall assessment

The stationarity analysis confirms that gas prices are integrated of order two, necessitating the use of second differences and restricting the analysis to short-run dynamics. Across the ARDL models, gas price acceleration does not exert a statistically robust influence on capital investment or poverty levels, while its impact on GDP growth is weak and only marginally significant. In contrast, the persistence of macroeconomic variables such as GDP growth and poverty levels dominates short-run dynamics.

These findings suggest that gas price shocks in Azerbaijan primarily affect the economy through indirect and delayed channels rather than through immediate short-run effects on investment and social indicators.

RESULTS AND DISCUSSION

The results reveal clear asymmetries in how energy price shocks affect the Azerbaijani economy. Investment shows strong persistence and only limited short-run sensitivity to gas price movements; current investment is driven mainly by past levels, with only delayed negative effects indicating that higher energy prices eventually dampen investment through uncertainty and cost pressures.

Macroeconomic activity, measured by GDP growth, displays only marginal and short-lived responses to energy price increases. The contemporaneous effect is weakly positive, but lagged effects are insignificant, suggesting that energy-driven growth impulses are temporary - consistent with patterns in energy-exporting economies.

Poverty dynamics are dominated by internal persistence, with no significant effect from gas price shocks. This indicates that poverty reduction in Azerbaijan is shaped primarily by structural and social factors rather than external price fluctuations.

Fiscal variables exhibit the strongest and most stable link to energy prices. Both revenues and expenditures are highly persistent and show robust long-run relationships with gas prices.

Government spending reacts immediately and positively, while revenues adjust more moderately but significantly, underscoring the fiscal system's dependence on hydrocarbons.

Labor market responses differ: unemployment declines in the short run following positive energy shocks, with rapid adjustment implied by strong error-correction terms. However, the lack of long-run cointegration suggests these improvements are temporary rather than structural.

Overall, the evidence highlights a clear policy contrast: fiscal indicators are deeply tied to energy prices, whereas growth, investment, and social outcomes exhibit only weak or delayed responses - revealing uneven transmission of energy shocks across the economy.

CONCLUSION AND POLICY IMPLICATIONS

This study shows that Azerbaijan's macroeconomic performance remains closely tied to external oil and gas price movements. Fiscal variables exhibit strong long-run dependence on energy prices, while investment, GDP growth, and poverty respond mainly through short-run or lagged channels. Unemployment adjusts quickly but only temporarily. Overall, energy shocks transmit asymmetrically across sectors, reflecting the economy's high resource dependence.

Several policy implications arise:

1. Strengthen fiscal stabilization:

The strong sensitivity of revenues and expenditures to energy prices highlights the need to reinforce fiscal buffers, enhance SOFAZ's countercyclical role, and adopt more conservative spending rules.

2. Promote diversification:

Weak investment and GDP responses reveal persistent structural constraints. Supporting SMEs, manufacturing, renewables, and human capital development can reduce hydrocarbon dependence.

3. Stabilize labor markets:

Since unemployment reacts rapidly to shocks, active labor-market measures - training, re-skilling, and targeted employment support - can ease adjustment.

4. Improve investment planning:

Delayed investment effects underline the importance of forward-looking risk assessments and scenario-based planning for both public and private investment.

5. Reduce exposure to external gas markets:

Greater focus on renewables, energy efficiency, and diversified export markets would help mitigate vulnerability to European gas price cycles.

Together, these steps would strengthen Azerbaijan's resilience and lessen long-term exposure to external energy shocks.

LIMITATIONS

This study has several limitations. First, the use of annual data prevents capturing short-term volatility in energy markets; higher-frequency data could yield richer dynamics. Second, the sample period includes major structural breaks (2008–2009, 2014–2016, 2020–2022), which may affect parameter stability despite the robustness of ARDL models. Third, the I (2) nature of the gas price series restricts the estimation of a full long-run ARDL model, limiting the analysis mainly to short-run effects. Fourth, the exclusion of variables such as global financial conditions, geopolitical risks, and institutional quality - due to data constraints - may lead to omitted- variable bias. Finally, the study assumes linear transmission, whereas energy shock effects may be asymmetric or non-linear, indicating potential directions for future research.

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Azərbaycanda enerji şokları və iqtisadi artım: ekonometrik təhlil

Xülasə

Məqalə enerji qiyməti şoklarının Azərbaycan iqtisadiyyatına təsirini araşdıraraq, həm qısamüddətli dinamikaları, həm də potensial uzunmüddətli əlaqələri əks etdirən ARDL və ECM modellərindən istifadə edir. Stasionarlıq testləri göstərir ki, qaz qiymətləri ikinci dərəcədə inteqrasiya olunub və bu, analizin yalnız qısamüddətli, stasionar çevrilmələr əsasında aparılmasını zəruri edir. Empirik nəticələr enerji qiyməti şoklarının makroiqtisadi dəyişənlər üzrə heterogen təsirlərə malik olduğunu göstərir: kapital investisiyaları və yoxsulluq səviyyəsi qısamüddətli perspektivdə əhəmiyyətli reaksiya göstərmir, ÜDM artımı isə yalnız zəif və sərhədyanı təsir nümayiş etdirir. Bunun əksinə olaraq, fiskal dəyişənlər - dövlət gəlirləri və xərcləri - enerji qiymətləri ilə güclü və stabil uzunmüddətli əlaqələrə malikdir ki, bu da Azərbaycanda neft-qaz sektorunun dövlət maliyyəsinə təsirinin həlledici xarakterini vurğulayır. İşsizlik digər dəyişənlərlə müqayisədə daha sürətli tənzimlənir və enerji qiymətlərinin müsbət şoklarına qısamüddətli dövrdə azalma ilə reaksiya verir. Ümumilikdə, nəticələr Azərbaycanın xarici enerji bazarındakı dalğalanmalara qarşı yüksək makroiqtisadi həssaslığını nümayiş etdirir və iqtisadi diversifikasiya ilə fiskal sabitləşdirmə mexanizmlərinin gücləndirilməsinin vacibliyini önə çıxarır.

Açar sözlər: *enerji qiyməti şokları; ARDL; ECM; Azərbaycan iqtisadiyyatı; makroiqtisadi həssaslıq; fiskal asılılıq*.