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ANALYSIS OF THE RELATION BETWEEN FUNDAMENTAL ECONOMIC INDICATORS AND ENERGETIC CONSUMPTION

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Abstract— The present article approaches the relation between two fundamental economic indicators (GDP and Work Productivity), a consumption indicator and two energetic consumption indicators. In the first part of the article, we tried to justify the importance of this concern, the second part is dedicated to describing the work methodology, defining and expressing the indicators and presenting the work algorithm,. The third part of the article refers to the results of the analysis and the conclusions

Keywords— GDP, energetic indicators, economic indicators , consumption

I.INTRODUCTION

In a world dominated by the globalisation process, the main concern is ensuring the resources needed for sustainable development, and the key vector is represented by the energy. It is estimated that the total energy consumption by 2030 will increase with 30%, compared to 2010 [1], and the primary energetic resources percentage (REP) will be maintain in the category of depleting energy resources (REE).

All though, the most important wish of mankind is decoupling economic growth from the energy consumption, through increasing the energetic efficiency, this is not yet operational, that is reflected in the gross domestic product (GDP) - consumption relation [2] (table I).

TABEL I
RECENT EVOLUTIONS AND TRENDS IN THE WORLD

Indicator	2010	2011	2012	2013	2014	2015
PIB (global)	5%	3%	-2%	1%	2%	3%
PIB (SUA)	3%	2%	-5%	1%	2%	2%
PIB (China)	10%	9%	4%	6%	7%	9%
Global Increase of energy consumption	6%	4%	-2%	1%	2%	2%

Source: Author's calculation based on the information available in [2].

Eropeean Union established the Treaty regarding the Energy Charta (T-CEN) and the Energy Charta Protocol (P-CEN). T-CEN's general objective is establishing a legal framework for promoting long term cooperation in the energy sector. P-CEN's main objectives are [3]:

1.Promoting the energetic efficiency policies compatible with sustainable development conditions;
2.Establishing the main conditions to stimulate producers and consumers to use energy more economical. ecological and more efficiently possible;
3.Encouraging cooperation in the energetic efficiency sector.

With the help of the Energy Green Charta (CV-EN) "A European strategy for safe, competitive and sustainable energy" the European Commission invites the member states to make all efforts to include three important targets into the energetic policy [4, 5]:

1.Durability – the main objective is blocking climatic change by reducing the green gas emissions, promoting sustainable energy (RRE), reducing the energetic sector's negative impact on environment;
2.Competitiveness – regardes the complete implementation of the internal energetic market, developing the competition of electrical energy, natural gases and energetic services market, the liberalisation of energy transition and ensuring an undiscriminatory access for all market participants.
3.Safetyness of the energy power – the main objective is reducing the EU vulnerability regarding the energy imports, and the enevtual energetic crisis.

It is obvious that at least from the perspective of the third objective, the main target is the EU population.

An important document that refers to the EU's strategy in the energetic sector is the balance document of the European Commission entitled "To a new energetic strategy for Europe 2011 - 2020 (D-NSE)". D-NSE published on 7th of May 2010, [6] is considered to be the first step to a unitary and comprising energy policy at EU level and it is realised according to Strategy EUROPA 2020 (SE2020).

Along with D-NSE ratification, the European Parliament requested the formation of European Energetic Community, stipulating that the New Energetic Strategy (NSE) should be implemented in the spirit of solidarity and responsability, starting from the principle according to which not a sing;le member state should be left behind or isolated.

In the case of Romania, this objective is clearly formulated in the energetic strategy [7], whose main objective is „satisfying the energetic necessities at the lowest price,

afordingly for the consumers, adequat for the modern economy and for a certain life standard, in safety conditions, respectig the sustainable development".

The main directions of the national energetic policy are established in close connection with the long term economic and social development strategies, considering that the energetic investments need important funding and long term implementation.

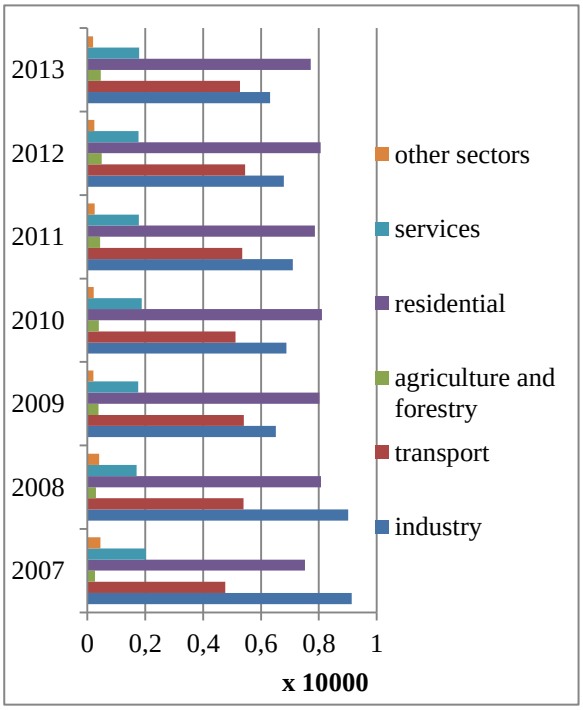

Fig 1 Recent evolution of the final sectorial energetic consumption (CFES) of Romania

Source: Author's calculation based on data published by Eurostat

The safetyness of energy powering is important not only because of it's social and economic aspect, representing an important share of the total national energetic consumption – Figure 1 [8].

We notice that over the analzsed period, the consumption increased, but it also decreased in 2013 a little less over the one registered in 2007. Almost all sectors register a recent evolution, the only sector that presents an important decrease from the energy consumption point of view is the industrial sector.

The present article continues the previous research regarding the economic and energetic competitiveness, the correlation between economic and energetic competitiveness [9-11]. In this paper we proposed to analyse Romania's relation between two fundamental economic indicatprs, a general consumption indicator and two energetic consumption indicators.

II.WORKING METHODOLOGY

We will choose and present the recent values (2007÷2013) of the mentioned based on the values published by NSI:

1.Δpib_r –GDP growth rate / pers [%] – the precedent year representing 100%;

2.Δpm_r – Work productivity growth rate [%] – the precedent year representing 100%

3.CEL – Annual energy consumption per inhabitant [tep/loc];

4.CEE – Annual electrical energy consumption in households[GWh];

5.CCM – Annual medium consumption expenditure per person [lei];

6.POP – Romanian population [persons].

For analysing the evolution of economical and energetic units, we will first calculate it in relative or absolute units (CEL, CEE, CCM) of time evolution rate (annual). For a certain unit (x) the annual evolution rate (Δx_r) is calculated using the following relation:

$$\Delta xr(t+1) = \frac{x(t+1) - x(t)}{x(t)} 100 \quad (1)$$

where,

t – current year

We will calculate:

$$cee = CEE/POP \quad (2)$$

$$\Delta celr(t+1) = \frac{CEL(t+1) - CEL(t)}{CEL(t)} 100 \quad (3)$$

$$\Delta ceer(t+1) = \frac{cee(t+1) - cee(t)}{cee(t)} 100 \quad (4)$$

$$\Delta cemr(t+1) = \frac{CCM(t+1) - CCM(t)}{CCM(t)} 100 \quad (5)$$

We will compare the economical indicators (Δpib_r, Δpm_r, Δccm_r) evolution with the one of energetic indicators (Δcel_r, Δcee_r). The convergence comparative evolution shows a strong correlation of the indicators, and the divergent evolution means the inexistence of a correlation between the analysed indicators.

III.RESULTS

In the following sectionn we present the primary indicators values, as they were published by the National Institute of Statistics (NSI) [12].

TABLE II
PRIMARY INDICATORS VALUES FOR THE ANALYSED PERIOD

Indicator	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Δpib_r [%]	-	8,5	10,3	-6,3	-0,2	1,6	1,1	3,8
Δpmr_r [%]	-	6,5	8,4	-5,2	-0,5	1,9	5,7	4
CEL [tep/loc]	1,858	1,875	1,931	1,685	1,72	1,769	1,737	1,583
CEE [GWh]	9.999	10.389	10.400	11.012	11.329	11.577	12.035	11.897
CCM [lei]	328,6	378,36	468,55	505,56	513,04	532,18	561,59	584,63
POP [mil loc]	21,26	21,13	20,65	20,44	20,29	20,2	20,1	20,02

Source: Author's calculation based on data published by NSI

The second table presents the osscillant evolution of indicator Δpib_r[%], that registers positive and also negative values (2009, 2010). This conclusion may also be driven in the case of indicator Δpmr_r[%], that registeres negative values in 2009 and also 2010.

Table III we will present the values for the annual evolution rates for CEL, CEE and CCM.

TABLE III
EVOLUTION RATES OF CEL, CEE AND CCM)

Year / *Indicator*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Δcel_r[%]	0,91	2,98	-12,7	2,07	2,84	-1,8	-8,86
Δcee_r[%]	4,25	2,04	8	1,85	3,63	5,26	-1,66
Δccm_r[%]	15,1	23,8	7,89	1,47	3,73	5,52	4,1

Source: Author's calculation based on data published by NSI

The Δcel_r[%] indicator registered an oscillating evolution, while the values of the other two indicators reflect an increase of the consumption in the analysed period of time.

Figure nr 2 presents in a comparative way the evolution of Δpib_r, Δcel_r and Δcee_r and Figure 3 Δpm_r Δccm_r, compared to Δcel_r and Δcee_r.

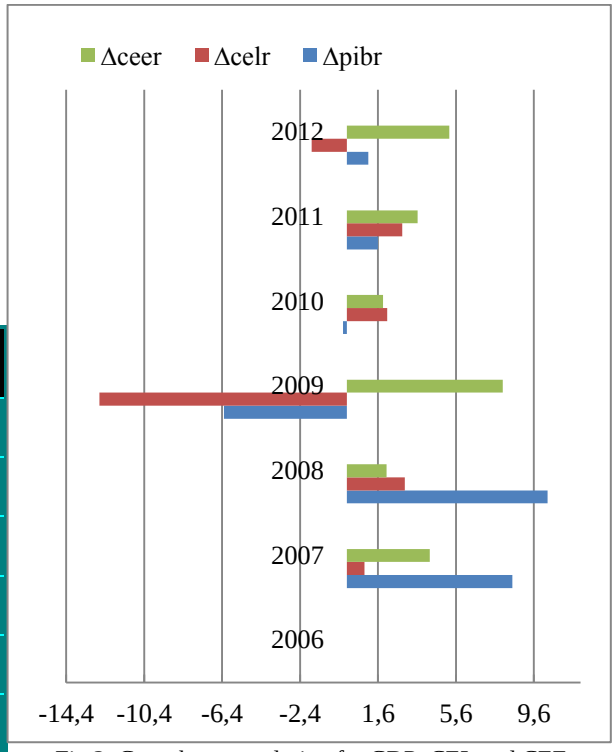

Fig 2: Growth rate evolution for GDP, CEL and CEE [%]

Source: Author's calculation based on data published by NSI

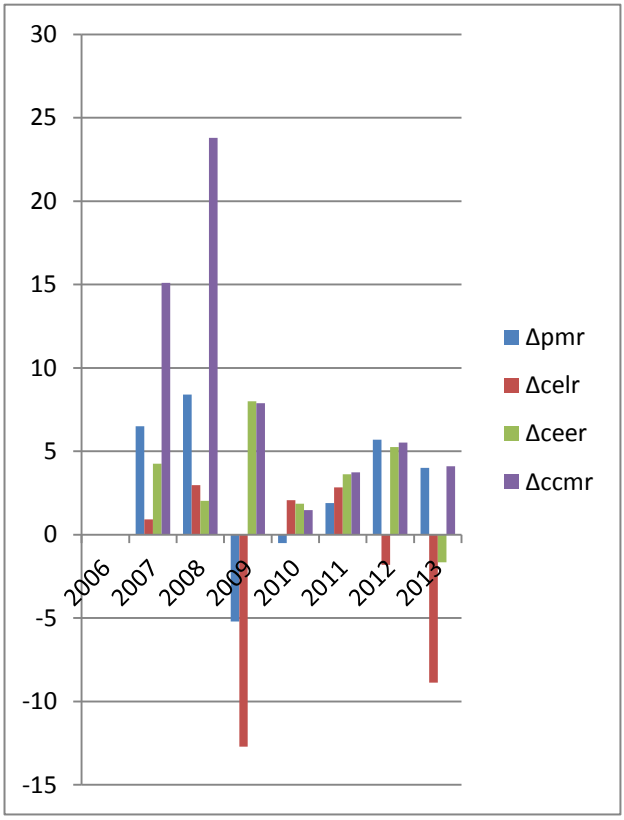

Fig 3 The evolution of economical and energetic indicators [%]

Source: Author's calculation based on data published by NSI

We can say that the first two economic indicators (Δpib_r and Δpm_r) have an osciallating evolution: positive at the beginning of the analysed period (2007, 2008), negative (2009, 2010) and again positive in the last three years of the analysis.

The third economic indicators Δccm_r registered positive values for the entire analysed period, showing a continuously increase of the consumption. The values of the energetic indicators (Δcel_r, Δcee_r) reflect the decrease of consumption of the energy resources and also an increase of the electrical energy consumption.

IV.CONCLUSIONS

On the entire analysed period we can see an improvement of Romania's economic performance, regarding GDP and also the working productivity, that also reflects in the increase of the consumption. As regarding the energy consumption, we could notice its decrease when reference to the total forms of energy and an increase of electrical energy consumption.

In conclusion, we identify a strong correlation between the economic indicator and the electrical energy consumption and also the lack of correlation with the annual energy consumption. An explanation offered for the decrease of consumption from the total forms of energy point of view, and an increase of electrical energy consumption might be the reduction of thermic energy consumption, through increasing the t thermic systems performance

In the case of Romania, we could not identify a correlation between the industrial competitiveness evolution and the other types of analysed competitiveness levels.

In the case of Hungary, the results reflect the best timing, between the industrial competitiveness and the three levels of national competitiveness levels analysed, which during the analysed period of time registered a negative evolution.

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