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THE ROLE OF ENERGY RESOURCES IN SHAPING INFLATIONARY PRESSURES IN THE REPUBLIC OF MOLDOVA

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The present research aims to assess the role of energy resources in generating inflationary pressures in the Republic of Moldova by analysing the relationship between energy price developments and inflation trends in recent years. The study seeks to identify how external energy shocks influence the internal cost structure, their impact on core inflation, as well as the vulnerabilities characteristic of a small and open economy with a high degree of energy dependence. The anticipated results indicate that increases in energy prices represent a key determinant of inflationary pressures in Moldova. The analysis highlights the need to enhance energy efficiency, diversify energy sources, and strengthen macroeconomic resilience.

Keywords*: inflation, energy resource prices, regression, correlation, cost, inflationary pressure.*

ROLUL RESURSELOR ENERGETICE ÎN FORMAREA PRESIUNILOR INFLAȚIONISTE ÎN REPUBLICA MOLDOVA

Prezentul demers de cercetare are ca obiectiv evaluarea rolului resurselor energetice în generarea presiunilor inflaționiste în Republica Moldova, prin analiza relației dintre evoluția prețurilor la energie și tendințele inflației din ultimii ani. Studiul vizează identificarea modului în care șocurile energetice externe influențează structura internă a costurilor, impactul acestora asupra inflației de bază, precum și vulnerabilitățile caracteristice unei economii de dimensiuni reduse și deschise, cu un nivel ridicat de dependență energetică. Rezultatele anticipate indică faptul că majorarea prețurilor la energie constituie un determinant esențial al presiunilor inflaționiste din Moldova. Analiza subliniază necesitatea creșterii eficienței energetice, a diversificării surselor de energie și a întăririi rezilienței macroeconomice.

Cuvinte-cheie: *inflație, prețuri ale resurselor energetice, regresie, corelație, cost, presiune inflaționistă.*

Introduction

Energy is one of the most sensitive factors of macroeconomic stability, and for import-dependent economies such as the Republic of Moldova, the dynamics of energy resource prices become a central determinant of inflation. The very limited structure of domestic resources means that most external shocks — geopolitical, climatic or commercial — are quickly transmitted to domestic prices, generating persistent inflationary pressures.

The influence of energy resources on inflationary processes in import-dependent economies is a subject of fundamental importance. The Republic of Moldova, characterised by significant dependence on imports of natural gas, petroleum products and electricity, feels the impact of their price fluctuations in an amplified way. The rise in energy prices affects not only production, transport and service costs, but also the general price level, generating cost-push inflationary pressures.

The period 2020–2025 is relevant for analysing the mechanisms of energy transmission on inflation, as it includes both stable phases (2020–2021 and 2023–2025) and extreme episodes: the energy crisis of 2022, the most severe in recent decades. In this context, the present research explores how natural gas, electricity and diesel prices determine the evolution of the inflation rate in the Republic of Moldova.

The aim of the article is to build an econometric model, based on multiple linear regression, which highlights the contribution of different energy resources to inflation and provides an in-depth economic interpretation of the results.

A key factor amplifying inflationary pressures is the high structural dependence on imports. In 2023, the Republic of Moldova managed to cover only about 23% of its energy needs from domestic resources, with the rest coming from external markets [7]. This dependence means that domestic prices are closely correlated with international developments in natural gas, petroleum products and electricity. The structure of primary energy sources clearly illustrates this exposure: petroleum products account for 43% of gross domestic consumption and natural gas for about 22%, both of which are overwhelmingly imported [3]. The combination of petroleum products and natural gas covers about 65% of gross domestic consumption, indicating a massive external dependence on these resources. Any increase in external prices is directly reflected in production, transport and final consumption costs.

The evolution of the inflation rate in the Republic of Moldova and beyond reflects in detail the major inflationary shock generated by the explosion of energy prices in the tense regional context of the Russian Federation's invasion of Ukraine. The main factors were [3]:

1.1. The sharp rise in natural gas prices

In 2022, natural gas prices for end consumers increased more than fivefold in a single year because of rising international prices and reduced supplies from the Russian Federation. This situation led to higher household bills, increased operating costs for industry and agriculture, and erosion of sectoral competitiveness.

1.2. Sharp increase in electricity prices. Electricity tariffs exceeded 5 lei/kWh at the end of 2022, amplifying inflationary pressures through heating, lighting and industrial production costs.The increases particularly affected energy-intensive sectors, leading to

1.3 Knock-on effects on consumption and economic behaviour. As a result of the price increases, natural gas consumption fell by about 50% in the winter of 2022–2023, including through substitution with fuel oil and reduced household demand. Businesses incurred additional fuel and electricity costs, which were passed on to food and non-food prices, amplifying overall inflation.

1.4 Substantial fiscal effort to cushion inflation. To limit the social impact of price increases, the government intervened with compensation programmes *("Ajutor la Contor" or "Help at the Meter"),* allocating approximately 5 billion lei during the cold season of 2022–2023 for energy subsidies. Although these measures eased the pressure on household budgets, they amplified the pressure on public finances, ***constituting an indirect channel of influence on inflation by widening the budget deficit.***

Materials and methods

The data used are monthly series for the period January 2020–October 2025, including:

- Natural gas price (lei/m³);
- Electricity price (lei/kWh);
- Price of diesel fuel (lei/litre);
- Annual inflation rate (%).

Monthly series are preferred to capture both sudden shocks (e.g. 2022) and short-term transmission effects.

The data comes from aggregated and processed statistical series based on official information on inflation rate developments published on the official website of the National Bank of Moldova [8] and on the prices of primary energy resources; natural gas, diesel and electricity taken from the official website of the National Energy Regulatory Agency [2; 4-6] as well as public information and data provided upon request by the regulatory authority.

The evolution of fuel prices for transport services is reflected in the evolution of a single type of product – diesel fuel, which accounts for the most significant share of total fuel used in the provision of transport services (over 70%) and allows for a substantial simplification of the research analysis of hypotheses.

The analysis consists of two main components: (i) correlation analysis (Pearson coefficient) to assess the strength and sign of bivariate relationships; (ii) econometric analysis using OLS regressions to estimate the relative contribution of each energy component to the variation in the inflation rate [1].

The Pearson coefficient r was accompanied by a significance test (p-value) to verify whether the observed correlations are statistically different from zero. In regressions, the significance of the coefficients was assessed based on t-statistics (p-values), and the explanatory power of the models was assessed using R^2 and adjusted R^2.

The research implements the simple linear correlation, linear regression and multifactorial regression methods as research tools.

Working hypotheses:

(H1) – changes in the price of energy resources (natural gas, electricity and diesel) are equally associated with increases in the inflation rate.

(H2) – changes in the price of natural gas and electricity have the most significant influence on the inflation rate.

Results and Discussion

To observe the dependence between the annual inflation rate, as an endogenous variable, and the exogenous reference variables, the evolution of the indicators for the analysis period was analysed (Figure 1).

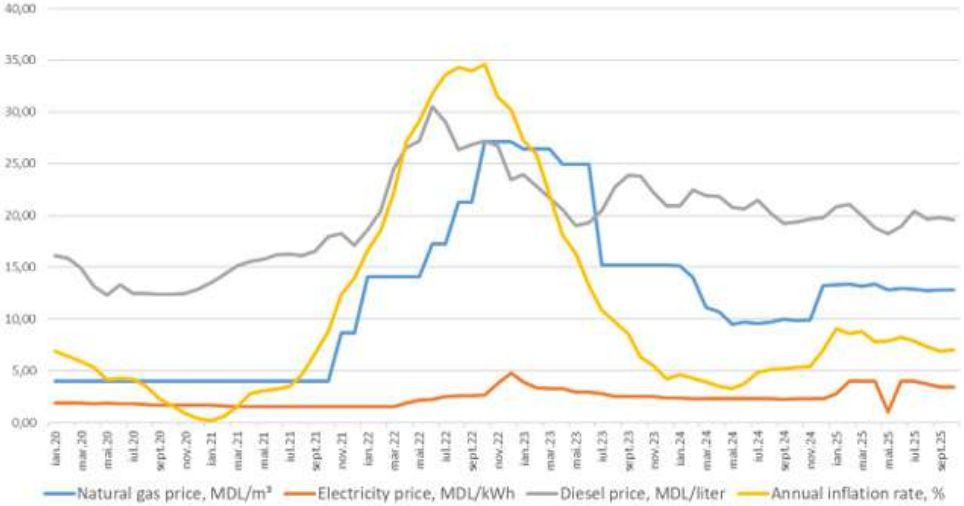


Figure 1. Evolution of reference indicators used in the model, January 2020-October 2025
Source: Developed by the authors based on available data, sources [2; 4-6]

The complete correlation matrix shows that energy prices often move in the same direction. Regression analysis will determine the existence of collinearity between the variables included in the research model. Assessing the bilateral relationships between energy variables and the inflation rate is an essential step in substantiating the econometric analysis.

It should be noted that natural gas and diesel price have a significant impact on the evolution of the inflation rate, as the correlation coefficient is close to 1 (table 1). Changes in electricity prices had a lesser influence on consumer prices as the correlation coefficient is close to zero.

Table 1. The correlation matrix between the inflation rate and the analysed energy resource prices

	Price Natural gas, lei/m³	Electricity price, lei/kWh	Diesel price, lei/litre	Annual inflation rate, %
Natural gas price, lei/m³	1			
Electricity price, lei/kWh	0.67	1		
Price of diesel fuel, lei/litre	0.76	0.45	1	
Annual inflation rate, %	0.76	0.35	0.77	1

Source: Calculated by the authors based on available data, sources [2; 4-6]

The correlation matrix obtained for the period analysed highlights consistent statistical links between energy price dynamics and inflation trends, as well as significant correlations between the energy variables themselves, which is relevant for the stability of regression estimates.

1. Correlation between natural gas prices and inflation (r = 0.76; significance test P <0.001)

The high correlation coefficient (r = 0.76) reveals a strong positive association between natural gas prices and the annual inflation rate. This relationship is in consistent with the economic realities of the Republic of Moldova, where natural gas is an essential input for household consumption, industrial production and energy-intensive services, particularly in the thermal energy sector. The increase in gas prices leads to higher production costs and their transmission to final prices, a mechanism that explains the intensity of the statistical relationship. The result confirms that the price of natural gas was one of the three main factors analysed that generated inflationary pressures in the period 2021–2023.

2. Correlation between diesel prices and inflation (r = 0.77; significance test P <0.001)

The correlation between diesel prices and inflation is very close to that observed for gas (r = 0.77), indicating a strong positive link. Diesel influences prices in the economy through transport and logistics costs, affecting the supply chain, domestic trade and imports. In the context of an economy dependent on foreign trade and road transport, this result suggests that shocks to diesel prices are transmitted quickly and broadly to the general price level. Thus, diesel is an essential determinant of cost-based inflation in the Republic of Moldova.

3. Correlation between electricity prices and inflation (r = 0.35; significance test P≈ 0.002)

The relationship between electricity prices and inflation is positive but moderate (r = 0.35) and much weaker than that between gas and diesel prices. This result reflects the structural specificities of the national economy: as electricity prices are regulated, the transmission of price increases to consumers and the impact of electricity prices on production costs and final prices is much lower compared to the price of natural gas and diesel fuel. However, the positive correlation confirms that electricity contributes to inflationary pressures, but to a lesser extent and at a slower rate than other energy resources.

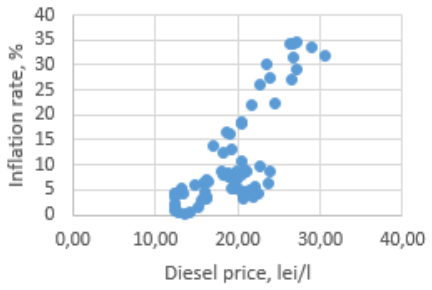


Figure 2. Distribution of monthly values, inflation - diesel price

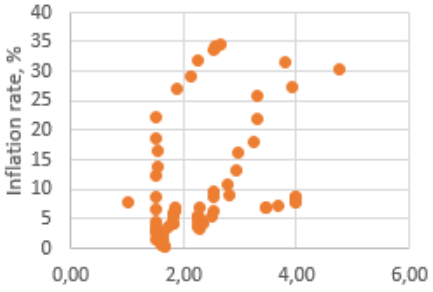


Figure 3. Distribution of monthly values, inflation - electricity price

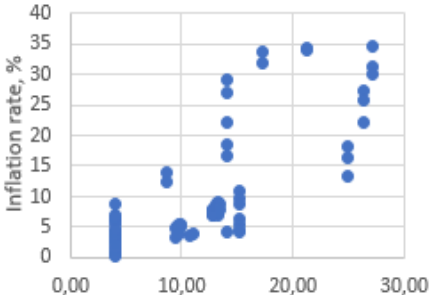


Figure 4. Distribution of monthly values, inflation - natural gas prices

Source: Developed by the authors based on available data, sources [2; 4-6]

Figure 2 illustrates the correlogram of monthly inflation values in relation to the price of diesel fuel. There is a clear positive relationship between the two variables, with inflation rising steadily in parallel with fuel price increases. Figure 3 shows the relationship between electricity prices and inflation. Compared to diesel or gas, the distribution of points is more dispersed, indicating a weaker or more complex link between the two variables.

The empirical distribution of values indicates a pronounced positive relationship between natural gas prices and the annual inflation rate, Figure 4. The empirical data aligns approximately in an upward direction, suggesting that natural gas price increases lead to proportional increases in the general price level. This visual distribution supports the hypothesis of cost-push inflation transmission in the Republic of Moldova and validates the use of a linear model to estimate the relationship between the two indicators.

The correlation matrix highlights important relationships between energy variables:

Gas – Diesel: r = 0.76 (strong correlation)

Gas – Electricity: r = 0.67 (moderate to strong correlation)

Diesel – Electricity: r = 0.45 (moderate correlation)

These values indicate that energy resource prices evolved convergently during the period analysed, being influenced by the same external factors (the European energy crisis, international price volatility, domestic tariff adjustments). The strong correlation between natural gas and diesel prices shows that prices are still dependent on the international fuel trading market, while the moderate to strong correlation between natural gas and electricity prices highlights the specific characteristics of the Republic of Moldova. Although natural gas is one of the important sources of electricity generation in Europe, the correlation between gas and electricity prices in the Republic of Moldova is only moderate (r = 0.67). This moderate intensity can be explained by several structural, institutional and regional factors.

In most European countries, electricity is traded on spot and futures markets (e.g. EPEX, Nord Pool), prices are determined by the cost of the last producer (“marginal price”), and gas-fired power plants are often the marginal producer - the price of electricity is directly linked to the price of gas.

But in the Republic of Moldova, the situation is different: a significant part of the electricity is imported, not produced locally, the market is not fully liberalised, consumer tariffs are regulated by the National Energy Regulatory Agency, and tariff adjustments take place periodically, with delays of months or quarters.

Regression model

The multiple linear regression model is expressed by the relationship:

$Infl,t = \alpha+\beta1Gas_t +\beta2Elec_t +\beta3Diesel_t +\varepsilon_t$ (1)

where:

Infl,t - inflation rate in month t, %;

Gas,t - natural gas price in month t, lei/m³;

Elec,t - electricity price in month t, lei/kWh;

Diesel,t - the price of diesel fuel, lei/l;

εt = residual term.

The analysis of monthly statistical series yields the following estimated regression equation (dependent variable: annual inflation rate, in percentage points):

$Inflation=-11.0028+0.83\ Gaz_t -2.88Elec_t +0.9498\ Diesel_t$

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,8362
R Square	0,6992
Adjusted R Square	0,6855
Standard Error	5,5860
Observations	70

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	4.786,7	1.595,6	51,1	0,000
Residual	66	2.059,4	31,2		
Total	69	6.846,1			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-11,00	4,03	-2,73	0,008	-19,04	-2,96	-19,04	-2,96
Preţ Gaze naturale, lei/m3	0,83	0,17	4,83	0,000	0,49	1,18	0,49	1,18
Preţ Energie electrică, lei/kWh	-2,88	1,09	-2,63	0,011	-5,07	-0,70	-5,07	-0,70
Preţ Motorina, lei/litru	0,95	0,23	4,05	0,000	0,48	1,42	0,48	1,42

Overall, the model shows a moderate dependence between the inflation rate and the independent variables analysed (adjusted correlation coefficient = 0.69). The test of model similarity indicates that the model is suitable for analysing the correlation (significance $F < 0.05$) between the inflation rate and the aforementioned causal variables. However, the results should be analysed with caution, given that the model converges towards multicollinearity of the variables, which would result in a reduced degree of efficiency of the independent variables.

The Gas regression coefficient (0.834) has a high and statistically significant value ($p < 0.05$) – an increase of 1 leu/m³ in the price of gas is associated, if all other conditions remain constant, with +0.834 percentage points in the inflation rate. The role of gas is consistent with the aspects attributed to cost-push inflation in the economy.

The regression coefficient for diesel (0.9498) is close to 1 and significant ($p < 0.05$) – 1 leu/litre increase in diesel prices increases inflation by ~0.95 pp. The increase in transport and logistics costs is directly reflected in the prices of goods.

The Electricity regression coefficient (−2.8807) is negative and significant – contrary to our expectations. Intuitively, this coefficient was expected to be positive according to our assumptions. The negative sign indicates that changes in electricity tariffs are associated with a decrease in inflation in the analysed data. This does not reflect economic reality but is a technical consequence of the model determined by the data structure; it is not a real direct effect but is determined by electricity price regulations, subsidies and multicollinearity. In the context of multicollinearity, the regression model can generate coefficients with inverted signs, which do not reflect causal mechanisms, but are technical consequences of the informational overlap between the included data.

Conclusions

1. The econometric results suggest a strong relationship between energy price developments and inflation dynamics in the Republic of Moldova. Both the high correlations and the significant regression coefficients confirm that shocks in international energy markets were the main driver of domestic inflation during the period analysed. Empirical evidence (correlation + regression) indicates a significant role of energy prices — especially natural gas and fuel — in shaping inflationary pressures in the Republic of Moldova during the period 2020–2025.

2. The correlation analysis shows strong and significant relationships, and the regression confirms that the energy variables in the econometric model explain approximately 70% of the variation in inflation.

3. Empirical analysis shows that the period 2020–2025 was marked by a strong transmission of energy shocks to inflation. The results support the conclusion that Moldova's structural dependence on energy imports is a critical factor of inflationary vulnerability.

4. Inflation transmission in the economy is cost-push, which means that pressures are driven by increases in production inputs, not by domestic demand. Thus, the economy faces cost-push inflation rather than demand-pull inflation.

5. Stabilisation policies (compensation, subsidies) have mitigated the social impact of price increases to some extent, but have created budgetary pressures. From the perspective of medium-term price stability, reducing dependence on external energy sources (diversification, regional integration) and accelerating the transition to renewable sources and energy efficiency are measures that would reduce the vulnerability of inflation to energy shocks.

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