Energy Resource Tariffs as a Tool for Comparing and Influencing Macroeconomic Indicators and Competitiveness

Tatiana Gutium
National Institute for Economic Research
NIER
Chisinau, Republic of Moldova
gutium.tatiana1@gmail.com

Vitaly Postolaty
The Institute of Power Engineering
Chisinau, Republic of Moldova
vpostolati@rambler.ru

***Abstract*—The main objective of the study is to analyze the impact of the level of prices of energy resource on the main macroeconomic indicators and use energy efficiency indicators in estimating competitiveness. The authors have used follow methods of the study: comparative analysis, correlation and regression analysis. The database of the study includes statistical databank from the National Bureau of Statistics of the Republic of Moldova, customs declarations of export and import of economic agents from Moldova, the database of the United Nations Statistics Division of the Department of Economic and Social Affairs. This article defines the place of tariffs in the general structure of economic indicators. It is shown that an increase of tariffs leads to a decrease of the gross value added of finished products. The authors have proposed recommendations for changing tariff regulation. The new approach will contribute to the sustainable development of economic sectors, including the energy sector.**

Keywords—economic indicators; macroeconomics; supply and demand; costs; econometrics.

I. INTRODUCTION

The country's livelihood, the potential for improving the competitiveness of the national economy and the development of branches of industry and industry as a whole, depends on the state of the energy sector. Therefore, the economic justification of tariff change is becoming increasingly important. It would create conditions not only for the stable development of the energy sector, but also for the development of the economy as a whole.

Taking into account, that the Republic of Moldova is not the owner of energy resources, it is necessary to consider the tariff policy of the Moldovan energy sector and to study the implications of its implementation on competitiveness, as well as to elaborate a system of measures which would prevent an unreasonable increase of tariffs.

Impact of energy resources price is object of research in the works of many scholars. According to macroeconomic theory, only in the short run does a change in the price level affect the main macroeconomic indicators, and in the long run the correlation coefficient between inflation and economic growth tends to zero [1], [2].

Andrea Vaona and Stefano Schiavo have concluded that inflation affects economic growth not only in the short term but also in the long term in their empirical studies [3]. The results of empirical calculations which was done for different countries lead to conflicting conclusions about the nature of the impact of price increases on output growth [4], [5], [6]. Kartaev in his works determined a level above which inflation affects negatively the growth of the economy, and below this level the effect of inflation is negligible [7].

II. CORRELATION BETWEEN ENERGY RESOURCES TARIFFS AND MACROECONOMIC INDICATORS

In process of analyzing the dynamics of energy resources tariffs and macroeconomic indicators, the authors recalculated data series by 2010. This year was chosen as the base year for two reasons. First, the National Bureau of Statistics switched to the SCN-ONU-2008/ESA 2010 methodology for calculating Gross Domestic Product (GDP), and statistic's data were recalculated starting with 2010. Secondly, 2010 was a post-crisis year. It is the first year of economic expansion.

In this year, the Moldovan economy recovered after the crisis and the physical volume of the Gross Domestic Product reached its level until the crisis. Economic growth reached 107.1% in 2010 [8]. This GDP growth has offset the decline in the crisis year. In 2010, after crisis, manufacturers already moved their losses on the end consumer, and received the necessary gap between the selling prices and cost, so a further gap is no longer needed. There is a reserve for reducing the producer price. One solution is to decrease the number of intermediaries.

But nonetheless, during the three years, 2011-2013, the both producer price and consumer price had significantly increased (Fig. 1), as a result, demand had decreased; physical volume of production and supply of electric and thermal energy, gas, hot water had decreased too.

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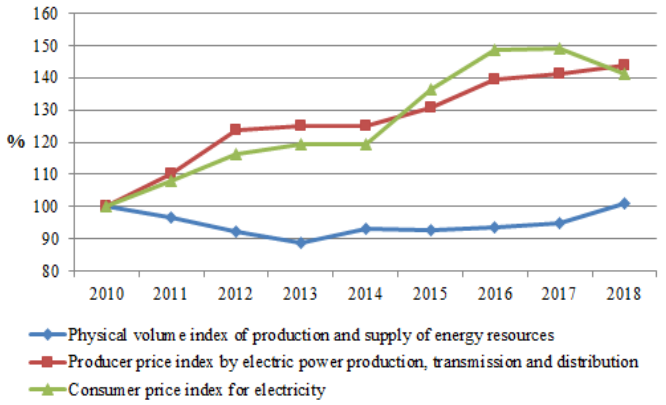

Fig. 1. Dynamics of physical volume index of energy resources and price index of electricity in Republic of Moldova, 2010 = 100%.

In subsequent years (2015-2017) the rate of growth of electricity tariff prevailed over the rate of growth of the producer price. In 2018, the electricity tariff was reduced [9], in accordance with the law of demand it led to an increase in the physical volume of production and supply of energy resources.

The price index curve is a mirror reflection of the curve of the physical volume index (Fig. 1), when price raises, the volume of production, transmission and distribution falls (Fig. 2).

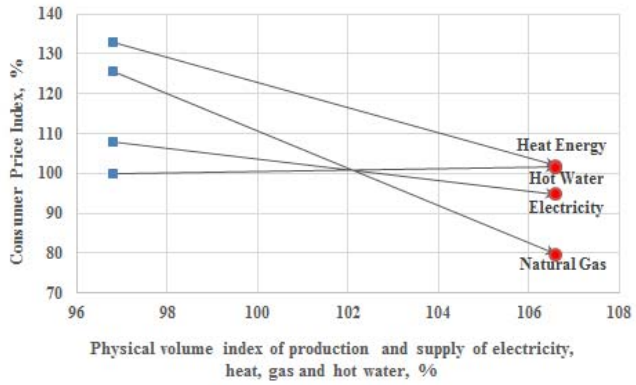

Fig. 2. The correlation between physical volume index and consumer price index for some energy resources, 2011-2018.

Econometric modelling methods were used for identifying the relationship between the volume of production and supply of energy resources and price fluctuations. Authors have obtained following results:

$$d(\ln(qer)) = 0.034 - 0.64d(\ln(ppie)) - 0.07D13 + 0.04D18 \quad (1)$$

$R^2 = 0.906394$;

$$d(\ln(qer)) = 0.037 - 0.33d(\ln(cpie)) - 0.07D13 - 0.06D12 \quad (2)$$

$R^2 = 0.919486$.

Where:

qer – physical volume index of production and supply of energy resources;

$ppie$ – producer price index by electric power production, transmission and distribution;

$cpie$ – consumer price index for electricity;

$d(\ln)$ – the first-order difference of natural logarithms;

D – dummy variable;

R^2 – the determination coefficient.

According to equations (1) and (2), the relationship between the price index and the index of the physical volume of production is negative. In turn, the prices of the production of electricity and heat depend directly on the import price of natural gas.

During the period under review, the producer price for electricity grew steadily, although in the previous three years (2015-2017) the import price of natural gas decreased significantly [10]. In 2018, the price of gas increased, but nevertheless, in comparison with the base year, this increase did not lead to the achievement of a level relatively higher than the producer price by electric power production, transmission and distribution (Fig. 3).

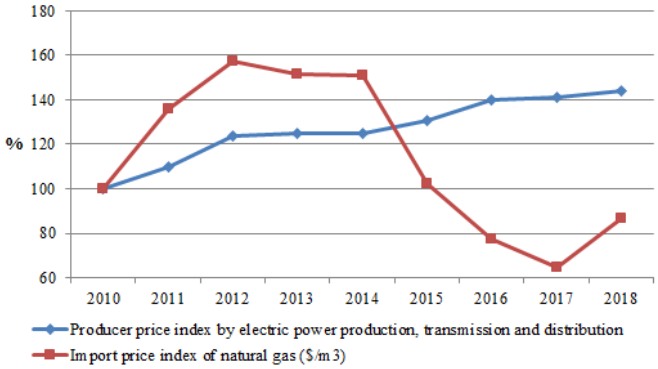

Fig. 3. Dynamics of producer price index of electricity and import price index of natural gas in Republic of Moldova, 2010 = 100%.

In the past four years, the consumer price index for natural gas has exceeded the import price index of gas, both in dollars and in national currency. The largest gaps occurred in 2016 and 2017 (Fig. 4), which allowed suppliers to make excess profits. The gap was caused by the depreciation of the national currency, poor management, the presence of intermediaries in this market.

An unjustified increase in the price of gas will inevitably lead to an increase in the price of electricity, heat energy, hot water, which in turn will lead to an increase in the prices of goods and services, i.e. to inflation.

In order to prevent the realization of the described scenario, it is necessary to stabilize the banking sector, strengthen the national currency, rational management of

companies in the energy sector and reduce the number of intermediaries to zero.

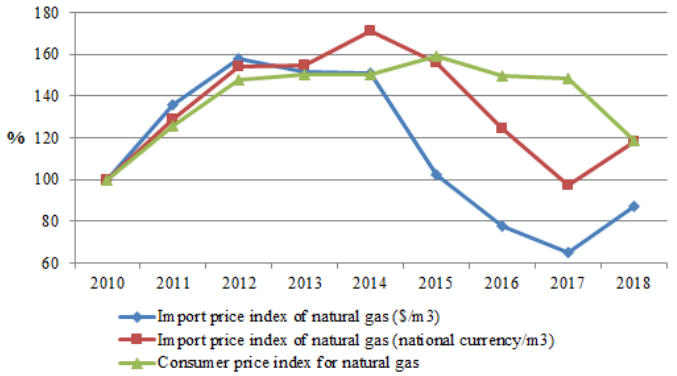

Fig. 4. Dynamics of import price index and consumer price index of natural gas in Republic of Moldova, 2010 = 100%.

Reducing the electricity prices and gas prices for non-household consumers in 2018 led to an increase of energy consumption, which in turn led to an increase of the physical volume index of Gross Added Value of production and supply energy resources. In the end, the contribution of the energy sector to the formation of gross domestic product has increased (Fig. 5).

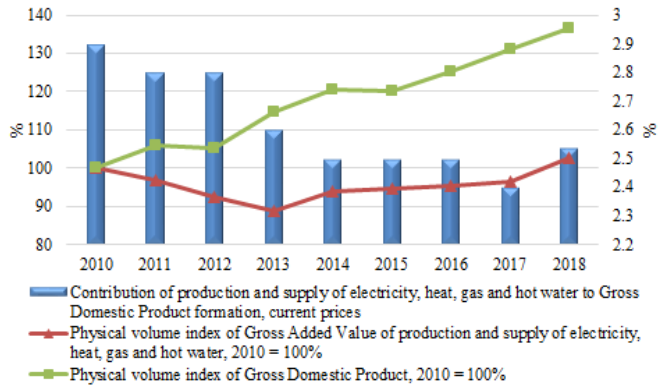

Fig. 5. Dynamics of physical volume index of Gross Added Value of production and supply energy resources and its contribution to Gross Domestic Product formation.

To assess the impact of tariffs on Gross Domestic Product, an econometric model was built. A close relationship was found between the price of electricity, heat and GDP:

$$d(\ln(gdp)) = 0.04 - 0.3d(\ln(pe)) - 0.09d(\ln(ph)) + 0.05D13 \quad (3)$$

$R^2 = 0.884537$.

Where:

gdp – physical volume index of Gross Domestic Product;

pe – price index of electricity;

ph – price index of heat.

According to equation (3), lower prices of electricity and heat will lead to an increase in economic activity, an increase in GDP. Cost-push inflation caused by rising prices for energy resources and other raw materials leads to an inflation and a decrease in output [11]. Thus, a tariff increase of energy resources leads to an increase in the cost of finished products, to gross value added decrease, and ultimately to a GDP decrease [12]. Obviously, the increase in the cost of production of domestic goods causes the increase of the price of the final goods, which become more expensive compared to the imported commodity. As a result, domestic merchandise will be replaced by imported one and domestic output will decline.

III. Use of Energy Efficiency Indicators in Estimating Competitiveness

In world practice, the Global Competitiveness Index (GCI) is used to analyze the competitiveness of the national economy [13]. In 2017, the method of calculating the GCI was changed with a new methodology GCI 4.0. From the calculation of the aggregate GCI index were excluded indicators that, from the point of view of the authors, reflect the competitiveness of the country, such as: quality of electricity supply.

The quality of the energy sector is taken into account in the pillar "Infrastructure". According to the new methodology, starting from 2018, instead of the indicator "Quality of electricity supply", the following two indicators are used in calculating the GCI: electrification rate; electric power transmission and distribution losses [13]. The dynamics of both the old indicators and the new ones for Republic of Moldova are shown in Table I.

In the analyzed period, there is a negative trend in the quality of the energy sector and in the quality of "infrastructure".

TABLE I. Global Competitiveness Index of Republic of Moldova, rank, 2014-2018

	GCI (old methodology)				GCI 4.0
	2014	***2015***	***2016***	***2017***	***2018***
Global Competitiveness Index	82	84	100	89	88
Pillar2: Infrastructure	83	83	86	88	79
Quality of electricity supply	82	83	87	91	
Electrification rate					1
Electric power transmission and distribution losses					111

In order to assess how tangibly the influence of the "Quality of electricity supply" indicator has on the pillar "Infrastructure", the authors have shown in Fig. 6 the correlation between the rank of these indicators for Republic of Moldova and for cross-border countries. The angle of the curves in all three cases is the same and positive. Thus, a higher quality of electricity supply provides the country with a more competitive infrastructure, and a more competitive

national economy. As a result, the authors concluded that the exclusion of this indicator from the Global Competitiveness Index is not rational.

The authors consider that the new version of the GCI 4.0 indicator is more imperfect than the previous one [14], and they propose not only to return the analyzed indicator to the GCI calculation, but also to include the following indicators in the calculation methodology: stability of energy resources tariffs; the degree of excess of the established allowable lag between the producer (supplier) price and consumer price of energy resources (in percentage).

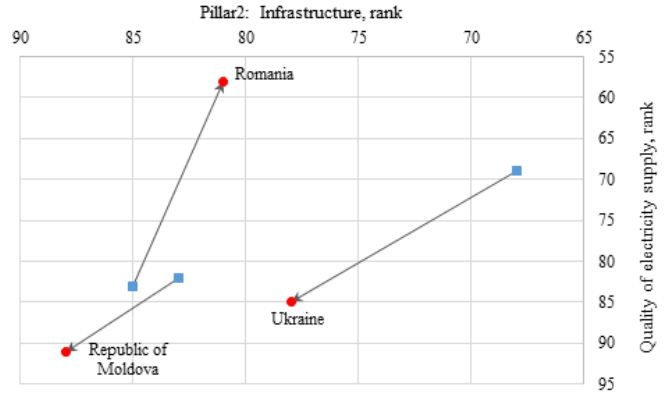

Fig. 6. The correlation between rank of "Quality of electricity supply" and rank of "Pillar2: Infrastructure", 2014-2017.

The first of the proposed indicators has a direct impact on the competitiveness of the national economy, and the second indicator – the opposite. It is necessary to take into account this relationship for determining the rank.

IV. Tariff Regulation: Recomandations

The authors predicted the evolution of energy resources demand and concluded: taken into account that the number of the population of the Republic of Moldova is constantly decreasing [15] (Fig. 7), the demand of electricity will also fall. A decrease in demand will inevitably lead to an increase in unit costs.

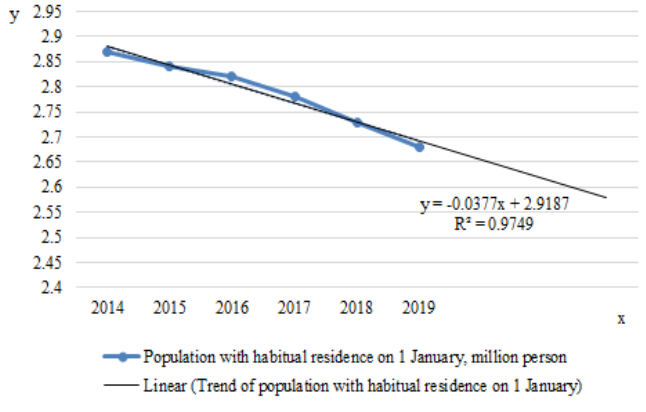

Fig. 7. Trend of number of population with habitual residence in Republic of Moldova.

Cost can be reduced in different ways. One solution is to reduce losses from equipment failure caused by load on the power supply system during peak hours. The authors offer a multi-tariff system that would take into account the interests of both the consumer and the supplier. The transition to a new calculation system requires the installation of special meters - smart meters.

The day must be divided into four time intervals; each interval must be set to its coefficient of calculation. The authors propose the following coefficients (Table II).

TABLE II. Coefficients

Time interval	Coefficient
from 23:00 h. to 7:00 h.	0.5
from 7:00 h. to 11:00 h.	1.4
from 11:00 h. to 17:00 h.	1.0
from 17:00 h. to 23:00 h.	1.4

The basis of the proposed coefficients is the principle of equilibrium; the sum should be equal with 24 $(8\times0.5+4\times1.4+6\times1.0+6\times1.4=24)$.

V. Conclusion

Studies have shown that there is a relationship between energy tariffs and macroeconomic indicators and competitiveness. The tariff increase leads to inflation, to a decrease of gross value added and GDP. Ultimately, a tariff increase adversely affects both the national economy and the welfare of the population.

Prices and tariffs of energy consumables are one of the most important factors of economical health of state. Through economic and mathematical modelling was shown that more qualitative energy ensures growth of competitiveness.

Also lower prices of electricity give impulse to economy by higher consumption.

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