NEW APPROACH TO EVALUATION OF THE EFFICIENCY OF HIGHER EDUCATION EXPENDITURE IN REGARD TO QUALITY ACHIEVED (EVIDENCE FROM SELECTED COUNTRIES FROM CENTRAL AND EASTERN EUROPE)

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Introduction

Higher education plays an important role in the development of human capital, and that, in its turn, is a boost to economic growth. The positive effects from the investments in this field stand out even more clearly at the individual level due to the improved opportunities for employment and for higher incomes and the reduced risks of unemployment and social exclusion for the individual user of the service. All of this proofs the importance of the field and the need for both public and private sector investments in it. At the same time, it is a requirement of economic logic to use the expenditures in the most efficient way possible. This means that either the increased investments in higher education should lead to greater effects, or the results that have already been achieved at a certain level, if desired, should be maintained at reduced expenditures.

One of the main questions related to the assessment of the results from the expenditures for higher education is associated with the aspect in which they are considered and measured. First of all, it is possible to use indicators which report the quantitative aspects of the results, e.g. tertiary educational attainment, which is one of the goals of the Europe 2020 strategy. The data provided in Table 1 show that during the period 2013-2018, the indicator increased on average in EU-28, as well as in the countries of Central and Eastern Europe (CEE), members of the EU.

It is also noteworthy that the goal of 40% of tertiary educational attainment (age group 30-34) for the EU-28 was successfully reached in 2018. Six individual Member States from CEE also achieved their national goals: Czechia, Estonia, Latvia, Lithuania, Poland, and Slovenia. A positive trend towards an increase in the value of the indicator in 2018 compared to 2013 has also been reported for Bulgaria, Croatia, Hungary, Romania, and Slovakia, though their national goals have not been achieved yet.

Despite the positive trends with respect to tertiary educational attainment indicator in the EU Member states from CEE, it is necessary to note that the analysis of its values is not sufficient to be able to reach definite conclusions concerning the impact of the higher education on the development of human capital, improvement in productivity, performance on the labour market, and on the welfare of the beneficiaries of the service.

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Table 1: Tertiary educational attainment (age group 30 -34) (%)

Country	2013	2014	2015	2016	2017	2018	Цел
EU-28 (average)	37,1	38	38,7	39,2	39,9	40,7	40
Bulgaria	29,4	30,9	32,1	33,8	32,8	33,7	36
Czechia	26,7	28,2	30,1	32,8	34,2	33,7	32
Estonia	42,5	43,2	45,3	45,4	48,4	47,2	40
Croatia	25,6	32,1	30,8	29,3	28,7	34,1	35
Latvia	40,7	39,9	41,3	42,8	43,8	42,7	34
Lithuania	51,3	53,3	57,6	58,7	58	57,6	48,7
Hungary	32,3	34,1	34,3	33	32,1	33,7	34
Poland	40,5	42,1	43,4	44,6	45,7	45,7	45
Romania	22,9	25	25,6	25,6	26,3	24,6	26,7
Slovenia	40,1	41	43,4	44,2	46,4	42,7	40
Slovakia	26,9	26,9	28,4	31,5	34,3	37,7	40
CEE countries (average)	34,4	36,1	37,5	38,3	39,2	39,4	

Source: Author's calculations based on Eurostat data.

According to Pritchett (2001), "People with more education have higher wages. This is probably the second best established fact in economics (after Engel's law)" (Pritchett, 2001, p. 368). Based on this logic, the increased share of the population with higher education should lead to an increase in the overall income of a country, and would be conducive to economic growth. However, whether this will be achieved and to what extent will depend on the quality of higher education. According to Pritchett (2001), one possible cause for the absence of a correlation between the increase in human capital as a result of the increase of the work force with higher education and the growth rate in the average worker's productivity is low quality of the education which fails to develop all the necessary skills. This draws the attention toward the qualitative aspects of the results from higher education because the end-goal of the expenditures should not be only an increase in the number of people with higher education, but the generation of positive effects for the individuals who use the service with regard to their performance on the labour market and their welfare (higher incomes and employment, lower levels of unemployment, lower risks of poverty and social exclusion, etc.) and for the economy as a whole. After exploring the role of human capital in economic growth, Barro (2013) notes that his results give sufficient reasons to assert that "the quality and quantity of schooling both matter for growth, but that quality is much more important" (Barro, 2013, p. 298).

The present paper focuses on the assessment of the efficiency of higher education expenditures in the EU Member States from Central and Eastern Europe in terms of the effects in relation to the quality of the received education, applying the DEA (Data Envelopment Analysis) method. The aim of the paper is to do a comparative analysis between the efficiency in this field among countries that are historically connected and are often grouped together into a common model of socio-economic development (Petrova, 2014).

The paper is organized as follows. The next part contains a brief review of the literature in the field, outlining also the areas in which the study in the present paper differs. The third part presents the methodology of the research, which introduces a new approach to the measurement of the output results from the investments in higher education related to the performance on the labour market and welfare. The fourth part summarizes the results from the conducted research through application of Data Envelopment Analysis (DEA) method for the selected group of CEE countries which are EU members. The last part presents the main conclusions from the analysis.

2. A brief review of the literature in the field

Data Envelopment Analysis is the most frequently used method in the specialized literature for assessing the expenditures for higher education efficiency in comparative terms. DEA belongs to the group of the nonparametric methods. Through its use, based on a calculation of the efficiency frontier, the entities in a given group are categorized as efficient and inefficient.

The studies that have been carried out in the field using mainly the DEA method offer a diversity of approaches with regard to the applied methodology. The differences between the approaches can be viewed from several perspectives. First, from the perspective of the scope of the studied countries. Since the DEA method determines efficient and inefficient units in terms of comparison, the scope of the countries being studied can have an impact on the results. Some of the studies (Herrera and Pang, 2005, Afonso and S. Aubyn, 2005, St. Aubyn et al, 2009, Toth, 2009, Dutu and Sicari, 2016, Jelic and Kedzo, 2018) explore a greater number of countries which, however, are not homogeneous in terms of their levels of economic development, historical peculiarities, etc. Other studies (Aristovnik 2013, Jafarov and Gunnarsson, 2008, Yotova and Stefanova, 2017, Ahec Sonje et al., 2018), just like the present one, explore a smaller and relatively more homogeneous group of countries, such as EU Member States from CEE.

Second, the majority of studies in the field (Afonso and S. Aubyn, 2005, Herrera and Pang, 2005, Jafarov and Gunnarsson, 2008, Aristovnik, 2013, Fonchamnyo and Sama, 2016, Dutu and Sicari, 2016) look at the efficiency of the education expenditures at various levels simultaneously, not focusing particularly on the specifics of the higher education. The studies focusing specifically on the field of higher education (e.g. St. Aubyn et al., 2009, Toth, 2009, Yotova and Stefanova, 2017, Jelic and Kedzo, 2018,) are fewer in number. Higher education is different from secondary education in terms of its funding, which in most European countries, including CEE countries, is comprised of mixed sources. Even in the majority of state universities, there are fees to be paid by the students. This is also a specific peculiarity which has a bearing on the results with regard to the efficiency of the expenditures.

As a whole, most of the research that has been devoted to the efficiency of the education expenditures has been focused exclusively on public expenditures (Jafarov and Gunnarsson, 2008, Herrera and Pang, 2005, Fonchamnyo and Sama, 2016, Dutu and Sicari, 2016, Ahec Sonje et al., 2018, St. Aubyn et al, 2009). There is a smaller number of studies that have taken into account the mixed financing in the field of higher education, using as an indicator of the input resources the total expenditures for higher education. Such an approach has been adopted for example by Toth (2009), Yotova, and Stefanova (2017), and also in this paper.

Substantial differences can be observed also in the selection of indicators for the input resources and the output results. Jelic and Kedzo (2018) direct their attention toward the qualitative indicators for input resources and output results. The present paper also focuses on the efficiency of the expenditures for higher education with regard to the quality of the received education. A similar approach can be found in other studies devoted to the same problem as well. Aristovnik (2013), Ahec Sonje et al. (2018), and Jelic and Kedzo (2018) use indicators reflecting the unemployment among the population with higher education as an indicator of an output result. This indicator can be considered as indirect result from higher education related to its quality, which has an impact on the performance on the labour market. More specifically, Aristovnik (2013) uses the indicator unemployment among the population with higher education as a relative share of total unemployment. Ahec Sonje et al. (2018) apply almost the same approach, using the unemployed population with higher education as a relative share of total unemployed population in the country. Jelic and Kedzo (2018) use the ratio of unemployment rates (%, age 15-64) for all educational levels to unemployment rates (%, age 15-64) of the tertiary educated labour force. Another indicator of an output result, which also reflects to a certain extent the quality of the higher education received, is the employment rate for the population with higher education used by Toth (2009) and Yotova and Stefanova (2017).

3. Methodology

The concept of efficiency is well known from the economic theory of the firm, but it can also be applied to the assessment of the efficiency of the

higher education expenditures at macroeconomic level. Providing efficiency is usually expressed by the achievement of a maximum result using a given resource, or the achievement of a specific result using the minimum possible resource. Within the context of the study in this paper, the aim is to assess from a comparative point of view the efficiency of the expenditures for higher education in selected countries from CEE which are EU Member States through the use of the concept of the efficiency frontier. In connection with that, the nonparametric method will be used as it does not require the preliminary definition of the functional form of the frontier or the specific relation between input resource and output result.[1]

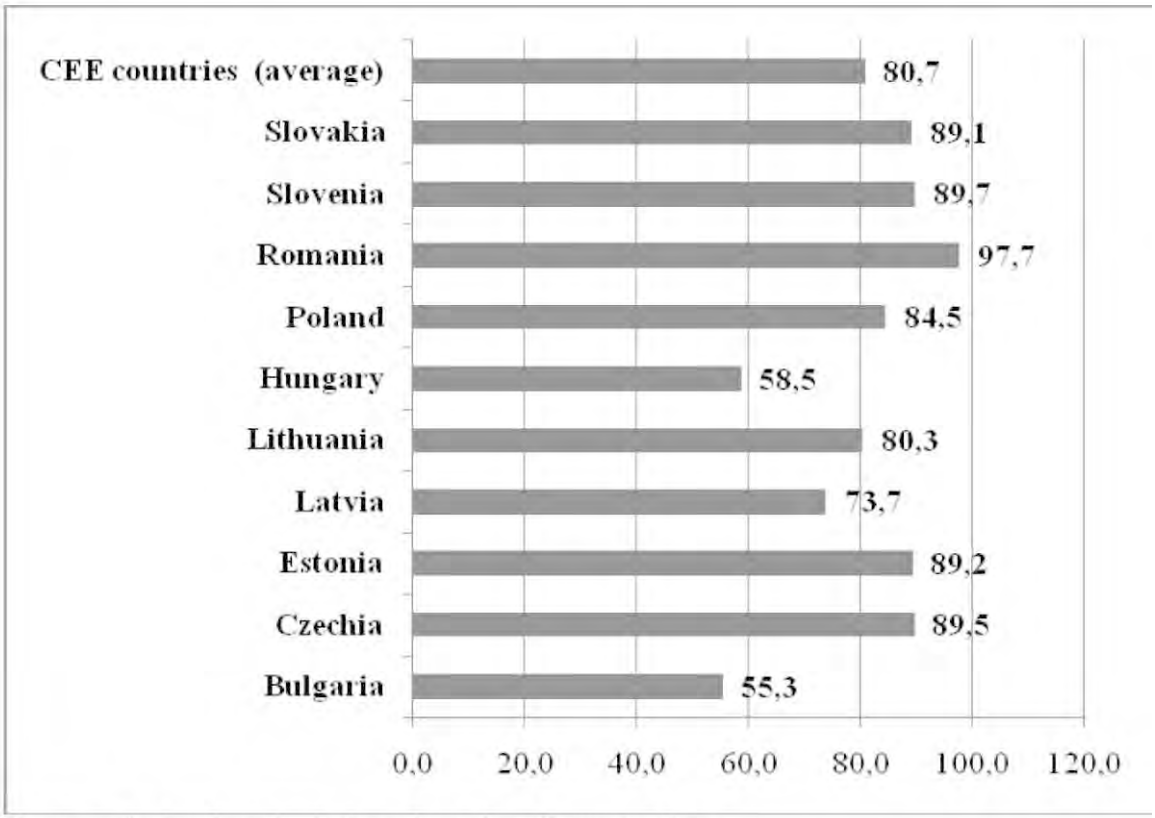
The review of the existing literature in the field shows that the most frequently used nonparametric method in similar studies is DEA (Data Envelopment Analysis). It "compares functionally similar entities described by a common set of multiple numerical attributes" (Aristovnik, 2013, p.5). By the use of this method, the efficiency of certain entities is determined in comparative terms, based on specific empirical data about input resources and output results. DEA defines which entities are efficient (i.e. situated on the efficiency frontier) and which are not efficient (i. e. situated below the efficiency frontier). In connection with this, the results from applying the method depend on the selection of entities (states) that will be included in the analysis. It is for that reason that the selection of countries in the present paper is narrower, including only states that are similar in terms of their geographic location, history, traditions, and levels of economic development. For the purposes of this study, an analysis of the input resources efficiency will be applied as they are easier to model. The output results which will be used in the present study are indirect, and cannot be directly impacted.

The Data Envelopment Analysis method has a number of advantages. According to Mihaiu (2010), it recognizes the complex non-linear (concave and convex) relationship between the results and the input resources, while the parametric methods usually limit this relationship, applying linear or simple forms of a non-linear relationship. Furthermore, the method can work with more than one indicator of input resources and output results, and these can also be expressed in different units of measurement.

A fundamental question in the development of the methodology of the study is the selection of input resources and output results indicators. As was already mentioned, the attention in the specialized literature is directed to the efficiency of the public expenditures for higher education, neglecting the private dimensions. In connection with this, most of the studies use the public expenditures for higher education as an indicator of input resources. At the same time, however, higher education in the EU Member States from CEE is financed from mixed sources. On the one hand, higher education in the state universities is a quasi public good and the education fee can cause the exclusion of certain users. It is the generation of positive external effects that motivates the state policies and expenditures in the field. On the other hand, education in private universities is pure private good. Because of everything said so far, even though public expenditures for higher education have greater share than private expenditure in the EU Member States from CEE (see Figure 1), it is more appropriate to use as an indicator of input resources the total expenditures for higher education, calculated as a sum of public and private expenditures of the households. In order to present the indicator of input resources as a relative indicator, the total expenditures for higher education per student as a percentage of GDP per capita were taken into account.

[1] For a comparison between the methods of measuring the efficiency frontier, see Hughes, 2002, p. 65.

Figure 1: Share of public expenditures in the total expenditures for higher education average for the period 2012-2016 (%)



Source: Author's calculations based on Eurostat data.

Figure 1 shows the share of public expenditures in the total expenditures for higher education, according to data from Eurostat. Depending on the availability of data, during the period 2012-2016, the average value of the indicator for the EU Member states from CEE[2] is 80.7 %. Even though a commonly observed tendency in all of the countries under consideration is that the relative share of public expenditures for higher education exceeds the share of private expenditures, there are also differences in the way of financing.[3] The lowest relative share of public financing for higher education during the period under review was observed in Bulgaria (55.3 %), Hungary (58.8 %), and Latvia (73.7 %).

The main specific characteristic of the methodology adopted in this article is connected to the selection and measurement of the indicators of output results from the higher education expenditures. The selected indicators will reflect the positive effects from acquiring a higher education degree compared to the possession of secondary education only, which can occur in a wide variety of spheres in the social and economic life of the individuals.

In this study, three types of positive effects have been selected, which have to do with the performance on the labour market and the welfare of the population with higher education - higher employment, lower unemployment and a lower risk of poverty and social exclusion. All the three effects can be perceived as indirect which reflect the quality of higher education.[4] At the same time, it is clear that other factors, which are unrelated to the level of education, can also contribute to the achievement of these effects, such as personal qualities of the individuals, family environment, etc. It is for that reason that the conclusions from the analysis of the efficiency of the higher education expenditures with regard to the indirect effects should not be absolutized and it is necessary to look for ways to

[2] All EU Member States from CEE in 2016 with the exception of Croatia, for which no data are available on Eurostat.

[3] For an analysis of the system of financing of higher education in the EU Member States from CEE, see Yotova and Stefanova, 2017

[4] For a more detailed analysis of the effects from higher education, see Velichkov and Stefanova, 2018.

increase their validity. The increment the validity of the results, precisely, is one of the purposes and of the advantages of adopted approach to the measurement of the output results. In the current study, in order to determine whether there is a positive effect from the acquisition of a higher education degree, and what is its magnitude, a comparison will be made with the situation of a person with secondary education, which is free and more widespread. In connection with that, the effects from acquiring higher education are measured compared to the population with secondary education. The indicators that reflect this are the amplitudes among the population with higher education and the population with secondary education measured as a percentage for the three selected types of effects from higher education (employment rate, unemployment rate, risks of poverty and social exclusion).

The amplitudes are calculated according to the following consecutive steps. First, with regard to the employment rate, it is calculated what percentage of the indicator of the population with higher education is the indicator of the population with secondary education. With regard to the unemployment rate and the people at risk of poverty or social exclusion, it is calculated what percentage of the indicator of the population with secondary education is the indicator of the population with higher education. Second, the calculated percentages for each of the three indicators for every country are subtracted from 100 %.

The adopted approach for the measurement of the output results by the amplitudes between the population with higher education and the population with secondary education has several advantages and removes certain methodological limitations. More specifically, with the alternative approach (the use of indicators of output results for the population with higher education), a positive relationship known from economic theory between input resource and output result should exists. Thus, some indicators should be excluded from the analysis (e.g. the unemployment rate for the population with higher education, population with higher education at a risk of poverty and social exclusion), because it could be assumed an inverse relationship between them and acquisition of higher education degree. With the use of the approach adopted in the present paper, it is not necessary a positive relationship to exist because an assessment is made of the way in which the resources expended for higher education lead to positive effects for population with higher education compared to the population with secondary education. In this way, the returns to higher education are accounted to a certain extent. Furthermore, through the use of this approach, the impact of other factors on the effects from higher education is diminished, which increases the validity of the conclusions based on the conducted research in spite of the indirect nature of the selected indicators of output results. The reason is that the effects among the population with secondary education from the same age group are accounted for, and thus, a greater certainty is achieved as to what is really due to the educational level, not to other factors. Of course, even with this approach, the conclusions should not be absolutized, but their validity increases.

In summary, it can be pointed out that with the aim of carrying out a comparative analysis in the assessment of the efficiency of the higher education expenditures among selected countries from CEE, which are EU Member States, a model will be built using one indicator of input resources (total expenditures for higher education as a percentage of GDP per capita) and three indicators of output results:

- the amplitude between population with secondary education and population with higher education with regard to the unemployment rate (age group 25-29);
- the amplitude between population with secondary education and population with higher education with regard to the employment rate (age group 25-29);
- the amplitude between population with secondary and population with higher education with regard to the risk of poverty and social exclusion (age group 25-49).

The first two indicators show the performance on the labour market, while the third one can be linked to the social effect on the welfare of the individuals. The data about the selected indicators was obtained from Eurostat. Data about the public and private expenditures for higher education is available on Eurostat for the period of 2012-2016. Data about the employment rate, the unemployment rate, and the population at risk of poverty and social exclusion is available until 2018.

The DEA method works with a cross section data at a particular point in time or with the averaged

data for a given period. The approach adopted in the paper is to use averaged data for 2 years, because that is the way not to allow the extreme values, if any, to affect the results. More specifically, the data used for input resources are the averaged data for the period 2013-2014, and the data used for output results - the averaged data for the period 2017-2018. The reasons for such a choice are two. On the one hand, there is a difference between the time when the expenditures have been made and the time when the output results from them are expected to start to manifest. That is the reason why the data used for input resources and for output results are not from the same period of time. On the other hand, the aim is to use the most recent data available (2017-2018 about the output results).

It is also important to note that again in order to increase the validity of the results, data used for the three indicators for output results is for an age group with lower limit, which is the age when it is assumed that the real integration on the labour market begins, and with upper limit, which is the lowest possible age. The lack of more specific data on Eurostat that would allow to narrow down the indicator to a smaller age group was the reason not to include in the model the amplitude between population with higher and population with secondary education with regard to incomes despite the existence of a clear relationship between this indicator and the returns to higher education and the effects from it.

All of the described methodological decisions were taken with the aim to establish a clearer relationship between the input resources and the output results, and also to increase the validity of the conclusions from the conducted research.

The availability of data on Eurostat about the selected indicators determines the geographical scope of the study as well. Due to the lack of data about the expenditures for higher education, Croatia was excluded from the study. Lithuania and Estonia were excluded due to the lack of data about the unemployment rate for the population with higher education. Slovakia was excluded as a consequence of the fact that when the amplitudes for the employment rate and for the unemployment rate were calculated, they turned out to be negative, which means that according to the two indicators, the effects from acquiring a higher education degree during the period 2017-2018 are negative in this country.

In order to distinguish between the indicators for the population with higher and the population with secondary education, the International Standard of Classification of Education (ISCED 2011) developed by UNESCO was used. For secondary education, levels 3 and 4 are used, and for higher education - from 5 through 8.

4. Results

The results from the application of the DEA method in accordance with the chosen methodology in the present paper have shown that only one of the countries under review (Romania) ranks as efficient. All of the other countries have been classified as inefficient, each one with a different deviation from the efficiency frontier. The results on Table 2 show that Czechia, Poland, and Latvia are with the smallest deviation.

Romania and Czechia are also shown to be among the most efficient EU Member States from CEE in terms of their expenditures for higher education by similar studies conducted in a previous time period (e.g. Yotova and Stefanova, 2017). The results are also confirmed in researches using different indicators for output results and a much more varied and comprehensive set of countries being researched. Among the states ranked by Aristovnik (2013) as efficient as regarding the higher education expenditure are namely Lithuania and Czechia. Romania is relatively efficient as well according to his study, being in the second group of countries. Poland, in its turn, has been ranked as efficient in other study (Ahec Sonje et al., 2018).

[2] All EU Member States from CEE in 2016 with the exception of Croatia, for which no data are available on Eurostat.

[3] For an analysis of the system of financing of higher education in the EU Member States from CEE, see Yotova and Stefanova, 2017

[4] For a more detailed analysis of the effects from higher education, see Velichkov and Stefanova, 2018.

Table 2: Efficiency coefficient

Country	Efficiency coefficient	Rank
Bulgaria	0,60	7
Czechia	0,90	2
Latvia	0,70	4
Hungary	0,62	5
Poland	0,74	3
Romania	1,00	1
Slovenia	0,61	6
CEE countries (average)	**0,74**	

Source: Author's calculations through applying DEA on Eurostat data.

The average value of the efficiency coefficient for all the countries included in the study is 0.74, corresponding to the efficiency coefficient of Poland. In connection with that, it should be mentioned that a majority of the countries included in the study have efficiency coefficients lower than the average.

The countries with the greatest observed deviation from the efficiency frontier, and therefore the most inefficient ones in terms of their expenditures for higher education, are Bulgaria, Slovenia, and Hungary. Bulgaria is defined as the most inefficient country. The results that show lower efficiency in Hungary and Bulgaria have also been confirmed by other studies (e.g. Yotova and Stefanova, 2017).

The application of the DEA method makes possible the calculation of the target values for the input resources and the output results which a country needs to have in order to be efficient. They are shown in Table 3. To become efficient, each one of the inefficient countries will need to either reduce to a varying degree the amount of their expenditures for higher education per student as a share of GDP per capita, or make efforts to increase the value of the indicators of output results.

Table 3: Input and Output Targets

Country	Input Target	Output Target		
		Unemployment rate amplitude	**Employment rate amplitude**	**Population at risk of poverty and social exclusion amplitude**
Bulgaria	18,05	27,22	10,64	61,96
Czechia	21,10	31,82	12,44	72,44
Latvia	20,88	31,49	12,31	71,70
Hungary	14,77	22,27	8,71	50,71
Poland	20,36	30,70	12,00	69,90
Romania	23,26	35,08	13,71	79,86
Slovenia	15,94	24,04	9,40	54,74

Source: Author's calculations through applying DEA on Eurostat data.

The data provided in Table 3 show that in order to keep the output results and achieve efficiency the expenditures for higher education per student as a share of the GDP per capita in Bulgaria should become 18.05%. This is a substantial decrease by 11.93 percentage points compared to the actual value of the indicator in the applied model (29.98%).

Some empirical studies (see for example, Toth, 2009; Yotova and Stefanova, 2017) account for the impact on the achieved efficiency of certain factors, such as the differences in the share of public expenditures in the total expenditures, which indirectly reflects funding of higher education. In order to find out whether such a relationship with the calculated efficiency coefficients actually exists, in Table 4 is provided data about the share of public expenditures in the total expenditures for higher education (%)

average for the period 2013-2014 as the indicator of input resources is precisely for that same period.

The data shown in Table 4 indicate that only in Slovenia the same ranking is not observed according to the share of public expenditures in the total expenditures for higher education compared to the ranking according to the efficiency coefficient (see Table 2). If Slovenia is taken out of the ranking, could be observed an identical ranking of the countries according to the two criteria (the efficiency coefficient and the share of public expenditures in the total expenditures for higher education), which presumes a positive relationship between the two indicators. Other studies have also reached the same conclusion for the EU Member States from Central and Eastern Europe (e.g. Yotova and Stefanova, 2017).

Table 4: Share of public expenditures in the total expenditures for higher education (%) average for the period 2013 -2014

Country	Share of public expenditures in the total expenditures for higher education (%)	Rank
Bulgaria	57,73	7
Czechia	89,63	2
Latvia	72,55	4
Hungary	59,83	5
Poland	83,45	3
Romania	96,94	1
Slovenia	89,94	6
CEE countries (average)	78,58	

Source: Author's calculations based on Eurostat data

Conclusion

The results from the conducted study of the efficiency of the higher education expenditures with regard to the quality of the received education in comparative term have shown that only Romania ranks as an efficient country among the EU Member States from Central and Eastern Europe. Czechia, Poland, and Latvia are the countries with the smallest deviation from the efficiency frontier, while Bulgaria, Hungary, and Slovenia exhibit the largest deviation. Due to the new approach in calculating the indicators of output results by comparing the populations with secondary and higher education, introduced in this study, it became possible to be accounted for the pure effects from the acquisition of a higher educational degree, and to increase the validity of the conclusions from the study. It is important to note that the results from the conducted research in the present article are confirmed also to a large degree by other authors using a different methodology.

The conducted research also shows that there are grounds to presume a positive relationship between the efficiency of the expenditures for higher education and the share of public expenditures in the total expenditures for higher education in the EU Member States from CEE. This favours the view that the greater share of public financing compared to private financing in this specific group of countries leads to better results with regard to the efficiency of the expenditures.

The purpose of the present paper is to direct the attention to the positive effects that can result from the quality of education. The selected approach covered three indicators of output results that are related to the performance on the labour market and the welfare of the individuals who have acquired a higher educational degree. This aspect of the efficiency of the expenditures for higher education is important, and needs to be an object of greater attention by public authorities at the national and supranational levels.

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