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Europe 2020 Implementation as Driver of Economic Performance and Competitiveness. Panel Analysis of CEE Countries

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Abstract: The Europe 2020 strategy is the EU strategy for sustainable and inclusive growth, for fighting the structural weaknesses of the European economies, and for improving their competitiveness. In this paper, we determined the most important ratios of the Europe 2020 Strategy impacting on economic performance expressed as the growth of the GDP per capita, and on economic competitiveness expressed as the share of the countries' exports in total world exports for some selected Central and Eastern European (CEE) countries (Poland, Slovakia, Bulgaria, Hungary, the Czech Republic, and Romania) using co-integration tests and OLS panel estimations with a dataset between 2004 (after four of these selected countries acceded to EU) and 2015 (the latest available data for all the ratios we used in our analysis). Our findings show that the tertiary level of education is the most important factor, positively correlated with both endogenous variables mentioned above. Other important factors for achieving the economic performance and competitiveness goals are the school dropout ratio, the share of renewable energy in final energy consumption, and the employment rate.

Keywords: CEE countries; GDP per capita growth; share of the CEE countries' exports in total world exports; Europe 2020 Strategy ratios

1. Introduction

In the era of frequent economic, environmental, and political crises at the global level, the concept of development begins to include an increasing number of aspects, having in mind the problems arising that should be solved, such as growing poverty, social exclusion, population aging, the reduction in the availability of non-renewable resources, environmental catastrophes with far-reaching consequences, the intensification of the globalization process, political crises, etc. In accordance with this concept, the European Parliament adopted the Europe 2020 strategy in 2010, as a program for smart, sustainable, and inclusive growth that has a much broader scope of action than the previous Lisbon Strategy. The strategy precisely defines the national targets that each economy needs to meet in order to achieve the long-term sustainable development of the EU as a whole. The

goals that should be achieved are grouped in five thematic areas with appropriate targets to be met by 2020 and indicators representing these areas (Table 1).

Table 1. Thematic areas, targets and indicators of Europe 2020 strategy.

Thematic Area	Targets	Indicators
Employment	<ul style="list-style-type: none"> 75% of the population aged 20–64 to be employed 	<ul style="list-style-type: none"> Employment rate, total (% of the population aged 20–64)
Research and development	<ul style="list-style-type: none"> 3% of GDP to be invested in the research and development (R&D) sector 	<ul style="list-style-type: none"> Gross domestic expenditure on R&D (% of GDP)
Climate change and energy	<ul style="list-style-type: none"> greenhouse gas emissions to be reduced by 20% compared to 1990; share of renewable energy sources in final energy consumption to be increased to 20% and energy efficiency to be improved by 20% 	<ul style="list-style-type: none"> Greenhouse gas emissions (index 1990 = 100) Share of renewable energy in gross final energy consumption (%) Primary energy consumption (Million tonnes of oil equivalent) Final energy consumption (Million tonnes of oil equivalent)
Education	<ul style="list-style-type: none"> share of early school leavers to be reduced to under 10% at least 40% of the population aged 30–34 to have completed tertiary or equivalent education 	<ul style="list-style-type: none"> Early leavers from education & training, total (% of the population aged 18–24) Tertiary educational attainment, total (% of population aged 30–34)
Poverty and social exclusion	<ul style="list-style-type: none"> poverty to be reduced by lifting at least 20 million people out of the risk of poverty or social exclusion 	<ul style="list-style-type: none"> People at risk of poverty or social exclusion (Cumulative difference from 2008 in thousands)

Source: According to the European Commission [1].

The first thematic area is employment policy. Employment and issues related to the labor market are the most discussed topics of economic and political debates in the EU, given that an increase in the employment rate is a key precondition for ensuring a satisfactory living standard and quality of life in EU. The biggest challenge for policymakers in EU countries is increasing the employment, labor productivity, and inclusion of young people into the labor market. There are many EU funds to tackle these problems, such as the Cohesion Fund and the Structural Funds, but the EU economies have been faced with numerous challenges and crises during the past decade. In that sense, the Europe 2020 strategy encourages the implementation of policies that increase employment in more comprehensive and innovative ways [2].

One of the strategy aims is achieving sustainable development. This fact implies the incorporation of aspects related to ecology and resource efficiency, having in mind that sustainability is often interpreted as needs versus resources, or as the short versus the long term [3]. The incorporation of the aforementioned aspects is especially important if one takes into account the fact that the EU, as a whole, is the largest energy consumer and one of the largest emitters of greenhouse gases in the world [4]. Analyzing the most appropriate ways to tackle these problems, some authors emphasize the concept of a bio-economy, which represents an economy in which the basic components of materials, chemicals and energy are derived from renewable biological resources [5,6]. The use of renewable resources, in general, is viewed as the most appropriate way to meet the growing energy needs, without harming the environment. In accordance with that, the Europe 2020 Strategy is focused on the increase in energy production from renewable sources and reduction of greenhouse gas emissions.

In the era of rapid technical progress, innovativeness is considered to be an essential tool for achieving a competitive advantage. Recognizing the importance of innovation and technological development, all developed countries in the world allocate increasing amounts of funds for research

and development. The amount and structure of these funds differ across the EU. The developed Western European countries invest more than 2% of their GDP in research and development and most of these investments are private. On the other hand, there are SEE and CEE countries (which are mostly transition economies) that invest much lower amounts in such purposes and most of them are obtained by the state. Additionally, it should be emphasized that the GDP of these countries is quite low, so the investments in science are also low and, consequently, there is slow scientific and technological progress, which additionally enhances their economic and political dependence on the developed countries. In that sense, the implementation of the strategy should reduce the gap between the aforementioned groups of countries.

An education system that is efficient, developed, and adjusted to labor market needs is the basic pillar of every developed society. Some authors [7] emphasized that in recent years, the attention of economists has shifted from tangible to intangible inputs as key elements of economic behavior, and among the intangible assets a critical role is played by knowledge assets. Although the EU as a whole has a significant share of highly educated people in the total population, this share in some Member States is relatively low compared to those recorded in the US and other highly developed countries in the world. Also, there is still a significant number of people that leave school too early, which has a significant influence on economic and social development. The targets defined in the Europe 2020 strategy reflect the opinion of the EU representatives that secondary education represents the minimum desirable level of education for EU citizens and that the skills and competences obtained during secondary education are considered essential for successful inclusion in the labor market. Young people who leave education too early do not have basic skills and knowledge, which seriously lowers their chances to find a job (except uncertain and low paid jobs). As a consequence, they are faced with the problems of poverty and social exclusion. In addition, the growing competitive pressure on the global market and the rapid development of science and technology increase the number and level of qualifications that employees need to have to conduct daily business activities. This emphasizes the importance of tertiary education and its role in improving the competitiveness of economy.

Poverty and social exclusion have become more pronounced problems in the EU, especially after the economic (2008), sovereign debt (2009), and migrant crises (2015). These problems have a negative impact on the lives of every EU citizen individually, but also on the EU as a whole, because they limit the ability of a part of the population to reach its maximum work potential and thereby contribute to the development of the entire community. Without efficient education, health and social systems, appropriate tax benefit and employment policies, the risk of poverty is transmitted from one generation to future generations. This increases inequality in society, decreases the productivity of a large part of the population, and limits its ability to achieve inclusive and sustainable development. In order to prevent the long-term negative effects of poverty and social exclusion, the Europe 2020 strategy defines targets that should reduce poverty to an acceptable level.

The mentioned thematic areas are interconnected and interdependent. Namely, achieving the goals in the area of education increases employability and higher employment reduces poverty. On the other hand, higher investments in research and development in combination with a more efficient use of resources increases the competitiveness of the economy, as well as the number of newly created jobs. Investments in “clean” technologies for energy production, based primarily on the use of renewable energy sources, provide environmental protection, reduce climate change, and also lead to the creation of new jobs. Achieving this virtuous cycle of reforms is especially important for the CEE countries, because most of them still cannot overcome the problems and imbalances inherited from the central planning period.

In the pre-transition period, economic growth in these countries was based on the strategy of extensive growth, which favored accumulation rather than technological and organizational changes. The production system was designed for the needs of the command economy based on cheap energy and transport [8]. Since the competitive environment of a market system favors productivity and innovation, such a production system is not suitable for functioning in substantially changed business conditions. After almost 30 years of transition, their economic systems were evaluated fairly, but there are still some imbalances in the labor and energy markets and the social protection system has

not yet been fully reformed. Having that in mind, it is not a surprising fact that the CEE countries have been lagging behind the old Member States in their level of development and competitiveness since their accession, lowering the EU perspectives for future growth and development and aggravating its competitive position on the world market. Furthermore, some of them have not yet reached the GDP recorded at the beginning of transition, in 1989. It is a clear signal to economic policymakers at the national and supra-national level to do something to ensure the convergence of these countries with other member states. We believe that an efficient implementation of the Europe 2020 strategy can help these economies to overcome these problems and to enhance their competitive position in the global market, contributing to the development and competitiveness of the EU as a whole.

The Organization of United Nations has defined the Central and Eastern European Union as the European region including the following countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Greece, Hungary, Poland, Romania, Serbia, Slovakia, Slovenia, Macedonia, and Ukraine.

In this paper, we focused on some selected CEE countries that joined the EU in 2004 and in 2007 (Poland, the Czech Republic, Slovakia, Hungary, Bulgaria and Romania) because we used a yearly dataset covering the period 2004–2015. We excluded from our analysis the EU countries from the former Yugoslavia. Croatia joined the EU in 2013 and for that reason we opted for analyzing the CEE countries that have joined the EU, without the EU countries from the former Yugoslavia.

In that sense, the aim of this paper is to determine the most important aspects of the Europe 2020 Strategy enhancing the economic performances of the CEE countries, expressed by GDP per capita and the countries' competitiveness expressed by the share of the CEE countries' exports in total world exports. We analyzed the CEE region because there is an important gap between the GDP per capita of these countries and the GDP per capita in other EU countries and in the competitiveness area.

Therefore, the following research questions are addressed:

Q1: How did the CEE countries progress in implementing the EU's common strategic goals during the period 2004–2015?

Q2: Which are the most important factors that contribute to the economic performances in the CEE countries?

In order to access the answers to these questions, we worked with yearly data starting with 2004, the year of the first Eastern enlargement of the EU. We performed a co-integration test to see if there was a long-run relationship between the variables we had worked with and we used panel analyses for the selected CEE countries to emphasize the main factors impacting on the economic performance and competitiveness in the CEE region as a whole. The obtained results enabled the formulation of some recommendations and guidelines for accelerating the catching-up process and achieving smart, inclusive, and sustainable development of the CEE countries in the future, through the implementation of Europe 2020.

The paper is organized as follows: the introduction presents the aim of this research; Section 2 presents some important findings of previous studies on this issue; Section 3 presents the latest developments in the CEE countries relative to the Europe 2020 Strategy ratios; Section 4 presents the methodology and data we have worked with; Section 5 discusses the results and Section 6 comprises the conclusions and makes some policy recommendations for the selected CEE countries, based on the conclusions drawn from the study.

2. Literature Review

The implementation of the Europe 2020 strategy and its impact on the development and competitiveness of the EU Member States and EU as a whole have been the research topic of a large number of authors. Most of them are focused on the effects at the EU level (before all macroeconomic effects) of the Strategy implementation [9–11]. Some authors [12] have analyzed the level of fulfillment and its aims with special concentration on the diversity between the New Member States that joined the European Union in 2004 and 2007 (EU-10) and the Old European Union Members (EU-15). The analysis highlighted the significant diversity between the New and the Old Member States.

The EU-10 countries have achieved good results especially in the case of climate/energy targets and they have strengthened their position in the area of education and the quality of human capital. The last one can be considered as especially important in the case of building the fundamentals for developing the knowledge-based economy in the region. On the other hand, the weakest achievements of the EU-10 can be seen in the area of investments in R&D and, in the future, this could become a significant obstacle for growth; thus, these countries should pay more attention to this area of the Europe 2020 strategy. Similarly, others [13] come to the conclusion that there are significant disparities in the level of implementation of the Europe 2020 strategy across the EU countries, especially between the “old” and the “new” member countries, as well as between the highly developed western countries and south European countries that were severely hit by the 2008–2009 economic crisis. Therefore, the European commission should pay more attention to these countries to enhance their progress in the implementation of the defined targets. In addition, national bodies should redefine their national strategies in order to enable the convergence with the advanced Member States.

Taking into account recent growth-related theories, some studies [14] have also intended to identify disparities across different European regions and countries. In this regard, they have analyzed the extent to which the regional development of the EU-27 Member States, measured by the cohesion policies indicators in 2010, is similar to the development of the EU-27 Member States, as defined by the Europe 2020 strategy, in order to identify regional and inter-country disparities. The results of cluster analysis have shown the existence of high disparities, both within countries and among member states. The obtained results have highlighted the need for long-term reforms, such as the reformed Cohesion Policy for the programming period 2014–2020, with a focus on growth and creating jobs, which will be reflected at a national level and in line with the vision and strategy of the European Union.

Some researchers went one step further and their studies have focused on measuring the progress in the Strategy implementation by usage of appropriate indicators or indexes [15–17]. One particularly important study is aimed at the formulation of the Europe 2020 Index [15]. This index is based on a set of relevant, accepted, credible, easy to monitor, and robust indicators presented by the European Commission at the time the strategy was launched. The internal and external analyses of the index were performed. The internal analysis pointed out that the Smart and the Inclusive growth dimensions of the Strategy are correlated and that the trade-offs between each of these two dimensions and the Sustainable one exist but are decreasing, suggesting that a change towards more sustainable models of development is occurring in Europe. The external analysis of the index pointed out that it can be a valid measure to assess the overall competitiveness of the countries and that the most critical factors for this strategy to be successful are good governance and social capital. Using this indicator, the same author analyzed the performances of the EU member states in the Europe 2020 Strategy in order to determine the main factors of success in another study [18]. The results of this research suggest that institutional factors are more relevant than macroeconomic indicators of public finances, such as the GDP growth and the levels of government debt and deficit, as success factors in the strategy.

On the other hand, one author [19] intended to decompose the Europe 2020 Index in order to evaluate progress in particular aspects of the Strategy. Some new sub-indexes were formulated—the Smart growth index, Sustainable growth index, Inclusive growth index, Country-specific smart growth index, Country-specific sustainable growth index, Country-specific inclusive growth index, Country-specific Europe 2020 index, Time-specific index, Objective-specific index, etc. The decomposition enabled better quantification, measurement, and monitoring of the progress of the European countries towards the achievement of the Europe 2020 objectives. The analysis of those sub-indicators highlighted significant patterns for all levels for each country.

In contrast to these studies, a significantly smaller number of papers are focused on the effects of all strategy areas at the level of the CEE region. Usually, the focus of these research studies is on individual aspects of the strategy, not on all of its components [20]. They strived to verify the link between national competitiveness and human capital, measured by public expenditure on tertiary

education and public expenditure on research and development. In doing so, they applied the panel data method for CEE using the data on competitiveness scores in the Europe 2020 Report 2014, the Human Development Index 2015, the Global Competitiveness Report 2016, public expenditure on tertiary education, and public expenditure on research and development in the period 2010–2014. The results have shown that there is a significant and positive relation between investment in education and research and national competitiveness. The results obtained have indicated that the Central and Eastern European countries need to initiate measures to reduce the brain-drain phenomenon and to create a favorable socio-economic context for retaining and attracting highly educated, talented, and qualified people, which will contribute to the improvement of national competitiveness.

Some authors [21] reached the similar conclusion that the ability of the CEE economies to shift towards more knowledge-intensive, higher-value-added activities depends on their capacity to generate new knowledge through better-performing innovation and educational systems, on the effective use of technologies (including ICT), but also on the conditions for entrepreneurship facilitating or hindering the ability to bring this new knowledge into the market in a timely and effective manner. The CEEs should strengthen their innovation potential through efficient investments in research and development and innovation in a broader sense, such as education and training or other intangible assets, like advanced management techniques. In this way, these countries will improve their competitiveness in the coming years.

Also, others [22] analyzed the efficiency of tertiary education expenditure in the EU Member States from CEE in comparative terms and in light of the Europe 2020 strategy. For this purpose, they used the method of Data Envelopment Analysis. The efficiency was investigated via three models due to the different character of the output results of tertiary education, which could be direct and indirect. The results from the study suggest that in the CEE countries the higher the share of public expenditure in the total spending, the more efficient is the expenditure achieved in terms of increasing the tertiary educational attainment and the quality of educational services. In their opinion, these countries should focus on that part of the Europe 2020 strategy in order to accelerate growth and increase employment.

According to some authors [23,24], who studied the relationship between education and economic growth in Taiwan, there is a positive impact of education on economic growth. The authors used a specific indicator for the average schooling years that were applied for measuring the overall education level of human capital, which is a very important factor for achieving economic growth. This represents a difference with our study where we have used the tertiary education ratio and the change of the labor quality ratio for stressing the overall education level of the population. We have performed a panel analysis for six countries, and so could not estimate the same overall education level ratio as the authors of these studies [23,24] because the number of school years differs a lot between the selected CEE countries and because we have not benefited from sufficient complete and homogenous national data observations for people attending different levels of education. Data released by Eurostat, expressed as the number of people attending different levels of education, covered the period 2013–2016 which represents an insufficient number of observations for our panel analysis. Also, Eurostat does not release any percentage data for the primary level of education, but only for lower and upper secondary educational attainment. For a deeper analysis we have used two additional ratios for the impact of the different educational levels of population on GDP per capita and the economic competitiveness of the selected CEE countries (percentage of people aged 25 to 64 who have successfully completed at most lower secondary education attainment, and the percentage of people aged 25 to 64 who have successfully completed at least upper secondary education attainment).

Because of the industrial development and the boom of trade and transport that led to the exponential growth of waste and climate changes due to pollution, the concept of sustainable development emerged. In the spirit of this concept, it was necessary to find a different approach to economic development which considers resources and environmental quality [25,26]. The implementation and reform of the environmental tax system in the CEE countries has also supported

the economic growth expressed as GDP per capita in the context of a heavy reliance of these countries on traditional energy sources as some studies have emphasized for some selected CEE countries [27]. That helped the decrease of the primary energy consumption and final energy consumption in the CEE region, and decreased the greenhouse gas emissions in these CEE countries. In this context, the attention has been focused on using a greater share of renewable energy in final energy consumption.

This paper was motivated by the observation that there was a lack of empirical research studies aiming to address the implementation of the Europe 2020 Strategy in the CEE countries in a comprehensive way (with incorporation of all Strategy aspects and ratios). Therefore, the aim of this paper is to start filling this gap by reviewing the underlying processes of the strategy implementation across the CEE region, in light of the competitiveness-oriented reshaping of development policies in these countries. We used panel analysis to research the implications of the Europe 2020 implementation on achieving sustainable economic development in those countries. Additionally, we formulated some preliminary suggestions and guidelines as to how to meet the goals of the strategy in order to ensure overall long-term development and a better integration of the lagging CEE regions in the future. One of our aims was also to motivate other authors to conduct similar research studies and propose additional measures for an efficient implementation of the strategy in this region, which could accelerate the catching-up process of these economies and improve economic performances at the EU level.

3. Developments in the CEE Countries Relative to the Europe 2020 Strategy Ratios

By 2015, Romania had reduced its greenhouse emissions compared to the 1990 levels, remaining well within its 2020 target. The country also significantly reduced the number of people at risk of poverty or social exclusion and already met its national target in 2013. In 2015, Romania exceeded its target and even the EU target for the share of renewable energy in gross final energy consumption from 2014 up to the present and remained well below its national target on primary energy consumption. The tertiary education was below its target in 2016 (25.6% against a national target of 26.7% and a large gap from the EU average and target of above 40%), although Romania had made strong progress in this area. However, its share of early leavers from education and training increased to 18.5%, widening the gap from the national target (a large gap from the national target which imposes values below 11.3%). The employment rate slowly increased and the gap with the national target remains to be closed by 2020 (66.3% in 2016 against a national target of 70%). Romania's R&D expenditure to GDP decreased after 2008, pushing it further from its national target or EU target than other EU Member States (0.48% in 2016 against a national target of 2%) [28].

In Poland, the employment rate in 2016 was 69.3%, close to the EU average and its national target (71%), R&D expenditure represented 0.97% (below its national target of 1.7%), greenhouse emissions 82.76% (within its national target), share of renewable energy 11.8% (below the national target of 15%), primary energy consumption was below the national target, school dropout 5.2% (above the national target of 4.5%), people with tertiary education 44.6% (close to the national target of 45%), and the people at risk of poverty largely decreased as compared to 2008 with the national target being reached in 2013 [29].

Bulgaria reduced its greenhouse emissions, staying within its national target. In 2015, the country achieved its renewable energy target (18.2% against the national target of 16%) and almost met its target on primary energy consumption. Despite the progress towards its national targets on early school leavers (13.8% in 2016 against the national target of 11%) and tertiary education (33.8% in 2016 against a national level of 36%), Bulgaria missed its targets and was far from the EU levels in these areas in 2016. The employment rate in Bulgaria decreased during the crisis and Bulgaria is far away from its national target of 76% (the employment rate was 67.7% in 2016). Despite a steady rise in R&D expenditure up to 2016 (0.78%), Bulgaria needs to double its expenditure to achieve its target of 1.5% of the GDP. Progress towards the country's poverty reduction target has been slow since the start of the crisis; still, Bulgaria has met its target in the poverty area since 2014 [30].

By reducing its greenhouse emissions up to 2015 (65.3% in 2015), Hungary remained well within its target. The country has also achieved both its target on primary energy consumption and on

renewable energy (renewable energy displayed a share of 14.5% in final energy consumption in 2015 against a national target of 13%). Although Hungary met its national target on tertiary education in 2014, a reduction of this ratio in 2016 made Hungary miss its national target (33% in 2016 against a national target of 34%) and widened the gap with the EU area. The school dropout ratio increased lately (12.4% in 2016 against a target below 10%). In terms of R&D expenditure, Hungary was close to its national target in 2015 (1.21% against the national target of 1.8%), but far from the EU target of 3%. Poverty levels have deteriorated since the start of the economic crisis. The number of people at risk of poverty largely increased after 2013 when Hungary met its target in the poverty area. Despite an improvement in the employment rate, the country was still below its national target of 75% with a rate of around 70%. Primary energy consumption displays a great gap with the national target in this area [31].

The Czech Republic reduced its greenhouse emissions, remaining within the national target. In 2015, the country already met its national target on renewable energy (15% against a target of above 13%). The R&D expenditure of GDP was above the national target (1.68% in 2016 against the national target of 1.1%). In 2016, the Czech Republic exceeded its national targets on employment (76.7% in 2016 against its national target of 75%) and tertiary educational attainment (32.8% in 2016 against its national target of 32%, but far from the EU target of 40%). The decrease in the number of people at risk of poverty or social exclusion supported the reduction of the gap to its national target. The developments of the primary energy consumption brought the Czech Republic very close to its national target in 2015. The gradual increase in the share of early leavers from education and training during 2015–2016 (6.6% in 2016) made the Czech Republic miss the national target of 5.5% in the school dropout area [32].

Greenhouse emissions in Slovakia decreased and the country remained below its national target. Since 2011, Slovakia has met its energy efficiency target. In 2015, the country was close to its R&D target, but in 2016, the R&D expenditure of GDP decreased down to 0.8% against a national target of 1.2%. The share of renewable energy in final energy consumption increased at 12.9%, close to the national target of 14%. The school dropout ratio has deteriorated since 2013 compared to its national target (7.4% in 2016 against its national target of maximum 6%). The country has displayed an important rise in the share of the people with tertiary education, but a large gap with its national target remains (31.5% in 2016 against a national target of minimum 40%). After a period of stagnation of several years, in 2016 the employment rate increased up to 69.8%, close to its national target of 72%. Slovakia has moved closer to its poverty reduction target; in 2015 it almost reached its 2020 goal [33].

The employment rate in the EU was around 71% in 2016 (the EU target being minimum 75%), R&D expenditure was around 2% (the EU target is minimum 3%), greenhouse gas emissions in the EU (base year 1990) are around 77–78% (the EU target is a level of 20% less compared to 1990 level), the share of renewable energy in final energy consumption was 16.7% in 2016 (the EU target is minimum 20%), school dropout ratio was 10.7% (the EU target is maximum 10%), people with tertiary education represent 39.1% (against an EU target of minimum 40%). The EU is far from achieving its goal in the poverty reduction area, because the number of people at risk of poverty and exclusion increased compared with the 2008 levels, mainly because of the situation of Italy and Spain in this area (the EU target is 20 million fewer people at risk of poverty or exclusion) [34].

Compared with an EU average employment rate of 70% in 2015, all the analyzed CEE countries (except the Czech Republic) displayed numbers below 70%, the lowest value being reached in Romania (66%) and the highest value being reached in Hungary (68.9%). The Czech Republic displayed a value of 74.8%, close to the EU target of 75% in this specific area. In 2016, the Czech Republic (76.7%) surpassed the EU target of 75% (Table 2).

Gross domestic expenditure on research and development (% of GDP) displayed different values across the CEE region. In the Czech Republic this ratio was 1.93% in 2015, the highest value among the selected CEE countries (but this ratio decreased at 1.67% in 2016), close to the EU average of 2.03%, but far from the EU target of 3%. Romania ranked at the last position again, with a value (0.49%) that was almost half of the Bulgarian one (Table 2).

Greenhouse gas emissions (base year 1990) represented 82.11% in Poland (the highest value among the analyzed CEE countries) and 46.97% in Romania (the lowest value among the CEE selected countries). In the EU area this ratio was 77.4%, below the EU target (20% less compared to 1990 levels) (Table 2).

The share of renewable energy in final energy consumption was high in Romania (24.8%), well above the EU target of 20%. In the EU area, this ratio was 16.1% in 2014. All the other CEE countries displayed lower values of this ratio compared to the EU average. Except Poland and the Czech Republic, with higher values in the primary energy consumption area, all the other selected CEE countries displayed very low numbers (Table 2).

School dropout was close to its target in the EU area (10.7% against a target of maximum 10%) in 2016. In Poland (5.2%), in the Czech Republic (6.6%), and in Slovakia (7.4%) this rate was well below that of the EU area in 2016. Romania displayed the highest value (18.5%) among the analyzed CEE countries (Table 2).

Table 2. Developments of Europe 2020 ratios in CEE countries and EU.

Countries	Employment Rate Age Group 20–64% (2015)	Gross Domestic Expenditure on Research and Development % of GDP (2015)	Greenhouse Gas Emissions (% Base Year 1990) (2014)	Share of Renewable Energy (% of Gross Final Energy Consumption) (2014)
Bulgaria	67.1	0.96	55.59	18
Czech Republic	74.8	1.93	64.24	15.1
EU-28	70.1	2.03	77.39	16.1
Hungary	68.9	1.36	61.88	14.6
Poland	67.8	1.00	82.11	11.5
Romania	66.0	0.49	46.97	24.8
Slovakia	67.7	1.18	54.74	11.7
Countries	Primary Energy Consumption (Thousands Tonnes of Oil Equivalent—TOE) (2014)	Early Leavers from Education and Training (% of Population Aged 18–24) (2016)	Tertiary Education Attainment (% of Population Aged 30–34) (2016)	Poverty and Social Exclusion (% of Total Population) Cumulative Difference from 2008 in Thousands
Bulgaria	17.2	13.8	33.8	−531
Czech Republic	39.3	6.6	32.8	−191
EU-28	–	10.7	39.1	+806
Hungary	21.0	12.4	33.0	−253
Poland	89.2	5.2	44.6	−3270
Romania	30.6	18.5	25.6	−1420
Slovakia	15.3	7.4	31.5	−161

Source: Elaborated according to data from [34].

The share of people with tertiary education was close to its target of over 40% in 2016 in the EU area (39.1%). Poland recorded the highest value of 44.6% and Romania (25.6%) recorded the lowest value in the CEE region (Table 2).

The number of people at risk of poverty largely decreased in Poland and Romania, based on the social measures adopted by the governments of these two countries during the crisis and after the crisis period, while in the EU area this number significantly increased (Table 2).

From the CEE statistical data compared with the EU average, we can emphasize that the Czech Republic and Poland display significant progress in the areas of tertiary education, employment, gross domestic expenditure on research and development, and school dropout, while Romania and Bulgaria rank on the last positions in these specific areas. Romania and Bulgaria display great progress in the areas of greenhouse gas emissions, the share of renewable energy in final energy consumption, and in primary energy consumption. Poland and the Czech Republic have focused mainly on the areas of education (they have invested in education more than the other CEE countries), research and technological progress, which supported the employment process, while Bulgaria and Romania have great achievements in the areas of energy and greenhouse emissions, compared to the EU average or EU 2020 targets. Hungary was largely impacted by the last crisis in terms of poverty reduction and in the areas of education and school dropout. All these negatively affected the employment process in Hungary. If we compare these CEE countries with the EU area, we can state that the Czech Republic displays the greatest achievements in the areas covered by the Europe 2020

Strategy. It is followed by Poland and Slovakia. Hungary, Bulgaria, and Romania form another group of CEE countries with lower achievements against the EU area for the ratios of the Europe 2020 Strategy. However, these CEE countries still display great differences in the areas covered by the Europe 2020 Strategy and their national targets for the Europe 2020 ratios are quite different. Some of their national targets are tighter than the EU targets, but some other targets are laxer.

4. Research Methodology and Data

4.1. Data

We used yearly data series from the Eurostat database (2004–2015) for Romania, Bulgaria, the Czech Republic, Poland, Hungary and Slovakia and we used the following indicators: GDP (euro per capita), chain linked volumes (2010) (%); CEE countries' export (goods and services) market shares of the world total exports (%); people suffering from severe material deprivation of total population (%); employment rate, age 20–64 (%); final energy consumption, base year 2005 (%); greenhouse gas emissions, base year 1990 (%); share of the people with tertiary level of education of the total population, age 15–64 (%); people living in households with very low work intensity of total population, age 0–59 (%); people at risk of poverty or social exclusion of total population (%); share of renewable energy in gross final energy consumption (%); research and development expenses, purchasing power standard (PPS) per inhabitant at constant 2005 prices (%); and the share of the early leavers from education and training of the total population, age 18–24 (%) (the description of the variables is presented in Table 3). We have also chosen to work with a ratio which is not covered by the Europe 2020 Strategy, for emphasizing the changes of the labor force quality in CEE countries [35]. We have added this specific ratio because our results have stressed the high impact of tertiary education on the economic growth and competitiveness of the CEE countries. The tertiary education ratio is definitely correlated with the last ratio we have added, namely the quality of the labor force. Still, the changes in the quality of the labor force reflect not only the tertiary education level of the people, but also some lower educational levels of the labor force; thus, it was used as a proxy for the ratios used by some previous studies regarding the overall education level of the population [23,24], for a more comprehensive analysis of the factors impacting on economic growth and competitiveness. We have also added two more specific ratios for education: namely the percentage of people aged 25 to 64 who have successfully completed at most lower secondary education (%) and the percentage of people aged 25 to 64 who have successfully completed at least upper secondary education (%), released by Eurostat [36], for a deeper analysis of the impact of the educational level of human capital on economic performance and competitiveness.

Table 3. Description of variables.

Variable	Description
gdp_capita_CEE	CEE GDP (euro per capita), chain linked volumes (2010) (%)
share_world_exports_CEE	CEE countries' export (goods and services) market shares of world total exports (%)
deprived_people_CEE	People suffering from severe material deprivation of total population (%)
employment_CEE	Employment rate, age 20–64 (%)
final_energy_CEE	Final energy consumption, base year 2005 (%)
greenhou_emis_CEE	Greenhouse gas emissions, base year 1990 (%)
tertiary_education_CEE	Share of the people with tertiary level of education of the total population, age 15–64 (%)
low_intensity_work_CEE	People living in households with very low work intensity of total population, age 0–59 (%)
poverty_exclusion_CEE	People at risk of poverty or social exclusion of total population (%)
renewable_energy_CEE	Share of renewable energy in gross final energy consumption (%)

research_develop_CEE	Research and development expenses, purchasing power standard (PPS) per inhabitant at constant 2005 prices (%)
school_abandon_CEE	Share of the early leavers from education and training of the total population, age 18–24 (%)
log_labor_quality_CEE	Growth of labor quality, log change (multiplied by 100)
lower_sec_attainment_cee	Percentage of people aged 25 to 64 who have successfully completed at most lower secondary education (%)
upper_sec_attainment_cee	Percentage of people aged 25 to 64 who have successfully completed at least upper secondary education (%)

Source: authors' own selection based on Europe 2020 Strategy ratios and based on [35,36].

4.2. Research Methodology

We tested these series for unit root and we found out that all these data-series are $I(1)$, except the growth of labor quality, log change, percentage of people with lower or people with upper secondary education, that are $I(0)$ at 1% significance level. We tested the co-integration (Kao panel co-integration test) between the CEE GDP per capita and, respectively, the share of the CEE exports in total world exports and the above-mentioned variables, related to the Europe 2020 Strategy goals. The co-integration tests revealed that there is a long-term relationship between the CEE GDP per capita and the share of the CEE exports in total world exports and the other variables used in our analysis, respectively.

Then, we determined two endogenous variables—the GDP per capita (for expressing the economic performance and development of each country) and the share of the selected CEE countries' exports in total world exports (for expressing the national competitiveness)—in relation with the above-mentioned ratios of the Europe 2020 Strategy, as exogenous variables, using a panel OLS estimation and a pool estimation.

The linear panel regressions that we built (using OLS estimations with fixed effects) display the following equation:

$$Y_{it} = \alpha + \beta * X_{it} + \gamma_i + \varepsilon_{it} \quad (1)$$

where Y_{it} is the dependent variable, X_{it} is a K -dimensional vector of regressors, β_i is a K -dimensional vector of the regression coefficients, γ_i represents fixed specific effects for the units of the transversal or for the specific time period section, and ε_{it} represents the innovations associated with the equation, unexplained by the independent variables X , for M transversal units and T periods. K is the number of regressors.

5. Results and Discussion

The data series are $I(1)$ (Table 4) and we have performed the Kao panel cointegration test. We can see that the share of the CEE countries' exports in total world exports and the CEE GDP per capita are correlated in the long run with the variables we used in our analysis.

Table 4 shows the results that we obtained by using the Levin-Lin-Chu (LLC) panel common root test and the Phillips-Perron (PP) Fisher panel unit root tests. According to the reported results, the analyzed variables are not stationary at these levels but become stationary at first-differences at 1% or 5% level of significance. Thus, we need the co-integration test to see whether there is a long-run relationship among them. Otherwise, the estimated coefficients will be without economic meaning.

The Kao co-integration tests for the GDP per capita in the selected CEE countries and for the share of the CEE countries' exports in total world exports, in relation with all the other variables we used in our analysis, suggest that the analyzed variables are co-integrated; thus, they have a long run relationship at 1% level of significance (Table 5).

Table 4. Results of panel unit root tests.

First-Differences						
	gdp_capita_CEE	deprived_people_CEE	employment_CEE	final_energy_CEE	greenh_emis_CEE	tertiary_education_CEE
Levin-Lin-Chu t *	−3.15587 *	−1.94343	−2.24005	−2.64613	−8.67065 *	−3.5923 *
PP-Fisher-chi-square	20.7919	21.3563	20.6870	73.7902 *	73.7902 *	23.6288
First-Differences						
	low_intensity_work_CEE	poverty_exclusion_CEE	renewable_energy_CEE	research_development_CEE	school_dropout_CEE	share_world_exports_CEE
Levin-Lin-Chu t *	−1.99582	−2.09203	−1.96630	−1.86127	−4.24489 *	−3.35605 *
PP-Fisher-chi-square	24.5259	20.1164	38.6391 *	20.4909	25.0100	20.7869

Note: values denote the statistical significance at 5% level. * denotes the statistical significance at 1% level. Source: E-views estimations.

Table 5. Kao co-integration test for GDP per capita, share of CEE exports in total world exports and Europe 2020 ratios, labor quality ratio, percentage of people with lower secondary educational attainment and of people with upper secondary attainment in CEE countries.

	t-Statistic	Prob.
ADF	−5.280276	0.0000

Source: E-views estimations.

To allow for heterogeneity across the selected CEE countries, we used an error-component model estimated as fixed effects. We tested this model by using the redundant fixed effects test and the chosen model was validated by the results of the test.

According to the pool estimation (Table 6) and the OLS panel regression (Table 7) for the share of the selected CEE countries' exports in total world exports, we can stress that the GDP per capita, the employment rate, and the share of the population with a tertiary education level in the total population are positively correlated with the share of the CEE countries' exports in total world exports, while all the other variables are negatively correlated with the trend of the share of the CEE countries' exports in total world exports. Our results suggest, like those in some studies [22], that the CEE countries should focus on the improvement of their education system, especially on tertiary education, in order to enhance their competitiveness and accelerate development in the future. Also, it is interesting to underline—from our pool estimation and OLS panel regression above—that the developments of the research and development expenditure (in constant prices of 2005) are negatively correlated with the share of the CEE countries' exports in total world exports, which means that the exports of the selected CEE countries on average do not rely much on high-tech products with high added-value. The research and development expenditure to GDP is the least important factor impacting on the share of the selected CEE countries' exports in total world exports. The research and development expenditure to GDP is also the least important factor impacting on the CEE GDP per capita (this time weakly positively correlated to the GDP per capita), as we can see from Tables 8 and 9 below. Moreover, the research and development expenditure to GDP decreased in all selected CEE countries during the last years of the analyzed period (except in Poland where it slowly increased during the analyzed period), against the EU level which steadily increased during the entire analyzed period. If we take into account all the aforementioned results it can be concluded that the obtained results are partly in accordance with the results of some studies presented above [20,21]. Their results indicated that the improvement and higher investments in the education system in the CEE countries had a positive impact on national competitiveness. However, they also concluded that investments in research and development had positive effects on national competitiveness, which is not the case in our research. One should have in mind that the authors mentioned in our study used different indicators than us and that they analyzed the influence of only these two factors on development and competitiveness. This stressed the importance of using adequate indicators and a much more comprehensive analysis when observing the impact of the

Europe 2020 strategy. Another explanation for our different results in the R&D area could be represented by the fact that in Tables 6 and 7, we can see a very low coefficient of this factor impacting on the competitiveness of the CEE countries against the other explanatory factors. This very small negative impact could be determined by some important differences in the R&D area in the analyzed countries. The group of CEE countries including Bulgaria and Romania displays much lower levels in the R&D area against the rest of the CEE countries analyzed here, so this could explain a low negative impact. As we have already explained at the end of Section 3, these analyzed CEE countries still display great differences in some areas covered by the Europe 2020 Strategy [12–14] and this could explain some differences in the results that we obtained compared to other previous studies. However, for the ratios with the most significant impact on economic performance and competitiveness, we found similar results and correlations just like the previous studies [20–22].

Table 6. Pool estimations with fixed effects for CEE countries' exports amongst total world exports.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.548556	1.627893	3.408428	0.0007
DGDP_CAPITA_CEE	0.025477	0.002973	8.570788	0.0000
DEPLOYMENT_CEE(-2)	0.005303	0.000723	7.338999	0.0000
DGREENH_EMIS_CEE(-)	-0.003119	0.000563	-5.537931	0.0000
DLOW_INTENSITY_WORK_CEE(-2)	-0.001947	0.000634	-3.070143	0.0022
DPOVERTY_EXCLUSION_CEE	-0.004013	0.001174	-3.419330	0.0007
DRENEWABLE_ENERGY_CEE	-0.008536	0.000920	-9.274360	0.0000
DRESEARCH_DEVELOP_CEE	-0.000320	7.44×10^{-5}	-4.301075	0.0000
DSCHOOL_ABANDON_CEE	-0.011038	0.001290	-8.554119	0.0000
DTERTIARY_EDUCATION_CEE(-2)	0.016344	0.002627	6.221997	0.0000
DSHARE_WORLD_EXPORTS_CEE(-1)	0.321903	0.031592	10.18933	0.0000
DFINAL_ENERGY_CEE	-0.000789	0.000317	-2.491063	0.0129
DDEPRIVED_PEOPLE_CEE	-0.005529	0.001124	-4.920712	0.0000
LOG_LABOR_QUALITY_CEE	0.004488	0.001225	3.662074	0.0003
LOWER_SEC_ATTAINMENT_CEE	-0.055280	0.016273	-3.396970	0.0007
UPPER_SEC_ATTAINMENT_CEE	-0.015604	0.006284	-2.483131	0.0007
Fixed Effects (Cross)				
DGDP_CAPITA_CEE--C	2.46×10^{-16}			
DEPLOYMENT_CEE--C	2.46×10^{-16}			
DGREENH_EMIS_CEE--C	2.46×10^{-16}			
DLOW_INTENSITY_WORK_CEE--C	2.46×10^{-16}			
DPOVERTY_EXCLUSION_CEE--C	2.46×10^{-16}			
DRENEWABLE_ENERGY_CEE--C	2.46×10^{-16}			
DRESEARCH_DEVELOP_CEE--C	2.46×10^{-16}			
DSCHOOL_ABANDON_CEE--C	2.46×10^{-16}			
DTERTIARY_EDUCATION_CEE--C	2.46×10^{-16}			
DSHARE_WORLD_EXPORTS_CEE--C	2.46×10^{-16}			
DFINAL_ENERGY_CEE--C	2.46×10^{-16}			
DDEPRIVED_PEOPLE_CEE--C	2.46×10^{-16}			
LOG_LABOR_QUALITY_CEE--C	2.46×10^{-16}			
LOWER_SEC_ATTAINMENT_CEE--C	2.46×10^{-16}			
UPPER_SEC_ATTAINMENT_CEE--C	2.46×10^{-16}			
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.688887	Mean dependent var	0.007593	
Adjusted R-squared	0.669884	S.D. dependent var	0.030138	
S.E. of regression	0.021943	Akaike info criterion	-4.764396	
Sum squared resid	0.375569	Schwarz criterion	-4.590432	

Log likelihood	1959.581	Hannan-Quinn criter.	−4.697606
F-statistic	25.72690	Durbin-Watson stat	2.114635
Prob (F-statistic)	0.000000		

Source: E-views estimations.

The use of renewable energy is also negatively correlated with the share of the CEE countries' exports in total world exports, which can be explained by a low share of renewable energy in total final energy consumption in those selected CEE countries (the average level of the selected CEE countries is lower than the EU average and well below the EU 2020 target in this area, except for Romania with higher values during the last two years).

The share of people that have attended at most lower secondary educational level and of the people that have completed at least upper secondary educational attainment, GDP per capita (expressing the economic performance) and the tertiary level of education (Europe 2020 Strategy ratio) represent the most important factors for the share of the CEE countries' exports in total world exports. The last of these above-mentioned factors are positively correlated with the CEE countries' exports. That can explain the fact that Poland displays the highest share of its exports in total world exports. Its tertiary education ratio is well above the EU average and EU target for 2020 and its economic growth was robust among the EU countries during the entire analyzed period. Moreover, Poland was the only country that did not face economic recession during the last economic crisis. School dropout and the share of renewable energy in final energy consumption are also important factors negatively correlated with the share of the CEE countries' exports in total world exports. However, the Central European countries (Poland, the Czech Republic, Hungary) display higher shares of their exports in total world exports than Romania and especially Bulgaria, because of the manufacturing industry that dropped in the Southern European countries right after 1990. People with at most lower secondary educational attainment, people with at least upper educational attainment display a significant negative impact on the CEE countries' competitiveness and the labor quality ratio seem to have a weak positive impact on the competitiveness of the analyzed CEE countries. Thus, we can conclude that a highly qualified labor force supports the increase in competitiveness of the CEE countries. Lower levels of education do not impact positively on the economic competitiveness on the CEE economies. This weak effect of the quality of labor could also be explained by the strong negative impact of school abandonment in the early stages of the education process in the CEE countries. The school abandonment ratio increased in the CEE region, while the share of people with tertiary education is much below that of the EU area.

Table 7. OLS panel estimations with fixed effects for CEE countries' exports amongst total world exports.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.995629	0.560735	1.775579	0.0563
DEMPLOYMENT_CEE(-2)	0.008574	0.001514	5.663133	0.0000
DGREENH_EMIS_CEE	−0.002342	0.000915	−2.560487	0.0159
DRENEWABLE_ENERGY_CEE	−0.008261	0.002263	−3.650776	0.0010
DRESEARCH_DEVELOP_CEE(-2)	−0.001045	0.000128	−8.147753	0.0000
DSCHOOL_ABANDON_CEE	−0.011081	0.002798	−3.960233	0.0004
DGDP_CAPITA_CEE	0.025805	0.008253	3.126772	0.0040
DFINAL_ENERGY_CEE(-3)	−0.002660	0.000387	−6.874716	0.0000
DSHARE_WORLD_EXPORTS_CEE(-1)	0.265030	0.105498	2.512184	0.0178
LOG_LABOR_QUALITY_CEE	0.014811	0.005774	2.565102	0.0158
LOWER_SEC_ATTAINMENT_CEE	−0.008747	0.004146	−2.109592	0.0436
UPPER_SEC_ATTAINMENT_CEE(-1)	−0.003112	0.001012	−3.075098	0.0133
DTERTIARY_EDUCATION_CEE(-3)	0.018421	0.015628	1.178717	0.0454
DLOW_INTENSITY_WORK_CEE(-1)	−0.001523	0.001076	−1.415100	0.0577

R² = 0.66, Durbin Watson stat = 2.15,

F-statistic	5.834389
Prob(F-statistic)	0.000067

Source: E-views estimations.

According to the results of the pool estimation (Table 8) and the OLS panel regression (Table 9) for the GDP per capita in the selected CEE countries, we can stress the positive impact of final energy use and the greenhouse emissions on the trend of the GDP per capita in these CEE countries, which means that these six CEE countries are, on average, energy-intensive economies. Renewable energy is also negatively correlated with the GDP per capita, just like with the CEE countries' exports. Another interesting result is represented by the positive correlation between school dropout and the trend of the GDP per capita. This means that, no matter their education, employed people support the economic growth in the selected CEE countries. This can also explain a low unemployment rate in the CEE region against the EU (in Romania, the unemployment rate is the lowest among the selected CEE countries and among EU countries, and school dropout is the highest among the selected CEE countries). Thus, although people do not attend the higher levels of the education system, they work in the economic areas that do not require an educated workforce so they can support an increase in the GDP per capita in the CEE region, or they work abroad (the emigration rate is high, especially in Bulgaria and Romania) and send a share of their income to their families at home, so they support consumption in these selected CEE countries. This positive correlation is validated especially in the CEE countries (Bulgaria and Romania, where the school dropout ratio is high, thus increasing the average ratio of the CEE region) where people are highly employed in the primary economic sector (agriculture) or in some industries (metallurgy, construction), or they work abroad in the primary economic sector or in industries that do not require high work qualifications. School dropout is negatively correlated with the share of the CEE countries' exports in total world exports, which means that people with low levels of education are not mainly engaged in export-oriented activities.

According to the results we have obtained for the positive impact of the school dropout ratio on the GDP per capita, the percentage of people with lower secondary educational attainment or of people with upper secondary educational attainment ratios are positively correlated with the trend of the GDP per capita. This could be explained by a low unemployment rate in the CEE region against that of the EU area and by the fact that some of the analyzed CEE countries display a very intense emigration process.

The factors we used in our econometric analysis correlate much more strongly with the GDP per capita than with the share of the CEE countries' exports in total world exports. The percentage of the population with lower or upper educational attainment, the labor quality ratio, the share of the CEE countries' exports in total world exports, the school abandonment ratio, the employment rate, and the level of the tertiary education are the most important factors positively impacting on the GDP per capita trend.

Table 8. Pool estimations with fixed effects for CEE countries' GDP per capita.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	57.17351	15.19576	3.762465	0.0002
DGREENH_EMIS_CEE	0.049268	0.003539	13.92187	0.0000
DLOW_INTENSITY_WORK_CEE	−0.060120	0.008342	−7.206486	0.0000
DPOVERTY_EXCLUSION_CEE(−1)	−0.018439	0.002959	−6.231630	0.0000
DRENEWABLE_ENERGY_CEE(−2)	−0.041494	0.010333	−4.015754	0.0001
DRESEARCH_DEVELOP_CEE	0.001406	0.000710	1.980815	0.0480
DSCHOOL_ABANDON_CEE	0.051219	0.011745	4.360916	0.0000
DTERTIARY_EDUCATION_CEE	0.377374	0.030297	12.45565	0.0000
DSHARE_WORLD_EXPORTS_CEE	2.014752	0.298598	6.747379	0.0000
DFINAL_ENERGY_CEE(−2)	0.024254	0.002739	8.855563	0.0000
DDEPRIVED_PEOPLE_CEE	−0.032438	0.004342	−7.471335	0.0000
DGDP_CAPITA_CEE(−2)	0.258020	0.028303	9.116385	0.0000

DEMPLOYMENT_CEE	0.078848	0.011593	6.801345	0.0000
LOG_LABOR_QUALITY_CEE	0.106426	0.014783	7.199174	0.0000
LOWER_SEC_ATTAINMENT_CEE	0.183789	0.052125	3.525928	0.0001
UPPER_SEC_ATTAINMENT_CEE	0.163299	0.051854	3.149207	0.0002
Fixed Effects (Cross)				
DGDP_CAPITA_CEE--C	3.18×10^{-15}			
DEMPLOYMENT_CEE--C	3.18×10^{-15}			
DDEPRIVED_PEOPLE_CEE--C	3.18×10^{-15}			
DFINAL_ENERGY_CEE--C	3.18×10^{-15}			
DGREENH_EMIS_CEE--C	3.18×10^{-15}			
DLOW_INTENSITY_WORK_CEE--C	3.18×10^{-15}			
DPOVERTY_EXCLUSION_CEE--C	3.18×10^{-15}			
DRENEWABLE_ENERGY_CEE--C	3.18×10^{-15}			
DRESEARCH_DEVELOP_CEE--C	3.18×10^{-15}			
DSCHOOL_ABANDON_CEE--C	3.18×10^{-15}			
DTERTIARY_EDUCATION_CEE--C	3.18×10^{-15}			
DSHARE_WORLD_EXPORTS_CEE--C	3.18×10^{-15}			
LOG_LABOR_QUALITY_CEE--C	3.18×10^{-15}			
LOWER_SEC_ATTAINMENT_CEE--C	3.18×10^{-15}			
UPPER_SEC_ATTAINMENT_CEE--C	3.18×10^{-15}			
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.836358	Mean dependent var	0.212963	
Adjusted R-squared	0.822838	S.D. dependent var	0.341801	
S.E. of regression	0.209912	Akaike info criterion	-3.247921	
Sum squared resid	34.36923	Schwarz criterion	-3.073957	
Log likelihood	130.4082	Hannan-Quinn criter.	-3.181131	
F-statistic	47.06780	Durbin-Watson stat	2.183937	
Prob (F-statistic)	0.000000			

Source: E-views estimations.

The share of the selected CEE countries' exports in total world exports displays a much greater impact on the GDP per capita than the impact of the GDP per capita on the share of the selected CEE countries' exports in total world exports. While the Czech Republic and Poland display employment and tertiary education ratios around or above the EU average levels and EU targets, the other selected CEE countries display lower levels of these important ratios for the GDP per capita growth. Romania in particular displays the lowest levels of these ratios, well below the CEE average or the EU levels. In the CEE region, Romania and Poland faced a robust economic growth during the last years, but Romania based its growth on very populist social measures that supported mainly consumption and largely decreased investments and production and that will certainly affect the Romanian macroeconomic environment in a negative way in the following years. School dropout and the share of renewable energy in final energy consumption are also important factors for the GDP per capita in the selected CEE countries (school dropout is positively correlated with the GDP per capita, while renewable energy is negatively correlated with the GDP per capita). Labor quality ratio also seems to have a positive impact on the GDP per capita growth in the analyzed CEE countries. The largest fluctuations of this ratio can be noticed in the case of Romania, just like in the case of the tertiary education ratio. Romania has faced a significant emmigration process of its "brains": the highly qualified labor force. The positive correlation of the labor quality ratio and the school abandonment ratio with the growth of the GDP per capita in the CEE countries support our conclusion that in those analyzed CEE countries (that include Poland and Romania with some robust economic growth rates during the last years of the analyzed period), labor force, no matter its qualification, supports the economic performance and the growth of the GDP per capita, because the average unemployment rate is quite low in the CEE region as a whole. These results are in line with other studies [23,24] that stressed that the quality of human capital expressed by the overall education level supports economic growth.

Table 9. OLS panel estimations with fixed effects for CEE countries' GDP per capita.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−13.99023	1.638681	−8.537498	0.0000
DEMPLOYMENT_CEE	0.090366	0.016755	5.393323	0.0001
DGREENH_EMIS_CEE	0.054081	0.004323	12.51044	0.0000
DRENEWABLE_ENERGY_CEE(-2)	−0.040224	0.012935	−3.109717	0.0067
DRESEARCH_DEVELOP_CEE(-4)	0.012829	0.000986	13.01511	0.0000
DSCHOOL_ABANDON_CEE(-2)	0.059533	0.022099	2.693922	0.0267
DSHARE_WORLD_EXPORTS_CEE(-2)	3.597548	0.309204	11.63487	0.0000
DLOW_INTENSITY_WORK_CEE(-2)	−0.051020	0.008740	−5.837371	0.0000
DFINAL_ENERGY_CEE(-4)	0.020394	0.003734	5.462288	0.0001
DDEPRIVED_PEOPLE_CEE(-1)	−0.043195	0.006156	−7.016338	0.0000
LOG_LABOR_QUALITY_CEE(-2)	0.083204	0.026060	3.192852	0.0057
LOWER_SEC_ATTAINMENT_CEE(-4)	0.146143	0.022726	6.430777	0.0000
UPPER_SEC_ATTAINMENT_CEE	0.135562	0.015348	8.832417	0.0000
DTERTIARY_EDUCATION_CEE(-5)	0.199243	0.018397	10.82998	0.0000
DGDP_CAPITA_CEE(-5)	0.123362	0.038335	3.218005	0.0054
R ² = 0.89, Durbin Watson stat = 2.03,				
F-statistic				6.538718
Prob (F-statistic)				0.000027

Source: E-views estimations.

6. Conclusions

Only Poland displays a higher share of its exports in total world exports, while Bulgaria displays a very low level among the selected CEE countries. Poland ranks first if we consider the competitiveness ratio, but it is surpassed by the Czech Republic and Slovakia in the economic performance area (expressed by GDP per capita). Bulgaria ranks last too, if we consider the GDP per capita, and Romania takes the penultimate place, in front of Bulgaria.

Romania and Bulgaria have met their national targets set by the Europe 2020 Strategy, except the targets for the tertiary education level, employment rate, and school dropout (and those are the main factors impacting on the GDP per capita and on the share of CEE countries' exports in total world exports, according to our analysis) and for the share of research and development expenditure of GDP. Poland has missed its targets in the areas of renewable energy and school dropout. Hungary's position among the CEE countries has deteriorated after the crisis. Hungary has missed its national targets for the school dropout ratio, tertiary education level, employment rate, final energy consumption and the share of the research and development expenditure of GDP. Slovakia has missed its targets for the school dropout ratio, employment rate, tertiary education level, the share of the renewable energy in final energy consumption and the share of the research and development expenditure in GDP. The Czech Republic has missed its national target only for the school dropout ratio and ranks first among the analyzed CEE countries, followed by Poland and Slovakia, while Bulgaria occupies the last position.

According to our results, the most important factors contributing to the increase in the CEE GDP per capita and the share of the selected CEE countries' exports in total world exports are the tertiary level of education (the most important factor), school dropout (positively correlated with GDP per capita and negatively correlated with the competitiveness), the labor quality ratio, the share of renewable energy in final energy use (the share of renewable energy is negatively correlated with both GDP per capita and the share of the selected CEE countries' exports in total world exports, but this share is very low in all the analyzed CEE countries, except Romania), and the employment rate. Populations with lower secondary educational attainment and with upper secondary educational attainment are positively correlated with GDP per capita and negatively correlated with the competitiveness of the analyzed CEE countries. Thus, the governments of the selected CEE countries should mainly focus on adopting some measures that can support the improvement of the education level of the people and the specialization of the people that leave the education system early. These

specific measures would also support the increase in the employment rate in the selected CEE countries. All the selected CEE countries display a descending trend of their public expenditure for education (especially Poland and Hungary that displayed the highest levels in the CEE region in the past) if we compare the latest levels of the public education expenditure of GDP to the levels achieved by these countries in the last decade (according to the data released by Eurostat). Even in the Czech Republic, the public expenditure for education decreased from high levels in recent years but very slowly. Only in Slovakia can we notice a very slow increase, while in Romania, the public expenditure for education steadily decreased and recorded the lowest levels during the entire analyzed period. Our results highlighting the important role of tertiary education for economic performance and competitiveness are also validated by the cases of the Czech Republic and Poland that have invested much more in education than the other CEE countries; they currently display the highest achievements on average in the areas covered by the Europe 2020 Strategy. The governments of the selected CEE countries should allocate more of their budgets for public education in the following years and should support and finance more training and professional reconversion programs for early leavers from the education and training systems or for unemployed people (including using the European funds allocated for this specific aim for European countries). Also, the governments of the selected CEE countries should support investments and production, not mainly consumption (such as in Romania and Hungary lately) in order to increase the employment rate in these CEE countries. Moreover, in Romania, the consumption relies mostly on imports that negatively affect the Romanian commercial balance and thus, the GDP. The public support for investments and production would also determine an increase in the CEE countries' exports, another important factor which contributes to an increase in the CEE GDP per capita. The governments should also focus on their national exports, by supporting state-guaranteed export credits and by granting export subsidies if their national budgets allow that kind of support/burden.

Another important target for the governments of the selected CEE countries would be to increase the share of renewable energy in final energy use, because (except for Romania) the selected CEE countries display very low levels of this ratio against the EU target of 20% in 2020. Their focus on the use of renewable energy, together with the reduction of the total energy consumption would support the achievement of the main goals of the Europe 2020 Strategy in the selected CEE countries.

In future research we can extend this panel analysis for a larger sample of CEE countries (including Slovenia and Croatia) and for a larger dataset of yearly observations. Another interesting direction for further research would be to proceed with a cluster analysis for the CEE countries, because, as we have already stated above and as other previous studies have shown, there are many disparities among the CEE countries in the areas of education, research and development, environment and energy. The CEE countries should be analyzed into at least two or even three clusters, given their different achievements in the areas of environment and energy, education, or R&D. This type of cluster analysis could offer a deeper insight for smaller regions across the CEE area and would add important results to this current analysis that presents the results for the CEE region as a whole.

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