FORECASTING YOUTH UNEMPLOYMENT RATE IN THE POST-CRISIS PERIOD

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ABSTRACT

In the present paper the authors intend to predict the level of youth unemployment in the post-crisis period, both for Romania and Poland. The chosen forecasting method is multiple linear regression with parameters estimated by the Least Squares Method. The application of this method was accomplished using Qm for Windows software. The results were interpreted both econometrically and economically. Among the chosen independent variables, the education level of young people and their health status have a positive influence on the unemployment rate, both for Romania and for Poland.This is undesirable, as while the number of young people with a higher level of education increases or their state of health improves, the unemployment rate also increases. The influence of the minimum wage on the unemployment rate is negative, so a rise in wages leads to a decrease in the unemployment rate.

KEYWORDS: *education level, forecast, unemployment rate, minimum wage, health status.*

JEL CLASSIFICATION: *C53, E24, O52.*

1. INTRODUCTION

Labor is one of the production factors, meant to support the development of an economy. It includes both employed and unemployed people. A particular category of unemployed appears among young people aged 15-24. This segment of the economically active population shows increased vulnerability to unemployment for several reasons. These include: youth experience and professionalism, job attractiveness, remuneration, labor market competitiveness (CNTM, 2015).

Unemployment among young people is a widely discussed topic, understanding it as a big phenomenon in an economy, meaning saving the younger generation by implementing measures and policies designed to reduce both unemployment and its effects. Thus, it is important to study the factors of influence on unemployment, to determine to what extent they can influence either an increase or a decrease in its registered level. All these influences overlap with the effects of the economic crisis and uncertainty, which requires detailed and complex analyzes.

Through this paper, we aim to forecast the youth unemployment rate, given the importance of the subject in the period following the global crisis. The chosen method of estimating the unemployment rate is that of multiple linear regression. As independent variables, we selected some socio-economic factors, chosen as representative for the category of youth affected by unemployment.

2. LITERATURE REVIEW

In the literature, there has always been a clear concern for the study of youth unemployment. Economically it is considered that a high level of youth unemployment generates harmful macroeconomic consequences. Firstly, it greatly influences the consumption of goods and services,

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reducing it, then it decreases taxes and increases government spending with the unemployment benefits. Secondly, if youth unemployment appears, then young people skills and abilities will not be used in a productive way. Where they do not exist, employers will perceive candidates as untrained.

There is undeniable evidence that education reduces the likelihood of unemployment. Athanasou et al. (1995) argue that both low levels of education and lack of post-school qualifications are risk factors for long-term unemployment. In his study, Borland (1997) shows that the youth unemployment rate can reach up to 6% for those with a university degree, up to 8% for those with qualifications diplomas, up to 16% for those who have not completed high school.

The way in which the unemployment rate is calculated helps to define it as accurately as possible. As Collins (2009) explains, from a mathematical point of view, the unemployment rate is made up of the number of unemployed people, relative to the civilian labor force, multiplied by 100. A person is considered to be engaged in a certain period if he has at least an hour of work in a reference week. An alternative is the situation where a person has worked for at least 15 hours on an unpaid post in a family business. Also included here, are those who are temporarily absent because they are either on vacation, either sick or are missing for other reasons.

Researchers in the field have demonstrated that there are a number of factors which can influence the unemployment rate in various forms. These are either factors that have a direct impact on the individual (what becomes the future unemployed), or macroeconomic factors with a direct impact on the unemployment rate.

For example, Marks and Fleming (1998) conducted an ample survey of youth unemployment in Australia, studying the factors that influence it. Thus, factors such as age, gender, area of residence, ethnicity (understood here as an English speaker or not), school results, educational attainment, achievement of an internship. Among the most important results reported by this study are:
- the most vulnerable to unemployment are 18-year-olds, and the least vulnerable are those aged 30;
- a high level of school outcomes significantly reduces the time spent in unemployment;
- the additional qualifications and achieved level of education have a low impact on unemployment;
- gender differences have emerged as obvious: men are more vulnerable than women.

Women are believed to be more committed to homework and family responsibilities.

A study on socio-economic factors affecting youth unemployment in Namibia (Tjikune, 2012) also reveals that the factors mentioned above are extremely relevant. The author defines the unemployment rate as the ratio of the non-institutionalized population of the nation who is at least 16 years old, who does not work, seeks employment or is available for work.

On the other hand, macroeconomic factors influencing unemployment may also refer to:
- The inflation (Lui, 2009) that acts as a two-edged sword: high inflation can increase the benefits of employees for performed work, with a negative effect on unemployment. On the other hand, inflation reduces the chances of a company to create jobs, thus contributing to rising unemployment;
- The population growth rate can negatively impact unemployment, as in the case for African countries. Rapid population growth "will make it difficult for economies to create enough jobs to get people out of poverty and improve living standards" (Rusu, 2013);
- Foreign direct investment (Aqil et al., 2014), which can influence unemployment by diminishing it through the technology and knowledge transfer.

The unemployment rate forecast is a subject of interest for many authors. For example, Simionescu (2015) predicted the unemployment rate in Romania using a panel data method (data that has both a spatial and a temporal dimension). For example, the author used the unemployment rate in Romania (the spatial dimension) in 2005-2010 (the temporal dimension) to predict its value in the upcoming years 2011-2014.

Taking all of the above into account, it can be argued that in order to model the unemployment rate with a prediction technique based on linear regression, it is necessary to choose its most representative factors of influence.

3. DATA AND METHODS

To achieve youth unemployment rate forecast for the next four years, the multiple linear regression will be used. At the same time, the regression method can show to what extent a variable is influenced by one or more independent variables. This is explained by the parameters of the regression equation, estimated by applying the least squares method. This method is based on using the regression equation, which on our example will take the following form:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \qquad (1)$$

- Y is the dependent variable;
- X_1, X_2, X_3 are the independent variables;
- α is the intercept:
- $\beta_1, \beta_2, \beta_3$ are the estimated coefficients;
- ε represents the residuals.

In order to use this method, it is necessary to identify the dependent variable and the three independent variables. In this case, the dependent variable will be the youth unemployment rate (Eurostat, 2017a), which is influenced by the following variables: young people with a higher education level (Eurostat, 2017b), minimum wage level (Eurostat, 2017c) and health status of young people (Eurostat, 2017d).

We believe that the way these variables influence the youth unemployment rate is as follows: a young person with a higher education and a good health state will have very low chances of being unemployed; also a higher level of the minimum wage will motivate young people to engage. In other words, a high level of these variables will have an economically favorable influence on the dependent variable, contributing to its mitigation.

The analyzed period will be the post-crisis period, 2008 - 2016. The analysis will be carried out in parallel for 2 countries in the European Union, namely Romania and Poland. The reason for choosing these two countries is the similarity in terms of the youth unemployment rate in 2016. Next, the data extracted from Eurostat will be briefly analyzed for all 4 indicators, with graphical representations of their evolution during the analysed period.

3.1. Youth unemployment rate
The chart below shows the evolution of the dependent variable between 2008 and 2016 at the level of the two analyzed countries, Romania and Poland, in comparison with the EU-28 level.

The graphs highlight the extreme points from 2008 to 2016 as follows:
- For Romania, the unemployment rate among young people registers an increase till 2013 and a decrease after that. The lowest value of this indicator is 5.4%, a value recorded in 2008, while the highest value is 7.6% in 2013.
- In Poland, the indicator registered a continue growth until 2013. The lowest value recorded is 6.1% in 2008, unlike in 2013, when the maximum value is 10.0%.
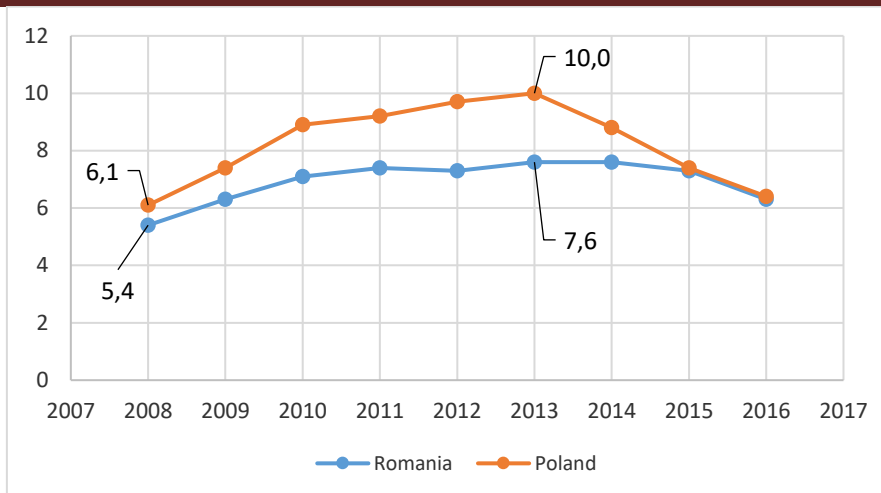
Figure 1.Youth unemployment rate for Romania, Poland and EU – 28
Source: Eurostat (2017a)

3.2. Young people with a higher level of education

The chart below shows the evolution that the independent variable, young people with a higher level of education, had between 2008 and 2016. A first thing that emerges from the graph is that Poland reports a higher level of youth whit higher education, compared to the level recorded by our country and even above the EU - 28 average.
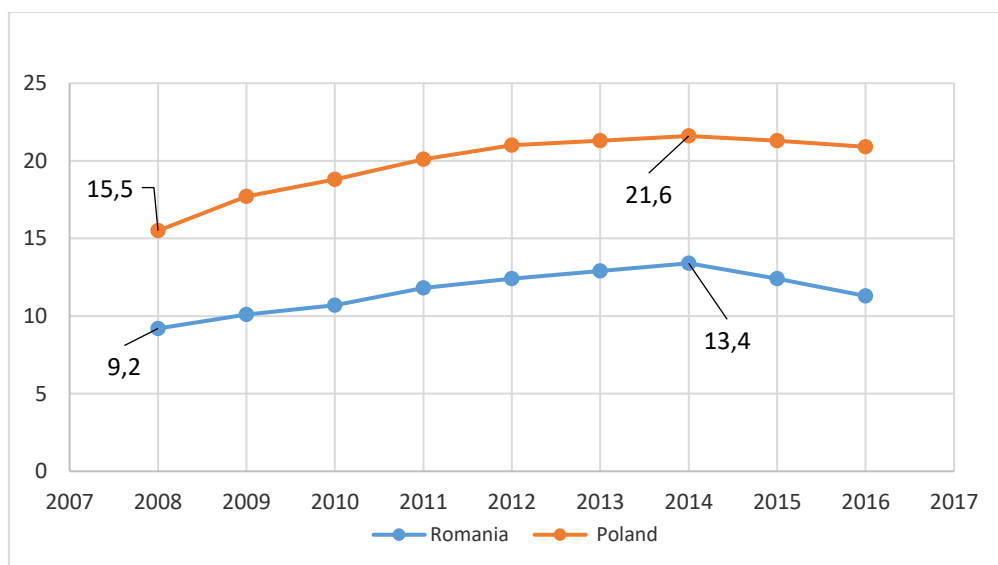

Figure 2. Young people with a higher level of education in Romania, Poland and EU – 28
Source: Eurostat (2017b)

Looking at the above figure, we can observe the following:
- An upward trend has been observed in Romania over the whole period, with a slight decrease at the end of the period between 2014 and 2016. Regarding the maximum and minimum values, they were registered in 2014 and 2008, those values are 13.4% and 9.2%.
- As regards the situation in Poland, the minimum value of the analyzed period was registered in 2008, so there were 15.5% young people with a higher education level, unlike in 2014, when the share of young people with higher education was of 21.6%.

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3.3. The minimum wage level

In the chart below we can see the evolution that the second variable, the Minimum wage level, had between 2008 and 2016. As with the previously analyzed variable, the minimum salary level in Poland is superior to that in Romania.
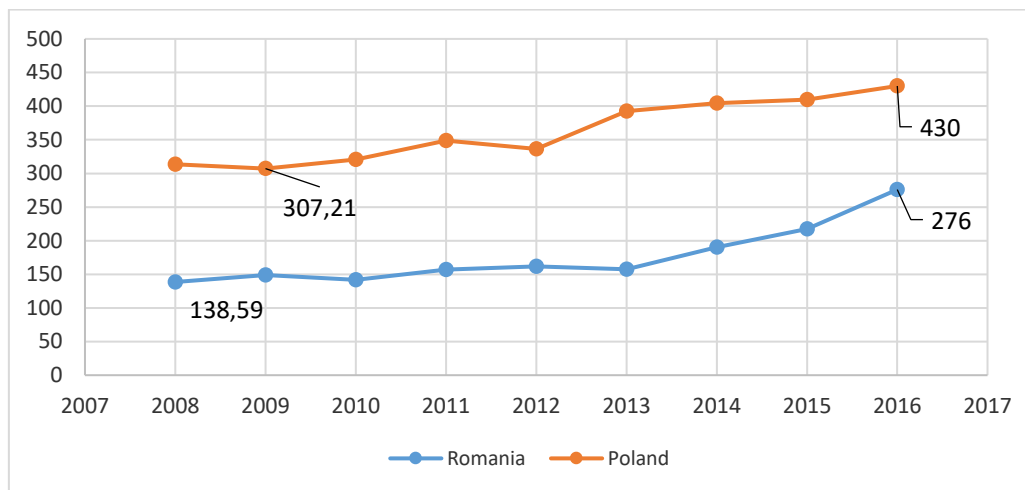

Figure3.The level of minimum wage for Romania and Poland
Source: Eurostat (2017c)

- In the 2008 - 2016 period, the minimum wage level in Romania was at about 139 euro in 2008, slightly increasing until 2016, when it recahed a maximum of 276 euro.
- In the same period Poland enregistered the highest value of the minimum wage in 2016, after entering on an ascending trend. The lowest value is reported for 2009, but it still remains superior to the level observed for Romania.

3.4. The youth health status

The next chart contains the evolution that the third independent variable, the Youth perceived health, had during 2008 - 2016.
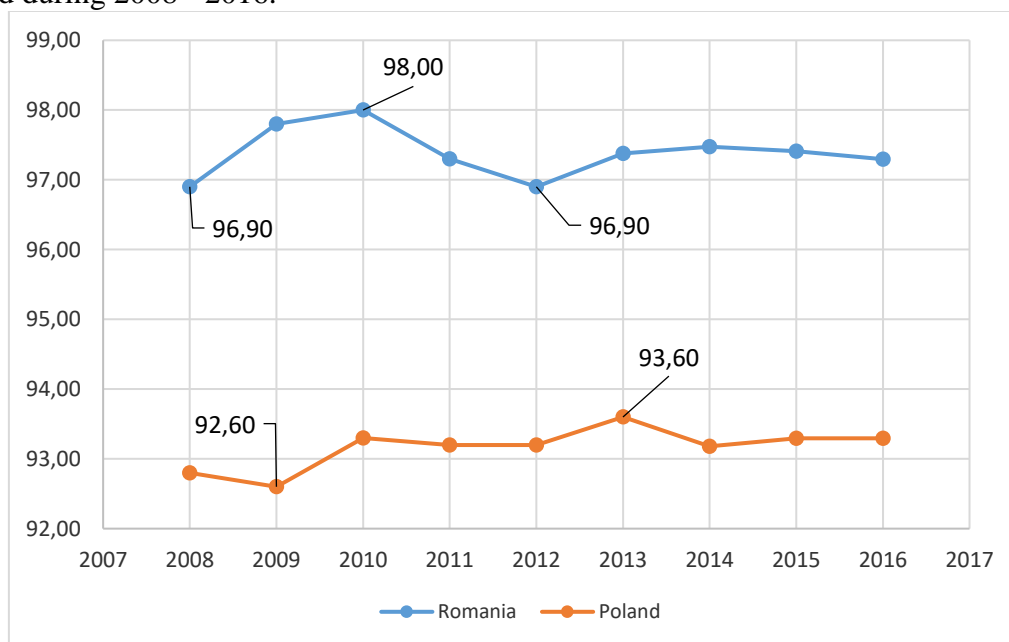
Figure 4.The youth health status for Romania and Poland
Source: Eurostat (2017d)

By studying figure 4, one can observe that this is a situation where Romania reports a better health status for its young people, as compared to Poland. For Romania we can admit an oscillating trend for the analyzed period, while for Poland an alternating trend describes the data.

Given the above information, we can move on to the analysis of the selected data, in order to estimate the regression equation parameters, to interpret the economic and econometric results, and finally obtain the forecast. The program used to estimate regression equation parameters is QM for Windows; the following modules will be used:
- *Forecasting/Least Squares – Simple and Multiple Regression*
- *Forecasting/Regression Projector*

4. RESULTS AND DISCUSSION

4.1. Results for Romania

By using the Forecasting module from *QM for Windows,* and using *Least Squares – Simple and Multiple Regression* option,we will determine the regression equation based on the three independent variables listed above.

After entering the data and running the program, we obtain the following results, shown in Figure 5:

Measure	Value
Error Measures	
Bias (Mean Error)	0
MAD (Mean Absolute Deviation)	.162
MSE (Mean Squared Error)	.034
Standard Error (denom=n-2-2=5)	.248
MAPE (Mean Absolute Percent Error)	.023
Regression line	
YUR = -49.653	
+ .54 * YEL	
-.004 * MW	
+ .525 * YPH	
Statistics	
Correlation coefficient	.966
Coefficient of determination (r^2)	.932

Figure 5.Results generated in Qm for Windows, Least Squares – Simple and Multiple Regression option
Source: the authors

Based on this regression equation, more precisely the parameters of the equation, one can observe the influence of the independent variables on the dependent variable:
- In the case of a one unit increase for the indicator representing young people with a higher education level (considering that the other variables remain constant) the youth unemployment rate will increase by 0.54.
- If the minimum wage would increase by 1 euro and the other variables would remain constant, the youth unemployment rate would decrease by 0.004.
- If the percentage of young people with a good perceived health status increases by 1% and the other variables remain constant, the youth unemployment rate will increase by 0.525.

$$YUR = -49.653 + 0.54 \times YEL - 0.004 \times MW + 0.525 \times YPH \quad (2)$$

Regarding multiple regression, the intensity of the link among variables is determined and measured with the determination coefficient. In this case, this indicator is 0.932. Based on this value, we can say that the dependent variable, the youth unemployment rate, is 93.2% influenced by the chosen independent variables.

The F-statistic reported for the estimation is 22.99, while the associated probability is 0.002. So, the group of considered variables are jointly significant and the probability that the results could have happened by chance is very low.

Although we expected that the level of higher education among young people and their health status would influence the unemployment rate in the sense of diminishing it, according to the estimated parameters of the regression equation, the situation is exactly the opposite. The explanation for this could be: when they reach a level of higher education, young people aspire to occupy a very well paid job, they are not willing to accept work even for a period of time and being paid below their expectations.

In terms of health, young people with a good perceived health status tend to develop their own business activities or are involved in educational activities, or remain inactive for a longer period of time, being supported by their families. An affirmation to support this conclusion is the one presented in an article by Ernst and Young (n.d.):"52% of Romanian students want to start their own business in the next two years, according to a recent analysis by EY Romania and the Department of Statistics and Econometrics of the Bucharest University of Economic Studies among 765 students". The article is called suggestively: Entrepreneurship - one of the solutions for the "lost generation" of young people without jobs.

In the case of the minimum wage, it behaves exactly according to the Phillips curve (Hoover, 2008; Citu, 2015), meaning that a rise in salary leads to a decrease in the unemployment rate.

In order to predict the main indicator, we have created 4 scenarios that can occur in Romania in the years to come. To achieve this forecast, we used the Forecasting module, but this time with the Regression Projector option. The possible scenarios and also the results of the forecast, can be seen in the figure below.

	Coefficients	Forecast 1	Forecast 2	Forecast 3	Forecast 4
Intercept	-49,653	xxxx	xxxx	xxxx	xxxx
YEL	,54	14	11,3	11,3	9,2
MW	-,004	276	320	276	0
YPH	,525	97,29	97,29	98	96
Forecast		7,88	6,246	6,795	5,715

Figure6.Results generated in Qm for Windows, Regression Projector option
Source: the authors

The first scenario involves increasing the share of young people with a higher level of education, while the other variables remain unchanged. In this case, the unemployment rate among young people registers a value equal to 7.88%. The influence of the independent variable was consistent with the estimate, leading to the increase of the main indicator.

The second scenario aims the increase in the minimum wage to a level of 320 euro, while the other variables retain their level from 2016.As a result of this change, the unemployment rate among young people reaches 6.246%. Practically, raising the minimum wage has led to the decrease of the dependent variable as previously demonstrated.

The third scenario shows the increase in the share of young perceived health by 0.7%, as compared to the level of 2016.In this scenario the unemployment rate among young people is 6.795%. As with the other 2 scenarios, the influence of the independent variables (indicated by the regression parameters) on the dependent variable is preserved. So, an improvement in the health status of young people, generates an increase in the unemployment rate almost in the same proportion.

The fourth scenario involves changing 2 variables in the same time: decreasing the value of the indicator reporting young people with a higher education level and worsening health status among young people. All these changes to the independent variables led to an unemployment rate among young people of 5.715%.

4.2. Results for Poland

We will apply the same method as for Romania, in order to analyze the influence of the three factors (young people with a higher education level, the minimum wage level and the health status of young people) on the youth unemployment rate, for Poland.

After running the Forecasting module, the Least Squares - Simple and Multiple Regression option, the new regression equation that also takes into account the factors outlined above,appears:

$$YUR = -215.831 + 0.734 \times YEL - 0.06 \times MW + 2.388 \times YPH \qquad (3)$$

Based on the above regression equation, more precisely on the estimated parameters of the equation, one can observe the influence of the independent variables on the dependent variable:

- In the case of one unit increase in the indicator regarding young people with a higher education level (considering that the other variables remain constant), the youth unemployment rate will increase by 0.734.
- If the minimum wage would rise by 1 euro, while the other variables remain constant, the youth unemployment rate would decrease by 0.036.
- If the percentage of young people with a good perceived health status increases by 1%, while the other variables remain constant, the youth unemployment rate will increase by 2.38%.

Measure	Value
Error Measures	
Bias (Mean Error)	0
MAD (Mean Absolute Deviation)	.421
MSE (Mean Squared Error)	.226
Standard Error (denom=n-2-2=5)	.638
MAPE (Mean Absolute Percent Error)	.051
Regression line	
YUR = -215.831	
+ .734 * YEL	
-.036 * MW	
+ 2.388 * YPH	
Statistics	
Correlation coefficient	.935
Coefficient of determination (r^2)	.875

Figure7.Results generated inQm for Windows, Least Squares – Simple and Multiple Regression option
Source: the authors

The intensity of the relationship among variables is determined and measured with the determination coefficient, R^2. In this case, R^2 is 0.875. Based on this value, we can say that the dependent variable, the youth unemployment rate, is 87.5% influenced by the chosen independent variables.

The F-statistic reported for the estimation is 11.64, while the associated probability is 0.01. So, the group of considered variables are jointly significant and the probability that the results could have happened by chance is very low. The confidence level reported is of 99%.

In order to predict the main indicator, we have created 4 scenarios that can occur in Romania in the years to come. To achieve this forecast, we used the Forecasting module, but this time with the Regression Projector option. The possible scenarios and also the results of the forecast, can be seen in the figure below.We chose to keep the same scenario structure as in the case of Romania for a more relevant comparative analysis.

	Coefficients	Forecast 1	Forecast 2	Forecast 3	Forecast 4
Intercept	-215.831	xxxx	xxxx	xxxx	xxxx
YEL	.734	22	20.9	20.9	16
MW	-.036	430	450	430	430
YPH	2.388	93.3	93.3	95	92
Forecast		7.637	6.11	10.89	.129

Figure 8.Results generated inQm for Windows, Regression Projector option
Source: the authors

The first scenario involves increasing the share of young people with a higher level of education, while the other variables remain unchanged In this case, the unemployment rate among young people is 7.637%.The influence of the independent variable was consistent with the estimate, leading to the increase of the main indicator.

The second scenario aims the increase in the minimum wage to a level of 450 euro, while the other variables retain their level from 2016.As a result of this change, the unemployment rate among young people reaches 6.11%. Basically, the minimum wage increase led to a decrease in the dependent variable as shown above.

The third scenario shows the increase of the share of young people with good health up to 95% as compared to the level of 2016. In this scenario, the unemployment rate among young people is 10.89%. As with the other 2 scenarios, the influence of the independent variables (indicated by the regression parameters) on the dependent variable is preserved.

The fourth scenario involves changing 2 variables in the same time: decreasing the value of the indicator reporting young people with a higher education level and worsening health status among young people. All these changes in the independent variables led to an unemployment rate among young people of 0.129%, this being the lowest value of the analyzed indicator.

5. CONCLUSIONS

In this paper we have been able to predict the youth unemployment rate comparing in the same time the situation in Romania with that of Poland (countries with similarities in terms of unemployment rate). At the same time, with the regression analysis that we conducted, we identified a specific feature for the young generation; concretely, young people of today`s generation are more selective and more demanding in terms of employment. They are no longer willing to accept a job if their salary and working conditions do not match their expectations. The claims that young people have are largely due to their studies and the effort made during the bachelor studies. This also has a negative perspective. Most of the time, young people's claims are disproportionately high compared to their level of experience and also to their knowledge, capabilities and skills. Hence, the increase of the unemployment rate with the increase in the level of education, supported by the positive value of the estimated parameter for the independent variable associated with the level of education. It is true that the model has its limits. Firstly, the program used in estimation does not return probabilities for the statistical significance of the estimated coefficients. However, in order to be sure that the results are statistically significant, we also used an excel worksheet for estimation. All coefficients are statistically significant at a 90% level of confidence.

Secondly, the period under review is limited, the analysis being carried out only on a period of nine years, since the economic crisis began. Also, the youth unemployment rate does not depend only on

the three variables considered in the present paper. In economic reality, any indicator is influenced by many social and economic factors. In our case, among the factors that could have influenced the main indicator (and which could have been selected for the regression analysis), we mention the inflation rate, the number of vacancies, the area of residence, the per capita GDP, the political factors, etc.

If we reconsider this analysis for a larger period of time, things could take a whole new turn, precisely because of the evolution of the three factors under consideration. Also, a possibility to improve both the regression analysis and the forecast is to choose new independent variables and include them either separately or alongside the already studied three independent variables.

Regardless the envisaged variables, the youth unemployment rate indicator is a very sensitive indicator that may have unexpected evolutions and explanations.

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