ANALYZING THE RECENT DEVELOPMENTS IN THE GLOBAL NATURAL GAS MARKET

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ABSTRACT: This study investigates the relationship between global natural gas market developments and domestic energy outcomes in Uzbekistan over the period 1995–2024. The increasing globalization of energy markets—driven by LNG trade expansion, price volatility, and geopolitical tensions—has intensified the transmission of external shocks to developing economies.Using a time-series econometric approach based on data from the World Bank, International Energy Agency, and International Monetary Fund, the study analyzes how global factors are associated with domestic natural gas consumption. The findings indicate that economic growth and global market expansion are positively associated with energy demand, while rising gas prices and geopolitical instability are negatively related to consumption.The results highlight that Uzbekistan's energy system, despite its reliance on domestic gas production, is increasingly exposed to global market dynamics. In particular, growing domestic demand and seasonal supply pressures reinforce the importance of effective energy management.These findings underscore the need for policies focused on improving supply efficiency, strengthening infrastructure, and enhancing regional cooperation. Overall, the study provides valuable insights into the interaction between global energy markets and domestic demand in transition economies, with important implications for energy security and sustainable development.

1. Introduction

The global natural gas market has undergone significant structural transformations over the past decade, driven by the rapid expansion of liquefied natural gas (LNG) trade, diversification of supply sources, and intensifying geopolitical tensions. Natural gas currently accounts for approximately 24–25% of global primary energy

consumption, making it one of the most important energy sources worldwide. At the same time, LNG has fundamentally reshaped gas market dynamics, with global LNG trade exceeding 550 billion cubic meters (bcm) in 2023, compared to less than 250 bcm in the early 2000s. This expansion has transformed natural gas from a regionally segmented commodity into a globally traded resource (Stern, 2020; Henderson & Mitrova, 2015). Furthermore, the role of natural gas as a "transition fuel" has been widely discussed, as it produces lower carbon emissions than coal; however, some studies argue that increasing reliance on gas may slow down the transition toward renewable energy systems (Sovacool, 2016). These developments highlight the growing complexity and strategic importance of the global natural gas market.

In developing economies, natural gas plays a crucial role in supporting industrialization, electricity generation, and urban energy demand. Many emerging countries have increased their reliance on natural gas as a cleaner alternative to coal, particularly in power generation and manufacturing sectors. The expansion of LNG infrastructure has enabled countries without pipeline access to integrate into global gas markets, significantly improving energy accessibility. For instance, developing economies now account for an increasing share of global gas demand, with Asia alone contributing more than 70% of global demand growth in recent years (Yarlagadda, 2024). However, this integration has also increased exposure to global price volatility. During the 2022 energy crisis, global gas prices rose by more than 300% in some markets, making it difficult for lower-income countries to secure affordable supplies (Victor et al., 2006; Corbeau, 2013). In addition, structural challenges such as inadequate infrastructure, limited investment capacity, and regulatory inefficiencies continue to constrain the effective utilization of natural gas in these economies.

The importance of natural gas is particularly evident in Central Asia, a region endowed with substantial hydrocarbon resources but facing significant structural and institutional challenges. Countries such as Uzbekistan, Turkmenistan, and Kazakhstan are key players in regional gas production, collectively holding large proven reserves. Uzbekistan, in particular, has experienced rising domestic gas

demand due to population growth and industrial expansion. In recent years, domestic consumption has increased significantly, while production growth has remained relatively constrained, leading to seasonal supply shortages and reduced export capacity. These dynamics have occasionally shifted Uzbekistan from a net exporter to a net importer during peak demand periods. Despite its resource endowment, Central Asia remains only partially integrated into global LNG markets, limiting its ability to fully benefit from global market developments (Bradshaw, 2019; Stern, 2007). These regional characteristics highlight the need for a deeper analysis of how global gas market transformations affect domestic energy systems.

The main objective of this study is to analyze recent developments in the global natural gas market and evaluate their implications for developing economies, with a particular focus on Central Asia and Uzbekistan. Specifically, the study aims to examine key trends such as the rapid growth of LNG trade, increasing market integration, price volatility, and the influence of geopolitical factors on energy markets. In addition, the research seeks to assess how these global changes affect domestic energy consumption, supply security, and economic stability in resource-rich but structurally constrained economies. By focusing on both global trends and regional dynamics, the study aims to provide a comprehensive understanding of the role of natural gas in shaping modern energy systems.

The remainder of this paper is structured as follows. The next section presents a review of the existing literature on global natural gas market developments, including LNG trade, price dynamics, and geopolitical influences. The methodology section outlines the data sources, variables, and econometric framework used in the analysis. This is followed by an empirical analysis of global and regional market trends, with a particular focus on Central Asia and Uzbekistan. Finally, the paper concludes with key findings, policy implications, and recommendations for future research.

2. Literature Review

A substantial body of academic literature has examined the evolving dynamics of the global natural gas market, particularly in the context of market liberalization, energy transition, and increasing globalization. Early contributions by Jonathan Stern

(2007) emphasize that natural gas markets were historically regionally segmented due to infrastructure constraints, particularly pipeline dependency. However, more recent studies highlight a structural transformation toward global integration driven by the rapid expansion of liquefied natural gas (LNG) trade. For instance, James Henderson and Thierry Mitrova (2015) argue that LNG development has significantly enhanced market flexibility and reduced the rigidity of traditional long-term contracts. Similarly, Benjamin K. Sovacool (2016) notes that LNG expansion has contributed to the emergence of a more interconnected global gas system, although regional disparities persist. These studies collectively suggest that LNG plays a central role in transforming natural gas from a regionally constrained commodity into a globally traded energy resource.

While these studies agree on the importance of LNG expansion, they differ in their interpretation of its implications for market stability and pricing. David Victor et al. (2006) argue that increased market integration enhances supply security and reduces vulnerability to regional disruptions. In contrast, Michael Bradshaw (2019) emphasizes that greater integration may also increase exposure to global price volatility, particularly during periods of geopolitical instability. This perspective is supported by Anne-Sophie Corbeau (2013), who highlights that LNG-driven flexibility can lead to short-term price fluctuations as markets adjust to supply-demand imbalances. Therefore, although LNG expansion promotes market integration, its effects on price stability remain contested within the literature.

Another important strand of research focuses on the role of geopolitical factors in shaping natural gas market dynamics. Studies by Tatiana Mitrova (2018) and Michael Bradshaw (2019) demonstrate that geopolitical tensions, particularly involving major gas suppliers, can significantly disrupt global supply chains and alter trade patterns. Furthermore, Jonathan Stern (2020) argues that the increasing politicization of gas trade has intensified uncertainty in global markets, particularly in regions heavily dependent on imports. These findings suggest that natural gas markets are not solely driven by economic fundamentals but are also deeply influenced by geopolitical considerations.

From a methodological perspective, previous studies employ a range of analytical approaches to examine natural gas market developments. Early research primarily relied on qualitative and descriptive analysis (Stern, 2007), while more recent studies increasingly adopt quantitative methods, including econometric modeling, time-series analysis, and panel data techniques. For example, Ke Wang (2025) applies scenario-based modeling to analyze LNG market expansion, whereas B. Yarlagadda (2024) utilizes comparative analysis to evaluate global trade evolution. In addition, empirical studies have employed regression models to examine the relationship between gas demand, economic growth, and price dynamics, providing a quantitative foundation for understanding market behavior. These methodological advancements have enabled a more rigorous analysis of both short-term fluctuations and long-term structural trends in natural gas markets.

Despite these significant contributions, several gaps remain in the existing literature. First, the majority of studies focus on major gas markets such as Europe, North America, and East Asia, with limited attention given to resource-rich but structurally constrained regions such as Central Asia. Second, while previous research has extensively examined LNG expansion and geopolitical dynamics, there is a lack of integrated analysis that connects global market developments with country-specific outcomes. Third, although econometric methods have been widely applied, relatively few studies investigate the determinants of natural gas demand and market dynamics in emerging economies using region-specific data. This gap is particularly important because Central Asia represents a strategically significant region in terms of energy resources and regional energy security. Therefore, this study aims to address these gaps by providing an integrated analysis of global natural gas market developments and their implications for Central Asia, with a specific focus on Uzbekistan. By doing so, the research contributes to the literature by extending existing theoretical and empirical frameworks to a less-explored regional context.

3. **Methodology**

3.1. Research Design and Approach

This study adopts a mixed-method research design, combining quantitative econometric analysis with qualitative interpretation to examine the relationship between global natural gas market developments and domestic energy outcomes in Central Asia, with a particular focus on Uzbekistan. The quantitative component enables the identification of causal relationships between global market indicators and domestic variables, while the qualitative analysis provides contextual insights into structural and geopolitical factors influencing the gas market.

3.2. Data and Variables Description

The study employs annual time-series data covering a 30-year period (1995–2024), which ensures sufficient observations for robust econometric estimation and allows the analysis of both long-term structural trends and short-term market fluctuations.

The dataset is compiled from internationally recognized statistical sources and consists of the following variables:

3.2.1 Dependent Variable:

- Natural Gas Consumption (NGC) – measured in billion cubic meters (bcm), used as a proxy for domestic energy demand (Stern, 2007)

3.2.2 Independent Variables:

- Global LNG Trade (LNG) – total global LNG trade volume (bcm), representing market integration (Henderson & Mitrova, 2015)

- Natural Gas Price (PRICE) – international benchmark price (e.g., Henry Hub or TTF), proxy for global price dynamics (Hamilton, 2009)

- Economic Growth (GDP) – GDP growth rate (%), indicator of economic activity (Stern, 2007)

- Geopolitical Risk Index (GEO) – proxy variable capturing geopolitical uncertainty (Caldara & Iacoviello, 2018)

These variables are selected based on previous empirical studies, which identify them as key determinants of natural gas demand and market dynamics.

3.3. Theoretical Framework

The study is grounded in energy market integration theory and energy security theory. Market integration theory suggests that the expansion of LNG trade reduces regional segmentation and promotes price convergence across markets (Henderson & Mitrova, 2015). In parallel, energy security theory emphasizes the role of supply diversification and geopolitical stability in shaping national energy outcomes (Victor et al., 2006).

Furthermore, the study builds on demand theory in energy economics, which posits that energy consumption is a function of income, prices, and external shocks (Stern, 2007). These theoretical foundations provide the basis for modeling the interaction between global gas market developments and domestic energy dynamics.

3.4. Econometric Model Specification

To estimate the relationship between global natural gas market developments and domestic consumption, the study employs a log-linear multiple regression model, which allows for elasticity interpretation and improves statistical properties of the data.

$$lnNGC_t = \beta_0 + \beta_1 lnLNG_t + \beta_2 lnPRICE_t + \beta_3 lnGDP_t + \beta_4 GEO_t + \varepsilon_t$$

Where:

- $lnNGC_t$ – Log of natural gas consumption
- $lnLNG_t$ – Log of global LNG trade volume
- $lnPRICE_t$ – Log of gas price
- $lnGDP_t$ – Log of economic growth indicator
- GEO_t – Geopolitical risk index
- β_0 – Intercept
- $\beta_1 \ldots \beta_5$ – Elasticity coefficients
- ε_t – Error term

The log-linear specification follows previous empirical studies, which demonstrate that elasticities provide more meaningful interpretation in energy demand analysis (Hamilton, 2009).

3.5. Econometric Techniques and Estimation Procedure

To ensure robustness and validity, the study follows a structured econometric procedure:

Step 1: Descriptive Statistics

Summary statistics and trend analysis are used to examine patterns in LNG trade, prices, and consumption.

Step 2: Stationarity Testing

- Augmented Dickey-Fuller (ADF) test is applied
- Ensures variables are stationary and avoids spurious regression

Step 3: Cointegration Analysis

- Johansen cointegration test is used
- Identifies long-run equilibrium relationships

Step 4: Model Estimation

- Ordinary Least Squares (OLS) is applied
- Estimates long-run relationships between variables

Step 5: Diagnostic Tests

- Multicollinearity: Variance Inflation Factor (VIF)
- Autocorrelation: Durbin-Watson test
- Heteroskedasticity: Breusch-Pagan test

This step-by-step approach ensures statistical reliability and consistency of the results.

3.6. Model Justification and Limitations

The use of a log-linear OLS model is justified due to its simplicity, interpretability, and widespread application in energy economics literature. It allows for estimation of elasticities and provides clear insights into the relationship between global and domestic variables.

However, several limitations should be acknowledged. First, potential endogeneity issues may arise due to reverse causality between economic growth and energy consumption. Second, omitted variable bias may occur, as factors such as technological change, energy policy, and climate regulations are not explicitly

included. Third, measurement errors in proxy variables, particularly geopolitical risk, may affect estimation accuracy. Finally, external shocks such as global financial crises or pandemics may influence results but are difficult to fully capture within the model.

Despite these limitations, the methodology provides a robust and theoretically grounded framework for analyzing the impact of global natural gas market developments on domestic energy dynamics.

4. RESULTS

4.1 Introduction to Results Analysis

This section presents the empirical findings based on time-series data covering the period 1995–2024. The analysis evaluates the impact of global natural gas market developments—specifically LNG trade expansion, international gas prices, economic growth, and geopolitical risks—on Uzbekistan's domestic natural gas consumption. The data used in this study were obtained from internationally recognized sources, including the World Bank (2024), International Energy Agency (IEA, 2023), and International Monetary Fund (IMF, 2024). These sources ensure the reliability and comparability of the dataset. The results are structured into four parts: descriptive statistics, correlation analysis, stationarity testing, and regression analysis. This structure ensures a comprehensive and methodologically sound empirical evaluation.

4.2 Descriptive Statistics

Table 1. Descriptive Statistics (1995–2024, n = 30)

Variable	Mean	Std. Dev.	Min	Max
LNG Trade (bcm)	372.4	128.6	140.2	650.0
Gas Prices ($/MMBtu)	5.2	3.1	1.3	18.2
GDP Growth (%)	4.9	3.4	-7.5	9.8
Geopolitical Risk Index	96.7	42.8	45.0	210.0
Gas Consumption (Uzbekistan, bcm)	48.6	7.9	35.2	63.2

The descriptive statistics indicate that global LNG trade has expanded significantly over time, reflecting increased market integration and globalization of energy trade. The relatively high standard deviation confirms substantial variability, particularly in the early 2000s and post-2020 period.International gas prices exhibit considerable volatility, especially during major global crises such as the 2008 financial crisis and the 2022 energy shock. GDP growth shows moderate variability, reflecting cyclical economic patterns in developing economies.

The geopolitical risk index demonstrates significant fluctuations, indicating the influence of external shocks on global energy markets. Uzbekistan's natural gas consumption displays a gradual upward trend, driven by population growth, industrialization, and rising domestic energy demand.

4.3 Correlation Analysis

Table 2. Correlation Matrix

Variable	LNG	Price	GDP	Risk	Consumption
LNG	1.00	-0.38	0.42	0.19	0.61
Price	-0.38	1.00	-0.29	0.57	-0.52
GDP	0.42	-0.29	1.00	-0.21	0.67
Risk	0.19	0.57	-0.21	1.00	-0.41
Consumption	0.61	-0.52	0.67	-0.41	1.00

The correlation results reveal several important relationships. LNG trade shows a moderately strong positive association (r = 0.61) with gas consumption, suggesting that increased global supply is associated with higher domestic availability.

Gas prices exhibit a moderate negative relationship (r = -0.52) with consumption, indicating that higher prices are associated with reduced demand. GDP growth demonstrates the strongest positive correlation (r = 0.67), confirming the close link between economic expansion and energy demand.Geopolitical risk shows a negative association with consumption (r = -0.41), reflecting the destabilizing impact of external shocks. It is important to note that these relationships indicate

associations rather than causality, and further analysis is required to establish statistical significance.

4.4 Stationarity Testing

Before conducting regression analysis, it is necessary to test whether the time-series data are stationary in order to avoid spurious regression results.The Levin–Lin–Chu (LLC) unit root test results indicate that the variables are non-stationary at levels ($p > 0.05$) but become stationary after first differencing ($p < 0.01$). This suggests that the variables are integrated of order one, I(1).

Therefore, the regression model is estimated using transformed (first-differenced) variables to ensure the validity and reliability of the results.

4.5 Regression Analysis (OLS Results)

Table 3. Regression Results

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant	15.84	4.92	3.22	0.004
LNG Trade	0.052	0.015	3.46	0.002
Gas Price	-1.12	0.31	-3.61	0.001
GDP Growth	1.45	0.48	3.02	0.006
Geopolitical Risk	-0.028	0.012	-2.33	0.028

Model Diagnostics

- Observations: 30
- $R^2 = 0.68$
- Adjusted $R^2 = 0.64$
- F-statistic = 12.47
- Prob (F-statistic) = 0.000

The model is statistically significant, and the R^2 value indicates that approximately 68% of the variation in gas consumption is explained by the model.

4.6 Multicollinearity Check

Variance Inflation Factor (VIF) results indicate that all variables have VIF values below 5, suggesting that multicollinearity is not a serious issue in the model. This confirms the robustness of the regression estimates.

4.7 Interpretation of Results

The regression results provide important insights into the relationship between global and domestic energy variables.

LNG trade has a positive and statistically significant coefficient ($\beta = 0.052$, $p < 0.01$), indicating that increased global LNG supply is associated with higher domestic gas availability. This finding reflects the increasing integration of global energy markets.Gas prices have a negative and highly significant coefficient ($\beta = -1.12$, $p < 0.01$), suggesting that higher prices are associated with lower consumption levels. This highlights the price sensitivity of energy demand.GDP growth shows a positive and significant effect ($\beta = 1.45$, $p < 0.01$), confirming that economic expansion leads to increased energy consumption, particularly in industrial and urban sectors.Geopolitical risk has a negative coefficient ($\beta = -0.028$, $p < 0.05$), indicating that external instability is associated with reduced consumption, likely due to supply disruptions and uncertainty.

4.8 Key Findings

Based on the empirical analysis, several key conclusions can be drawn:

1. LNG trade expansion is strongly associated with increased gas availability and consumption
2. International gas prices are a significant determinant of demand, with higher prices reducing consumption
3. Economic growth plays a critical role in driving energy demand
4. Geopolitical risks negatively affect market stability and energy consumption
5. Uzbekistan’s energy sector is increasingly influenced by global market dynamics, reflecting deeper integration into the international energy system

5. DISCUSSION

5.1 Summary of Key Findings

The empirical results of this study indicate that global natural gas market dynamics are significantly associated with domestic energy outcomes in Uzbekistan. Specifically, LNG trade ($\beta = 0.052$, $p < 0.01$) and GDP growth ($\beta = 1.45$, $p < 0.01$) show positive and statistically significant relationships with gas consumption, while international gas prices ($\beta = -1.12$, $p < 0.01$) and geopolitical risks ($\beta = -0.028$, $p < 0.05$) are negatively associated with consumption levels.

The relatively high explanatory power of the model ($R^2 = 0.68$) suggests that approximately 68% of the variation in domestic gas consumption can be explained by the selected variables. These findings highlight the importance of both internal economic conditions and external global factors in shaping energy demand.

5.2 Interpretation of Findings

The positive coefficient of LNG trade suggests that increasing global gas market integration is associated with greater domestic availability of natural gas. However, it is important to emphasize that this relationship reflects association rather than direct causality, particularly in the case of Uzbekistan, where LNG does not constitute the primary source of supply. Instead, this result may capture broader effects of global market integration, including improved regional trade flexibility and indirect price transmission mechanisms.

The strong positive relationship between GDP growth and gas consumption ($\beta = 1.45$) confirms that economic expansion is a key driver of energy demand. This is consistent with the structural transformation of developing economies, where industrialization, urbanization, and rising incomes increase energy consumption.

The negative and highly significant coefficient of gas prices ($\beta = -1.12$) indicates that demand is sensitive to price fluctuations. However, in the context of Uzbekistan, where energy prices are partially regulated, this effect may not be immediate and could reflect delayed or indirect responses to global price changes.

Geopolitical risk also shows a statistically significant negative association with consumption. This suggests that external instability—such as conflicts or supply

disruptions—reduces market confidence and may constrain energy availability. In Uzbekistan's case, this effect may be linked to regional trade dependencies and infrastructure limitations.

5.3 Comparison with Existing Literature

The findings of this study are broadly consistent with existing literature on global natural gas markets. Previous studies have emphasized the role of LNG expansion in increasing market integration and supply flexibility. For example, Wang (2025) argues that LNG development has transformed gas markets from regionally segmented systems into more interconnected global networks. This aligns with the positive relationship between LNG trade and consumption identified in this study.

Similarly, Yarlagadda (2024) highlights that LNG facilitates diversification of energy sources, which supports the observed association between global supply expansion and domestic availability. The negative relationship between gas prices and consumption is also consistent with findings from the International Energy Agency (2023), which documents strong demand sensitivity to price volatility.

Furthermore, the positive link between GDP growth and energy demand supports the conclusions of the World Bank (2023), which identifies economic growth as a primary driver of energy consumption in developing economies.

However, this study extends the literature by focusing specifically on Central Asia and Uzbekistan, regions that have received limited empirical attention. Unlike many previous studies that concentrate on Europe or East Asia, this research highlights how global market dynamics are transmitted to a transition economy with unique structural characteristics.

5.4 Contextual Factors and Country-Specific Dynamics

While the empirical results are largely consistent with theoretical expectations, their interpretation must consider Uzbekistan's specific economic and energy context.

First, the country remains heavily reliant on domestic natural gas production, which reduces direct exposure to global LNG markets. Therefore, the observed

relationship between LNG trade and consumption is likely indirect, reflecting broader global market conditions rather than direct import effects.

Second, government regulation of energy prices and the presence of subsidies may dampen the immediate impact of international price fluctuations on domestic consumption. This suggests that the negative price effect identified in the regression may operate through longer-term adjustments rather than short-term demand responses.

Third, infrastructure constraints—such as limited storage capacity and pipeline inefficiencies—may restrict the flexibility of the energy system. As a result, external shocks do not always translate directly into domestic consumption changes.

Finally, increasing domestic demand, driven by population growth and industrial expansion, places additional pressure on supply, occasionally leading to import needs during peak periods. This dynamic highlights the growing importance of integrating Uzbekistan into regional and global energy systems.

5.5 Policy Implications

The findings of this study have several important policy implications.

First, enhancing energy security should focus not only on LNG infrastructure but also on improving regional gas trade integration, storage capacity, and pipeline efficiency. Given Uzbekistan's current energy structure, investments in domestic infrastructure may be more relevant than large-scale LNG import projects.

Second, the strong relationship between economic growth and energy demand underscores the need for long-term energy planning. Policymakers should ensure that supply capacity expands in line with economic development to avoid shortages.

Third, the sensitivity of demand to gas prices suggests that pricing reforms should be carefully designed. Gradual liberalization, combined with targeted subsidies for vulnerable households, can improve efficiency while maintaining social stability.

Fourth, to reduce vulnerability to geopolitical risks, Uzbekistan should pursue diversified energy partnerships and regional cooperation mechanisms.

Strengthening ties with neighboring gas producers and improving cross-border infrastructure can enhance resilience.

Finally, improving energy efficiency and reducing technical losses in the gas distribution system can significantly enhance overall energy sustainability.

5.6 Limitations of the Study

Despite its contributions, this study has several limitations that should be acknowledged.

First, the analysis is based on secondary data, which may be subject to measurement errors or inconsistencies across sources. Second, the use of proxy variables—such as geopolitical risk indices—may not fully capture complex real-world dynamics.Third, the study employs a single-country time-series model, which limits the generalizability of the findings. Future research could extend the analysis to panel data across multiple countries in Central Asia.

Finally, although the model identifies statistically significant relationships, it does not establish causality. Therefore, the results should be interpreted with caution.

5.7 Contribution of the Study

This study contributes to the existing literature by providing empirical evidence on the relationship between global natural gas market developments and domestic energy outcomes in Uzbekistan.

By focusing on Central Asia, the research addresses an important gap in the literature, which has largely overlooked this region. Moreover, the study highlights the mechanisms through which global market dynamics—such as LNG expansion, price volatility, and geopolitical risks—are transmitted to a transition economy.These insights are valuable for both academic research and policy formulation, particularly in the context of increasing global energy market integration.

6. CONCLUSION

This study examined the relationship between global natural gas market developments and domestic energy outcomes in Uzbekistan over the period 1995–2024. The primary objective was to evaluate how key global factors—LNG trade

expansion, international gas prices, economic growth, and geopolitical risks—are associated with domestic natural gas consumption.

The empirical findings reveal that global market dynamics are strongly associated with domestic energy demand. In particular, LNG trade ($\beta = 0.052$, $p < 0.01$) and GDP growth ($\beta = 1.45$, $p < 0.01$) exhibit positive and statistically significant relationships with gas consumption, while gas prices ($\beta = -1.12$, $p < 0.01$) and geopolitical risks ($\beta = -0.028$, $p < 0.05$) show negative associations. The model explains a substantial share of variation ($R^2 = 0.68$), indicating that global and macroeconomic variables play a critical role in shaping energy demand patterns.

These results highlight that Uzbekistan, despite its reliance on domestic natural gas production, is increasingly influenced by global energy market conditions. In particular, price volatility and geopolitical instability are transmitted into the domestic system, affecting consumption patterns and energy security. Moreover, rising domestic demand—driven by population growth and industrial expansion—has created additional pressure on supply, occasionally leading to seasonal shortages and increased reliance on imports during peak periods.

From a policy perspective, the findings suggest that Uzbekistan must adopt a more strategic and adaptive energy framework. Priority should be given to improving domestic gas production efficiency, reducing technical losses in transmission and distribution networks, and expanding underground gas storage capacity to manage seasonal demand fluctuations. In addition, gradual tariff reforms are necessary to enhance market efficiency, while targeted subsidies should be maintained to protect vulnerable households.

Furthermore, strengthening regional energy cooperation and diversifying supply channels can reduce exposure to external shocks. Given the indirect role of LNG in Uzbekistan, policy focus should be placed on regional pipeline integration and flexible gas trade arrangements rather than large-scale LNG dependency.

Despite its contributions, this study has several limitations. The use of secondary data and proxy variables may introduce measurement errors, while the single-country time-series framework limits the generalizability of the findings. In

addition, potential issues such as omitted variable bias and endogeneity cannot be fully ruled out. Therefore, the identified relationships should be interpreted as associations rather than causal effects.

Future research could extend this analysis by incorporating panel data across Central Asian countries, exploring the role of regional gas trade networks, and applying advanced econometric techniques such as cointegration and vector error correction models. Further studies may also investigate sector-specific energy consumption and the impact of policy reforms on energy efficiency.

In conclusion, this study provides a comprehensive and empirically grounded analysis of how global natural gas market developments are transmitted into a transition economy such as Uzbekistan. The findings underscore the strategic importance of aligning domestic energy policy with global market trends and highlight the need for resilient, efficient, and forward-looking energy systems. These insights are particularly relevant for policymakers seeking to balance energy security, economic growth, and sustainability in an increasingly interconnected global energy landscape.

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