Analyse of the Influence of Major Romanian Indices over the Number of Early Leavers from Education and Training

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Abstract

The present paper result as a research with the main objective to analyse a possible influence correlation of three major country indices Gross Domestic Product at market prices (GDP), Main National Account (MAC) and Harmonised Index of Consumer Prices (HICP) over the Early Leavers from Education and Training (ELE). The method used is determination of mathematical functions that governance of ELE evolution based on each of the three indices values organised ascending order. Also, the functions are used for graphic representation in order to visual compare the degree of influence over the ELE. The software used was Mathcad 14 with data from 2000 to 2013.

The relevance of the research occurs from pointing out the hierarchy of influence over the ELE, considering that the country can act accordingly to minimize the early leavers from education and training.

Key words: leavers from education, country economics
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1. Introduction

The level of education and training of a country illustrate several characteristics like the level of richness of the country, the ability of the governance of that country to ensure higher education for each of their inhabitant and not the least the guarantee of country's good future. One of the method of measurement for the wellbeing of education system is the size of the leavers from the education and training before the end of each their studies.

Considering these facts it is important to understand which of the main countries indices influence the most the decision of leaving the education in order for governments to effectively use the way mange the cause of that indices for the wellbeing of education and training as an engine for a better future.

The goal of the present paper is to reveal the first steps of a research that tries to determine the main country indices that influences the people to leave in early stages of their education or training.

The importance of the paper and the research rise from the importance of the education and training over the future of a country and the significance of the determination of a hierarchy of the country indices influence over the dropout from education.

2. Data analysis

Data used represent the annual values of three country indices: Gross Domestic Product at market prices (GDP), Main National Account (MAC) and Harmonised Index of Consumer Prices (HICP) and the Early Leavers from Education and Training (ELE), collected from 2000 to 2013 for

Romania. Each of these indices are presented in the following. The values of the indices are presented in table no. 1.

Table no. 1 Annual values of the analysed data.

YEAR	GDP at market prices [Purchasing Power Standard per inhabitant]	HICP (2015 = 100) [Annual average index]	Main national accounts tax aggregates [Million euro]	Early leavers from education and training [Percentage FROM Total Population (From 18 to 24 years)]
2000	5.000	28,01	12.420,4	22,9
2001	5.500	37,66	13.098,8	21,7
2002	6.000	46,14	13.856,8	23,0
2003	6.500	53,18	14.794,4	22,5
2004	7.500	59,51	16.981,8	22,4
2005	8.000	64,90	22.722,1	20,3
2006	9.200	69,19	28.498,8	17,9
2007	10.700	72,58	37.161,0	17,3
2008	12.200	78,33	40.249,5	15,9
2009	11.700	82,70	32.485,7	16,6
2010	12.400	87,73	34.052,8	19,3
2011	12.900	92,84	37.403,8	18,1
2012	13.600	95,98	37.235,4	17,8
2013	13.900	99,04	39.532,7	17,3

Source: table drawn up by the authors based on data provided by EUROSTAT website

Gross domestic product (GDP) at market prices is the final outcome of the production process of inhabitant maker units. It is defined as the value of all goods and services created minus the value of any goods or services used in their making. This definition is elaborated by the Eurostat [3].

Main national accounts tax aggregates [Million euro] (MAC), as defined by the Eurostat [1], is detailed tax and social contribution earnings by type of tax or social contribution and by sub-sector of general government, notified by national authorities.

Harmonised indices of consumer prices (HICP) [Annual average index (2015 = 100)] give similar measures of inflation for the states and state clusters they are produced. They are financial indicators that measure the variation over time of the prices of consumer goods and services attained by households, as defined by Eurostat [2].

Also Eurostat [4] defines the *Early leavers from education and training [Percentage FROM Total Population (From 18 to 24 years)]* as the percentage of the people aged 18 to 24 having accomplished at most lower secondary education and not being involved in additional education or training. The numerator of the index mentions to peoples aged 18 to 24 who meet the following conditions: (a) the highest level of education or training they have completed is ISCED 2011 level 0, 1 or 2 (ISCED 1997: 0, 1, 2 or 3C short) and (b) they have not acknowledged any education or training (i.e. neither formal nor non-formal) in the four weeks former to the survey.
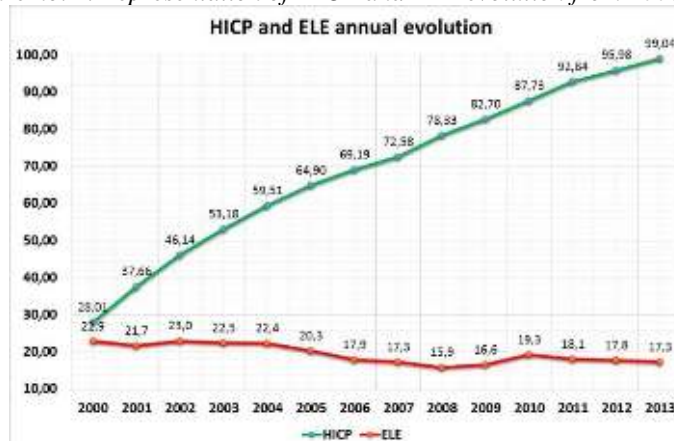
The first graphical analysis of the indices evolutions are presented in figures from 1 to 3.

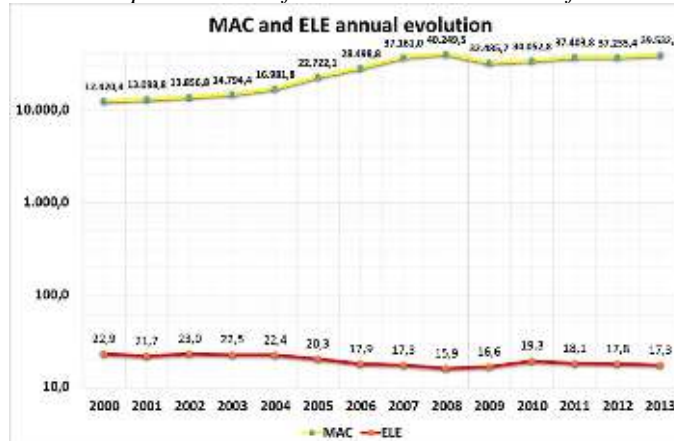*Figure no. 1. Representation of GDP and ELE evolution from 2000 to 2013.*
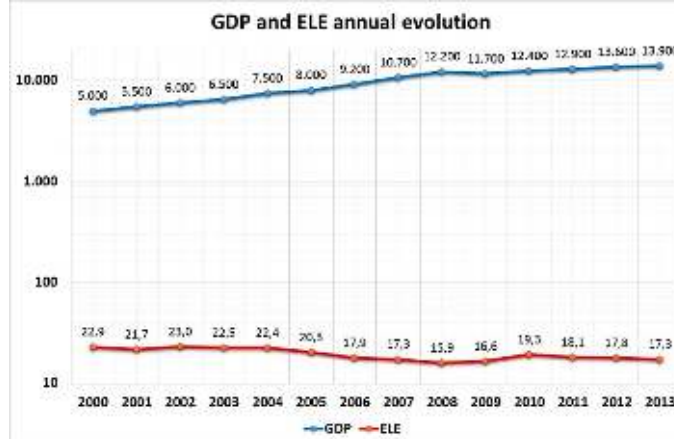
Source: Author's own graphic representation.

Figure no. 2. Representation of HICP and ELE evolution from 2000 to 2013.

Source: Author's own graphic representation.

Figure no. 3. Representation of MAC and ELE evolution from 2000 to 2013.

Source: Author's own graphic representation.

As the graphical representations reveals the following evolution of values:
- ELE has an inverse evolution than GDP, HICP and MAC;
- The HICP trend growth is developing much faster than ELE trend;
- The evolution trends for GDP and MAC is produced a year earlier than ELE, which demonstrates the influence of the two over the ELE.
So the major conclusion of the initial data analysis is that there is an influence between the three

indices and the ELE. This conclusion is the base for the research that follows.

3. Application

In order to further analyse the influences between the indices the authors proposed to find mathematical function that rule the way that the values of each of the three country indices affects the trends of ELE (or the influence).

The authors used Mathcad 14 software to determine each of the function. For the mathematical process of function calculation the values of each of the three indices were reordered in ascending order, keeping the correlation with the ELE values or each year. After the mathematical process the following function were calculated:

$$\text{ELE(GDP)} := -1.315 \times 10^{-14} \cdot \text{GDP}^4 + 5.319 \times 10^{-10} \cdot \text{GDP}^3 - 7.682 \times 10^{-6} \cdot \text{GDP}^2 + 0.046 \cdot \text{GDP} - 73.547 \tag{1}$$

$$\text{ELE(HICP)} := -1.847 \times 10^{-9} \cdot \text{HICP}^6 + 3.264 \times 10^{-7} \cdot \text{HICP}^5 + 1.231 \times 10^{-5} \cdot \text{HICP}^4 - 6.136 \times 10^{-3} \cdot \text{HICP}^3 + 0.483 \cdot \text{HICP}^2 - 15.181 \cdot \text{HICP} + 191.721 \tag{2}$$

$$\text{ELE(MAC)} := 6.1823 \cdot 10^{-25} \cdot \text{MAC}^6 - 1.08568 \cdot 10^{-19} \cdot \text{MAC}^5 + 7.53 \times 10^{-15} \cdot \text{MAC}^4 - 2.63 \times 10^{-10} \cdot \text{MAC}^3 + 4.86 \times 10^{-6} \cdot \text{MAC}^2 - 4.522 \cdot 10^{-2} \cdot \text{MAC} + 188.966 \tag{3}$$

Using the above mathematical function graphical representation were elaborated. Those graphics were compared with the real graphics in order to evaluate the proximity with the mathematical models. In figures from 1 to 3 the graphics shows the graphics from the real data. The graphics from the right reveals the application of modelled mathematical functions and the calculated ELE's values for each of the three country indices.

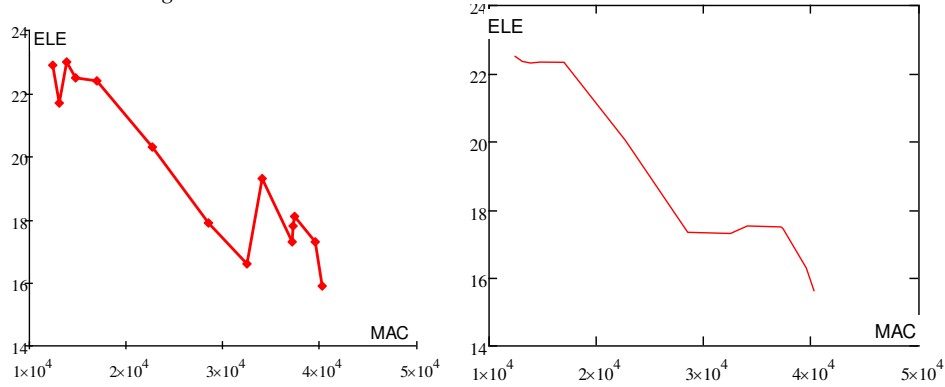*Figure no. 4. ELE evolution determined on GDP annual values.*
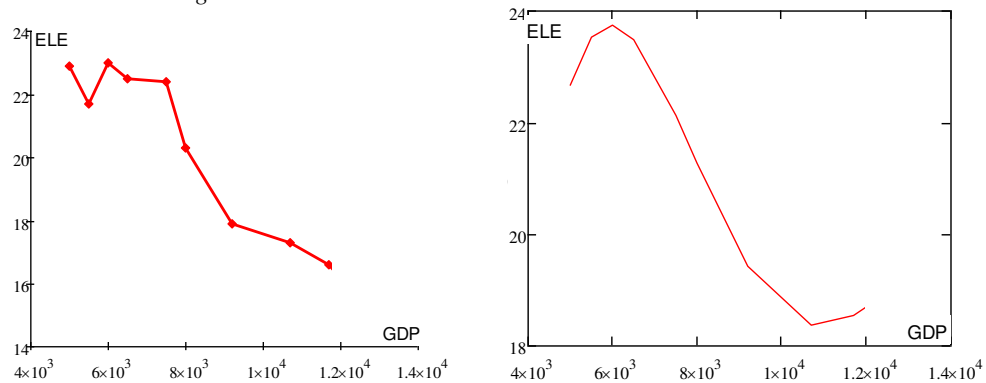
Source: Author's own graphic simulation representation.

Figure no. 5. ELE evolution determined on HICP annual values.
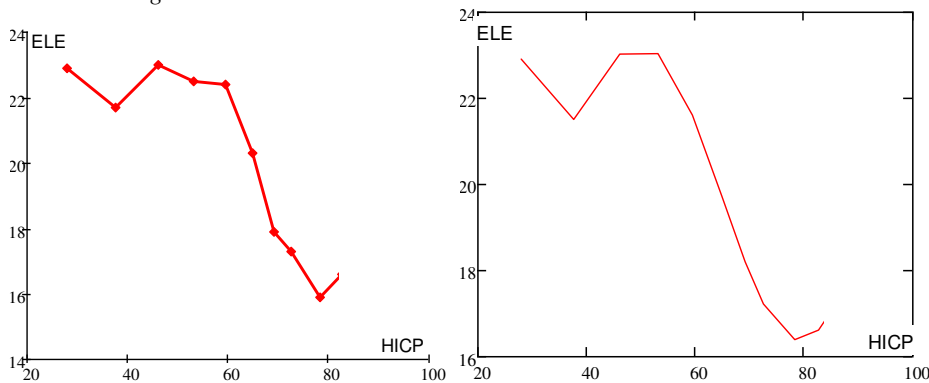
Source: Author's own graphic simulation representation.

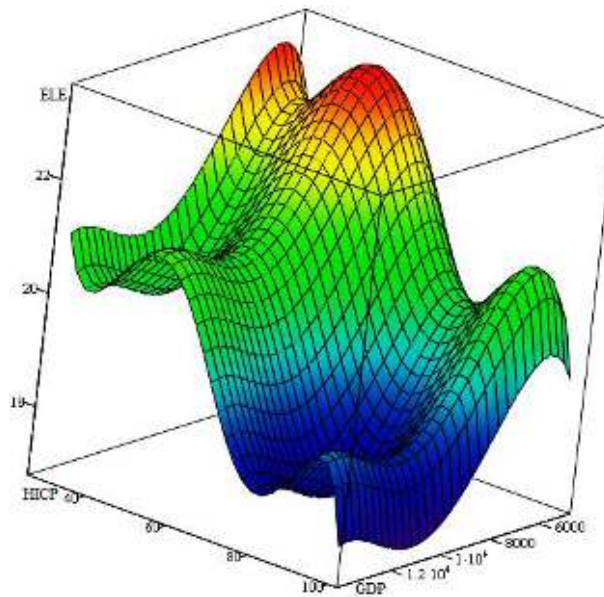*Figure no.6. ELE evolution determined on MAC annual values.*

Source: Author's own graphic simulation representation.

Evaluating the two graphic representation of the influence function for each of the indices it can be easily see that the representation are similar, therefore the authors considered the modelling a success.

The next step in research was to evaluate which of the indices has the most influence over the ELE. In order to achieve that the authors used 3D representation of the calculated function of influence and determined the surfaces that shows the values of influences over the ELE for each of the indices taken two by two.
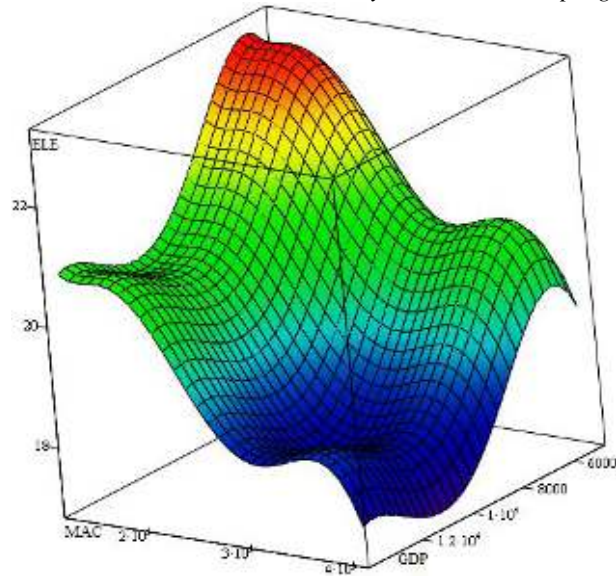
Each of the surfaces is represented in figures from 7 to 9.

Figure no.7. ELE evolution determined by GDP and HICP progression.

Source: Author's own graphic simulation representation.

*Figure no.8. ELE evolution determined by GDP and MAC progression.*

Source: Author's own graphic simulation representation.

Analysing the 7 to 9 figures the following conclusion were made:
- In figure 7 the ELE variation is more sudden under the influence of HICP than the influence of GDP;
- In figure 8 the ELE variation is more sudden under the influence of MAC than the influence of GDP;
- In figure 9 the ELE variation is more sudden under the influence of HICP than the influence of MAC, even the difference is small.

Figure no.9. ELE evolution determined by HICP and MAC progression.
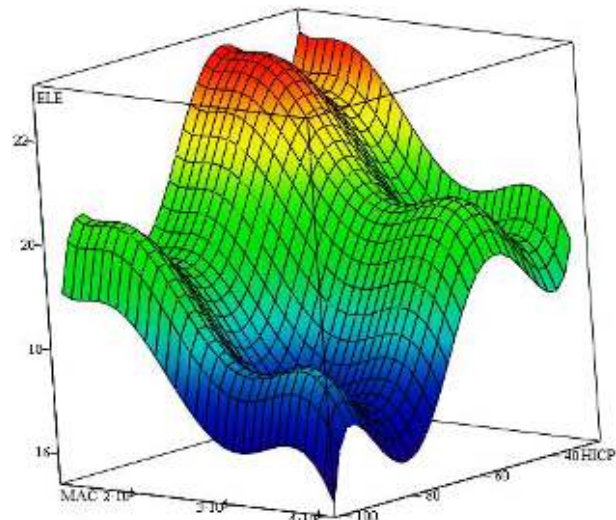
Source: Author's own graphic simulation representation.

Considering this analysis the hierarchy of influences over Early Leavers from Education and Training are as follows: the most influential is Harmonised Index of Consumer Prices and the slightest influence belongs to the Gross domestic product. The Main national accounts tax aggregates is situated between them closer to the Consumer prices.

4. Conclusion

The authors consider that all the established objectives were achieved. With the help of mathematical modelling mathematical function were determined to reveal the way that indices Gross domestic product, Harmonised Index of Consumer Prices and Main national accounts tax aggregates influences the Early Leavers from Education and Training.

Also the authors determined the hierarchy of influence of the three indices over the ELE, confirming the speculation of authors from the beginning of the paper that the most important factor for leaving the education and training is the prices.

5. References

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4. http://ec.europa.eu/eurostat/cache/metadata/en/edat1_esms.htm