Research on Human Resources Measures from the Educational Systems at the EU Level

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Abstract

Human resources from the educational systems are essential for the efficiency of these systems and for ensuring a qualitative educational act. The European Union faces a number of challenges in terms of human resources, especially within the educational systems of the member countries.

This paper investigates the trends of some human resources measures from education at the EU level (employees, pupils, the ratio between pupils and employees), along with the influences that the evolutions economic measures have on these measures. The aims of paper study the effects of economic crisis on human resources from education, analyzing the influences of GDP and educational expenses on the ratio of pupils-teachers (RPT) at the EU level.

Key words: educational system, economic trends, employees, pupils, European Union
J.E.L. classification: O15, I20, H52.

1. Introduction

The quality of education is crucial at EU level in order to develop a competitive economy. Competent teachers are the fundamental premise for effective education systems, in order to provide pupils with the best training for life, as active and dynamic members of society. The increasing expectations concerning pupils' results, the variety of the pupil's population, joined with the impact of the rapid evolution of technological improvements have a substantial effect on the teaching profession (OECD, 2005, 2012).

European leaders are dedicated to recognizing the challenges and finding the best ways to provide effective sustenance to professors, boost their competence and increase their prestige, a more efficient human resource management being an essential tool in addressing these challenges (Barbu and Barbu, 2012; Bocean and Sitnikov, 2015; Eurydice, 2018). Many countries at EU level are experiencing severe quantitatively, qualitatively and structurally human resource deficits. (Eurydice, 2015). While digital innovations and technologies supply new opportunities for refining teaching, the European Union is experiencing a rigidity in their actual utilization. (Eurydice, 2004)

In this paper we intend to investigate the influences that the economic evolutions have on measures that illustrate the EU HR in education. The paper is organized in five sections. The first section introduces the research topic. The second section made a brief literature review. The third section establishes the methodological bases and the research hypotheses. The fourth section is dedicated to analyzing the evolution of employees from education and pupils at EU level. The fifth section present the evolution of some HR in education. The sixth section concludes.

2. Literature review

The ratio of pupils-teachers (RPT) is the most frequently used indicator for international comparisons. Like wages, the RPT influences the level of employees' motivation. In the pre-university education level it can found a great differentiation between the EU countries. Previous research concluded that the RPT is not connected to the economic growth of a country. Countries such as France and the UK, for example, record the highest RPT.

The RPT is an important parameter that affects the working conditions of teachers. In most countries, teachers' unions demand a reduction in class size. The RPT is easier to calculate than the mean of the pupils per class and thus allows the evaluation of circumstances in diverse countries. On the other hand, it is not very significant, as it is an average figure, while "the expectations of the teachers (concerning the difficulty of working conditions) vary depending on the context and mainly be contingent on the level, attitude and conduct of the pupils" (Eurydice, 2004, p. 15).

The economic situation is an important aspect that influences decision in education (Eurydice, 2015). In periods of economic crisis, the financial crisis has a special impact on government spending: "due to high unemployment, on the one hand, the demand for education is increasing and on the other hand, economic crises put pressure on public spending (more people for unemployment benefits, support for the economy, etc.) and, therefore, governments may not be able to respond properly to all the demands they have made" (EACEA, 2013, p.3) and it must make decisions to keep costs under control. As far as education expenses are concerned, this can be done, for example, by increasing private contributions or by freezing and reducing teachers' salaries (Bocean, 2007).

3. Research methodology and hypotheses

Starting from the conclusions of the previous international and national studies, we formulated two hypotheses concerning the evolutions in the area of HRM at the pre-university level within the European Union. H1. Employees in education at EU level has increased in recent years, while pupils have decreased. H2. The RPT in EU countries is influenced by the economic evolution.

These hypotheses will be subject to the validation process, and the resulting conclusions will allow to formulate recommendations concerning the HRM at pre-university level within the European Union.

As research tools we will use descriptive statistics that have the role of synthesizing quantitative data which allow the researcher to obtain a holistic overview of the research data. In addition to analyzing the correlations between the variables, we will also conduct a research of the curve-fit framing to determine the optimal function for an in-depth analysis. Starting from the most relevant functions for the collected data sets we will apply an analysis of the artificial neural networks that are established between the variables to identify their influences.

4. Trends of employees' numbers of educational institutions and pupils in European Union countries

In order to investigate the validity of the hypothesis H1 we have collected both synthetic and analytical data that characterize the HR measures (EU 28) for the period 2003-2017 is illustrated in table 1.

Table no. 1. Trends of employees and pupils in education at EU level (EU 28)

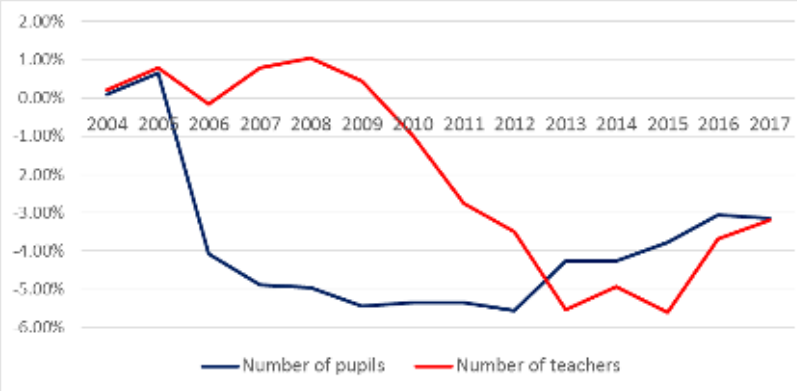
	Number of pupils	Number of employees
2003	92200286	5957776
2004	92277321	5970805
2005	92797437	6004073
2006	88442021	5948019
2007	87688836	6005010
2008	87624293	6020005
2009	87183031	5984479
2010	87272211	5899710
2011	87270631	5793276
2012	87071914	5749148

2013	88283909	5628541
2014	88272446	5663666
2015	88730265	5624062
2016	89390219	5738595
2017	89303103	5767803

Source: Data collected from Eurostat (2019)

To illustrate trends of employees and pupils at the EU level, figure 1 shows the changes of these measures in the period 2004-2017, using as a basis the values from 2003.

Figure no. 1. Changes in the employees' and pupils' number at EU level (EU 28)



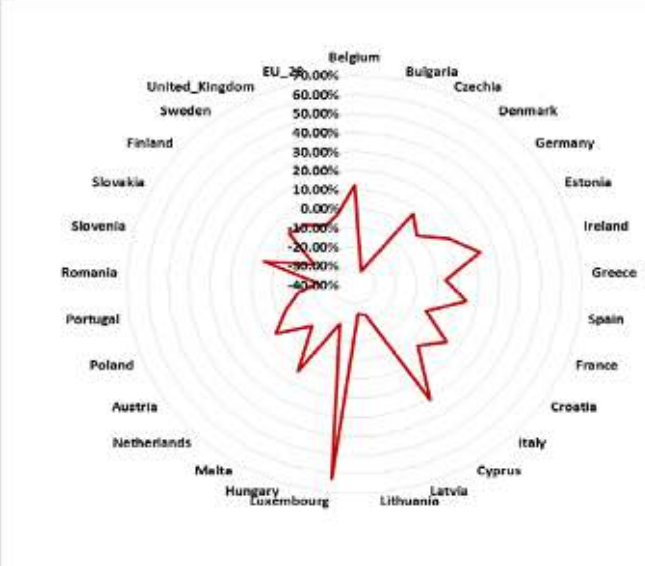
Source: Data collected from Eurostat (2019)

Analyzing the data in table 1 and figure 1, no clear trend of both measures can be observed within the selected period. In the initial three years of the selected period (2013-2005) both measures show slight increases, which lasts in the case of employees from education another two years. Starting with 2008, both measures have a downward trend, their growth resuming between 2012 and 2013 and continuing until 2017.

The trend of the employees was influenced by the evolution of pupils, during the economic growing and by the descending development of the economy and budgets for education during the crisis period.

Following the analysis of the analytical data, the gap between different groups of countries can be observed. Number of teachers registered decreases (in 2017 compared to 2003), especially in countries with a lower degree of development, from the cluster of the former communist countries (figure 2).

Figure no. 2. Change of employees' number from education at EU level in 2017 reported to 2003



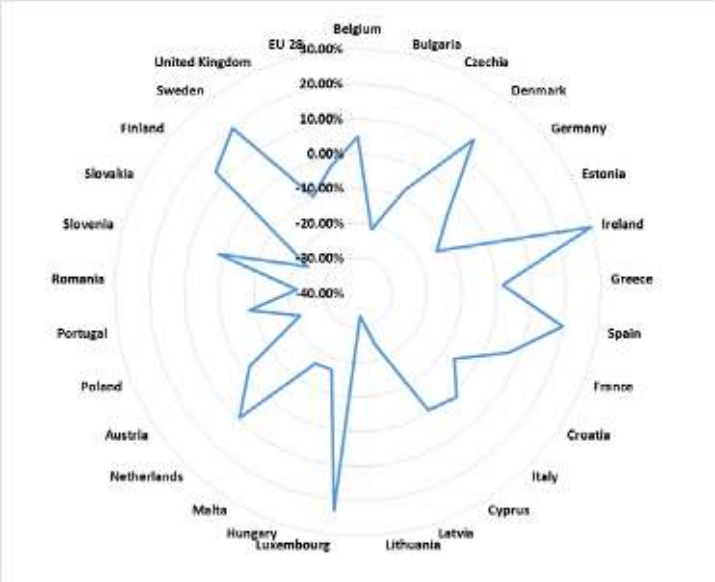
Source: Data collected from Eurostat (2019)

By investigating the evolution of pupils we observed that this indicator has recorded decreases (in 2017 compared to 2003), especially in countries with a lower degree of development, from the cluster of countries that were communist (figure 3).

Starting from the analysis of the synthetic and analytical data we can conclude that the hypothesis H1 is invalidated for the period studied (2003-2017).

There is a tendency to reduce the number of pupils due to the phenomena of birth shortage and aging of the population, but this is moderated by the growth in the population extent. At EU level, the natural growth is supplemented by the strong immigration phenomenon towards the developed EU member countries.

Figure no. 3. Change of pupils' number of at EU level in 2017 reported to 2003



Source: Data collected from Eurostat (2019)

Concerning the evolution of employees of educational institutions, it does not show a clear evolution during the studied period, being biased by the pupils' number, the periods of economic crisis that determine the reduction of the expenses with education, national employment policies and in the area of education.

5. The influences of economic evolutions on the RPT

In order to examine the validity of the hypothesis H2 we collected both synthetic data at the EU level (table 2).

Table no. 2. Evolution of the RPT at EU level (EU 28)

	UE 28	Eurozone (19 countries)
2003	15.48	14.63
2004	15.45	14.48
2005	15.46	14.22
2006	14.87	14.04
2007	14.60	13.67
2008	14.56	13.62
2009	14.57	13.42
2010	14.79	13.58
2011	15.06	13.56
2012	15.15	13.50
2013	15.54	13.97
2014	15.54	14.12
2015	15.48	14.15
2016	15.43	13.82
2017	15.36	13.91

Source: Data collected from Eurostat (2019)

Following the comparative analysis of the data in table 2 it can be seen that the RPT recorded lower values in the more developed countries belonging to the Eurozone, the expenses with education allowing the employment of more teachers reported to the number of pupils.

In order to define the effect of the economic evolution on this indicator, we calculated the correlations recorded between the evolutions of the RPT, educational expenses, per capita GDP in the period 2003-2017 (table 5). Following the analysis of the correlations in table 3 leads to the conclusion that the analyzed measures are strongly correlated, inversely proportional and that the RPT is significantly influenced by the evolution of educational spending and GDP. The decreases determine an increase in the RPT.

Table no. 3. Correlations among the RPT, educational expenses, GDP per capita at EU level 28 (2003-2017)

		Pupils / teacher ratio	**Educational expenses for the pre-university level**	**GDP per capita**
Pupils / teacher ratio	Pearson correlation	1	-0.813**	-0.789**
	Significance		0.000	0.000
	Values	15	15	15
Educational expenses for the pre-university level	Pearson correlation	-0.813**	1	0.863**
	Significance	0.000		0.000
	Values	15	15	15
GDP per capita	Pearson correlation	-0.789**	0.863**	1
	Significance	0.000	0.000	
	Values	15	15	15
**. The correlation is strong.				

Source: Developed by the author

To measure the effects of the two independent variables (education expenditure and GDP per capita at EU level 28) on the dependent variable (the RPT) we proceeded to carry out an in-depth analysis. In this sense, ten functions have been tested to choose the optimal function for estimating the variation curve. We found that the optimal function is the sigmoid function. Based on the function testing to estimate the variation function, we deepened the investigation by conducting a neural network analysis, in which we used educational expenditure and GDP per capita as input variables, and the RPT as an output variable, in order to determine the influence of economic evolution (illustrated by the input variables) on the analyzed ratio.

Table 4 presents the summary of the MLP (multilayer perceptron) model and the estimated parameters. We used a single hidden layer, and the model generated two units of influence of the layer. Given the test results of the relevant functions, as a function of activation for the input and output layers, we selected the sigmoid function.

We found that there is an inversely proportional influence on the values of RPT exercised by educational expenses and GDP per capita. The evolution of these have a negative influence on the unit H (1:2) of the hidden layer that constitutes the general economic evolution and a positive influence on the appetite for the school preparation and the interest for the didactic career (unit H(1:1) of the hidden layer).

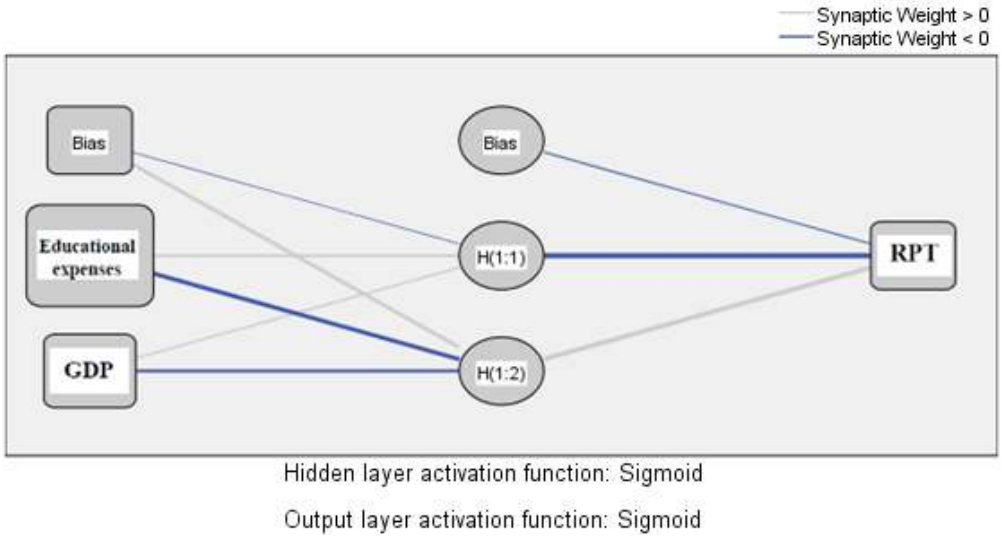
Table no. 4. Multilayer perceptron type (MLP) model applied to the variables regarding educational expenses, GDP per capita and RPT

Predictors		**Predicted values**		
		Hidden Layer 1		Output Layer
		H(1:1)	H(1:2)	RPT
Input Layer	(Bias)	-0.016	2.595	
	Educational	0.792	-3.010	
	GDP per capita	0.483	-0.876	
Hidden Layer 1	(Bias)			-0.057
	H(1:1)			-3.646
	H(1:2)			3.619

Source: Developed by the author

The bias exercised by the input layer on the hidden layer and the bias exercised by the hidden layer on the output layer indicate an external influence on the overall negative, but not very prominent, being represented by factors such as educational policies. These relationships are graphically illustrated in Figure 4.

Figure no. 4. MLP network applied to the variables concerning educational expenses, per capita GDP and the RPT



Source: Developed by the author

The ANN illustrate the influence of the selected measures to express the economic evolution on the RPT. An economic crisis causes an increase in the RPT, while a period of economic growth leads to the reduction of this ratio, which drive the improvement of the educational act. These effects are displayed with a postponement of several years, considering that the educational sector has a certain rigidity being a predominantly public sector.

Following the data analysis we can conclude that the hypothesis H2. During the economic crisis (2008-2010) this ratio decreased as a result of reducing the pupils' number and lowering employees' number. The growth period brings a reversal of these trends, which causes an increase in RPT.

6. Conclusions

In this paper, we set out to investigate the influences that the economic evolutions have on some measures that illustrate the HR in the EU educational system. In this regard, we formulated two hypotheses that were subjected to a validation process, during the research.

A first hypothesis states that employees in education at EU level has increased in recent years, while pupils has decreased. Analyzing the data we cannot observed a clear tendency of both measures during the selected period, which invalidated the hypothesis. The second hypothesis claimed that the RPT at EU level is influenced by the economic evolution. Resulting from the analysis of the neural network we found that an economic crisis causes an increase in RPT. These effects appear with some delays, considering that the educational sector has a certain rigidity being a predominantly public sector.

An effective and efficient HRM has a decisive role in achieving the academic success by an educational institution. The school organization offers quality educational services if it has implemented an efficient HRM system.

7. References

- Barbu, R.M.C. and Barbu M.C., 2012. Training of personnel in leadership positions in sport organizations. *Studia Universitatis Babes-Bolyai, Educatio Artis Gymnasticae*, 57(3), pp. 41-51.
- Bocean, C.G., 2007. *The Impact of Active Labour Market Policies in Romania*. [online] Available at: <https://mpra.ub.uni-muenchen.de/10397/> [Accessed 9 September 2019].
- Bocean, C.G. and Sitnikov C.S., 2015. Setting international standards in human resources. *Management & Marketing Journal*, 13(1), pp 16-22.
- EACEA, 2013. *Government education expenditure in the European Union during the economic crisis (2008-2011).* Brussels: Education, Audiovisual and Culture Executive Agency.
- European Commission, 2013. *Study on Policy Measures to improve the Attractiveness of the Teaching Profession in Europe*. Final report. Luxembourg: Publications Office of the European Union.
- EUROSTAT, 2019. *Database Education and training*. [online] Available at: <https://ec.europa.eu/eurostat/web/education-and-training/data/database> [Accessed 22 July 2019].
- Eurydice, 2004. *Key topics in education in Europe. Volume 3 - The teaching profession in Europe: profile, trends and concerns*. Brussels: Directorate-General for Education and Culture.
- Eurydice, 2015. Profesia de cadru didactic în Europa: Practicile, Percepţiile şi Politicile. Raportul Eurydice. Final report. Luxembourg: Publications Office of the European Union.
- Eurydice, 2018. Carierele cadrelor didactice în Europa: acces, progres și sprijin. Brussels: Directorate-General for Education and Culture.
- Galgoczi, B. and Glassner V., 2008. *Comparative study of teachers' pay in Europe*. Brussels: ETUCE/EI Research Project.
- OECD, 2005. *Teachers Matter: Attracting, Developing and Retaining Effective Teachers*. Paris: Organisation for Economic Cooperation and Development.
- OECD, 2012. *Preparing Teachers and Developing School Leaders for the 21st Century - Lessons from around the world*. Paris: Organisation for Economic Cooperation and Development.