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ANALYSIS OF IMPACT OF EDUCATIONAL ATTAINMENT ON ECONOMIC PERFORMANCE IN VISEGRAD GROUP COUNTRIES

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Abstract: The Visegrad Group countries are often cited as an example of a successful transition from a centrally planned economy to a market-based one. Education is crucial in enhancing the quality of human capital, which directly impacts a country's economy. The paper addresses the impact of educational attainment on the gross domestic product in the Visegrad Group countries. To assess the educational attainment of economically active persons, the Educational Attainment Index was calculated. The period analysed is the time from 2005 to 2020. Changes in the share of economically active persons with tertiary education were examined, with the best values achieved in Poland compared to other countries. Poland outperformed the remaining Visegrad Group countries in terms of the Educational Attainment Index, but Slovakia and the Czech Republic also managed to perform above the EU average. In terms of gross domestic product per capita, the Visegrad Group countries showed values below the EU average throughout the studied period. The analysis found that Poland had the highest Pearson correlation coefficient between the education index and gross domestic product per capita among the four countries and the EU average.

Keywords: economic performance, education, gross domestic product, human resource, Visegrad Group countries

JEL Classification: I21, I25, J21, E24

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Introduction

The Visegrad Group (Visegrad Four – V4) is comprised of Poland, Hungary, the Czech Republic and Slovakia, established via a declaration signed at a meeting by the top representatives of these countries on 15 February 1991. The Visegrad Group is an informal grouping of four Central European countries that share similar values, history, culture, and geography. According to Bieszk-Stolorz and Dmytrow (2020), the aim of the meeting was to establish cooperation for the purpose of joint integration with the European Union and the Atlantic zone. It was agreed that joint actions would be consulted and coordinated and mutually supported in the international arena. These countries had convergent foreign policy objectives and similar possibilities to achieve them. The Visegrad countries are now regarded as an example of a successful transition from a centrally planned to a market economy. Institutional reforms and technological changes were implemented in the quality of human capital and fiscal stabilization policy. These changes supported modernization and increased competitiveness in the globalized economy. Sufficiently qualified human resources are prerequisites for the long-term sustainable economic growth of states and their competitiveness on an international scale. Human resources and their educational structure are considered important indicators of the overall maturity and development of a country. Several scientific studies have confirmed that the educational level of human resources affects the economic results of states and regions, which is reflected in their economic performance. In the paper, the impact of the educational attainment of economically active persons on the economic performance of the Visegrad Group countries in the period 2005-2020 is examined.

Literature overview

Human resources play a vital role in the labour market, contributing significantly to the development and economic growth of a country. Macro-terms (Ningsih et al., 2022), development input factors, such as natural, material, and financial resources will not provide optimal benefits for the improvement of people's welfare if not supported by an adequate availability of human resources factors, both in quality and quantity. According to Batarlienė et al. (2017), the term human resources is used both in the business environment and in reference to people working in organisations. Human resources (employees) are the most important assets and valuable resources in the company’s performance. Employees are important since their knowledge, experience and skills increase the value of an organization in the market. The ability of human resources to provide skilled labour to various extents ensures the successful implementation of a country's economic policy.

The accession of the Visegrad Group to the EU had a positive impact on their labour markets, as confirmed by research by Bieszk-Stolorz and Dmytrow (2020). Changes in the labour market resulted in the creation of a knowledge-based economy. Having informed human capital is crucial for better economic growth in today's era of globalization as claimed by Islam et al. (2016). Several external and internal factors can influence the formation and quality of human capital. According to

Tchanturia et al. (2015), the conditions and quality of life of the population are among the external factors which depend on the average level of income and subsistence, access to health care, education, dynamics of labour migration, the existence of job opportunities, the necessary qualifications, and the state's policy on social security and support for the cultural development of the population. That is why the educational attainment of a country's population has been viewed as a significant measure of the overall maturity and development of a country. Rakytová (2019) and Karšay (2019) maintain that the quality of education affects the skills level of the adult population, the composition of the workforce, and the quality of the business environment.

Bobáková (2018) suggests that education is crucial for both individual growth and societal progress. It shapes a person's potential and career opportunities, but also contributes to economic development. Education is more important than ever, as it is essential in the new economy, which is characterised by the widespread use of innovative technologies. The education of the next generation is dependent on the quality of education and spending on education. The result should be emotionally mature, independent, critically thinking individuals with valuable skills applicable in new economy. Just as educational attainment affects economic growth, economic growth affects both the retention of existing jobs and the creation of new jobs. Therefore, research and development comprise some of the main sources of new knowledge creation through human capital (Lelek, 2014). It can be regarded as one of the most important sources of competitiveness. Bilan et al. (2020) argue that the main factor shaping intellectual potential is the higher education system and research, with government funding playing a significant role at both the higher and lower education levels. The impact of such investments should be positive in the context of the economic results achieved and their impact on future developments.

Widarni and Bawono (2021) believe that innovative human capital is an important factor for the rapid development of the knowledge economy and technology. Employees are no longer seen as mere resources, but as an important asset for the continuity and development of the company. This is the era of turning human resources into human assets known as human capital. The importance of education and tracking its development has necessitated the emergence of a new sub-discipline of educational demography, which focuses on the analysis of the relationship between education and demographic phenomena and processes (Barakat & Blossfeld, 2010). This discipline analyses human resources in the context of education (Moretti, 2002), especially in relation to forecasting the future demographic potential of states or their regions.

The development of human resources and their quality undoubtedly affect the economic performance of countries and regions, which is reflected in their economic performance. The gross domestic product (GDP) remains a key indicator of economic growth and development, despite alternative measures. The connection between GDP and the labour market is mutually dependent since the goods and services that constitute the essence of production are the result of the transformation process organized by the labour force (Húževka, 2023).

Education is a collective good and is essential for the overall development of any society and has a significant impact on its economic, cultural, and social aspects. Therefore, it requires more attention (Hronec & Vicianová Hroncová, 2014) Countries that prioritized education and promoted science and research in the past tend to achieve high innovation performance and have low unemployment rates. Public spending on education and science is crucial. In their paper, Štrangfeldová and Mališová (2021) attempted to identify whether there are disparities in the highly qualified workforce in terms of funding and numbers between the countries of the European Union. The assessment of public spending on tertiary education revealed disparities among EU countries when economically strong European countries diverge. Numerous studies have addressed the impact of public spending on education on GDP. The study by Torruam, Chaiwa and Abur (2014) investigated the relationship between the public spending on tertiary education and economic growth in a country. The study found that the educational attainment of human capital has a significant impact on a country's economic growth. Zou (2016) analysed the correlation between GDP growth and education spending in China and determined that in the short term, GDP growth contributed significantly to the increase in public education spending. The impact of non-economic factors such as science and higher education and the innovation index on GDP per capita in European countries, Turkey and Israel was investigated by Panić et al. (2022). Their results suggest that elements of science and the quality of higher education greatly affect the size of GDP per capita in the studied countries. Similar research was carried out in South-Eastern Europe by Popović et al. (2020). The authors focused on assessing the impact of the education system, educational, scientific, and other institutions on economic growth in nine countries of South-Eastern Europe (SEE) and concluded that indicators of the state of educational and other institutions are positively correlated with GDP per capita growth.

Aim and methodology

The paper aims to assess the educational attainment of economically active individuals in the Visegrad Group nations compared to the EU27 average, as well as to examine the impact of educational attainment on the economic performance of these nations from 2005 to 2020.

In the literature, various methods are used to assess educational attainment. In the paper, the share of employed persons with tertiary education and the Educational Attainment Index are used to assess educational attainment. In the case of the Educational Attainment Index (coefficient), several methods of its calculation are presented in the literature (Kulčár, 2010). In the paper, the following method will be employed:

$$EAI = \frac{1\times EDU_{0-2}+2\times EDU_{3-4}+3\times EDU_{5-8}}{employed\ (working)\ population} \quad (1)$$

Where:
EAI – Education Attainment Index of employed (working) population
$EDU_{0\text{-}2}$ – Employed population with less than primary, primary and lower secondary education (levels 0-2)

$EDU_{3\text{-}4}$ – Employed population with upper secondary and post-secondary non-tertiary education (levels 3 and 4)
$EDU_{5\text{-}8}$ – Employed population with tertiary education (levels 5-8)

The index values range from 1 to 3. The value of 1 would indicate that the whole employed population has less than primary, primary and lower secondary education. Conversely, the value of 3 would indicate that the whole employed population has a tertiary education.

The impact of educational attainment on the economic performance of the Visegrad Group countries was measured using the Pearson correlation coefficient. This coefficient is commonly used to assess the strength of correlation between two quantitative variables and is one of the most common measures of linear dependence (Hebák, 2013).

Let us assume there is a linear dependence between the *X* and *Y* quantities. Let $(x_1, y_1), \ldots, (x_n, y_n)$ are the measured values of an independent random sample of the n range system of two *X, Y* random variables of the bivariate normal distribution and let $\overline{x}$ and $\overline{y}$ be their sampling averages. The following relationship holds for Pearson's sample correlation coefficient (PCC):

$$PCC_{x,y} = \frac{\overline{x.y} - \bar{x}.\bar{y}}{\sqrt{\overline{x^2} - (\bar{x})^2}.\sqrt{\overline{y^2} - (\bar{y})^2}} \tag{2}$$

where

$$\overline{x^2} = \frac{1}{n}\sum_{i=1}^{n} x_i^2,\ \overline{y^2} = \frac{1}{n}\sum_{i=1}^{n} y_i^2,\ \overline{x.y} = \frac{1}{n}\sum_{i=1}^{n} x_i.y_i, \tag{3}$$

Pearson's sample correlation coefficient $r_{x,y}$ measures the tightness of the linear relationship between the X and Y variables on both sides, i.e. $r_{x,y} = r_{y,x} = r$.

Pearson's sample correlation coefficient takes values from the $(-1; 1)$ interval and expresses the degree of linear correlation between the X and Y variables. The closer $PCC_{x,y}$ is to 1, the stronger the linear dependence is and the closer $PCC_{x,y}$ is to 0, the weaker the linear dependence is (Ostertagová, 2013).

Following PCC, the coefficient of determination (CD) was calculated. The coefficient of determination represents the proportion of common variance, i.e. what percentage change in one variable affects the other. It provides information about the strength of the relationship between the variables. The following formula was used to calculate the coefficient of determination:

$$CD_{x,y} = PCC^2 \tag{4}$$

To conduct the research, several methods including descriptive statistics, time period analysis, comparison and synthesis were used. The data from the Eurostat database were utilized for the time period analysis.

Results

This section explores the educational attainment and economic performance of the Visegrad Group countries. The educational attainment of the economically active population was analysed, followed by the gross domestic product per capita indicator as a measure of economic performance. Moreover, the dependence of educational attainment and economic performance of the Visegrad Group countries and EU27 was investigated.

Educational level of the working population in the Visegrad Group countries

Tertiary education (TE) access expansion is a prevalent trend in developed countries. It is endorsed and supported by national governments. In the European Union, this policy was also promoted at a supranational level, with a clearly articulated target of having at least 40% of people aged 30 to 34 in TE by 2020. This was also one of the main objectives of Europe in the 2020 Strategy (Štefánik & Horvát, 2015). In this context, we conducted an analysis of the share of employed persons with tertiary education in the total number of employed persons. Changes in this indicator from 2007 to 2020 in all the Visegrad Group countries and the EU27 are shown in Figure 1.

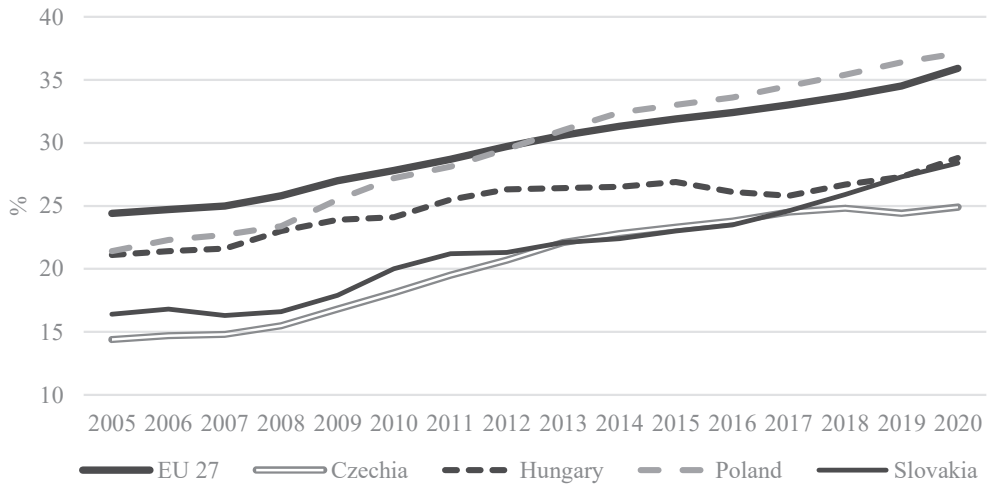

Figure 1. Share of employed persons with tertiary education in Visegrad Group countries

Source: Eurostat (2023), authors' own graph

Until 2012, not a single V4 country reached the level of the EU27 average in the share of tertiary-educated employed persons. Over the period under analysis, only Poland managed to reach a level slightly above the EU27 average since 2013. The Czech Republic showed the lowest values especially since 2018. In 2018 it shows a value of 25.9% and in 2019 even a decrease to 24.4%.

Over the period under analysis, the share of tertiary-educated economically active persons increased most significantly in Poland, by 15.70 p.p., while in the EU27 it was 11.5 p.p. Slovakia achieved an increase of 12 p.p., but Hungary only by 7.7 p.p.

Educational attainment is one of the basic characteristics used to assess the cultural level and quality of human capital among different population groups. To assess the educational attainment of the employed (working) population in the V4 countries, we calculated the Educational Attainment Index. The results are shown in Figure 2.

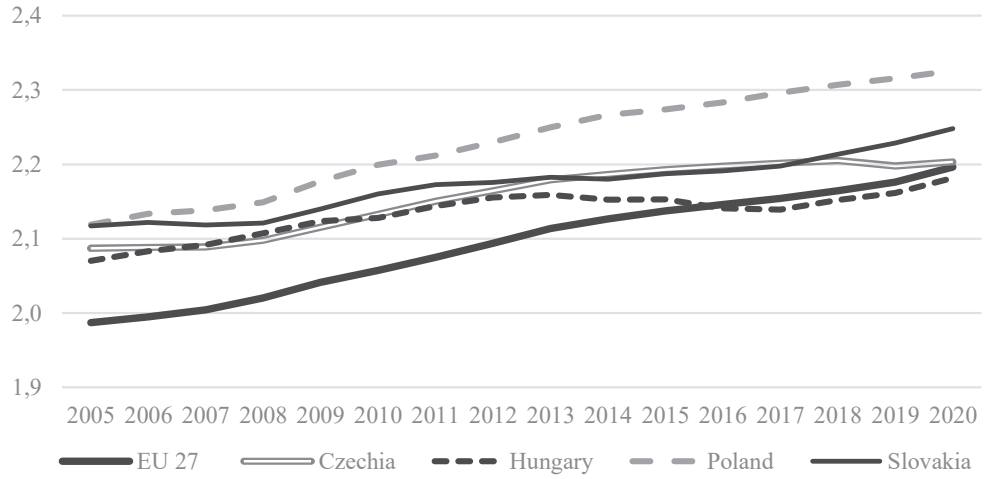

Figure 2. Educational attainment index of employed persons in Visegrad Group countries

Source: Eurostat (2023), authors' own calculations

The graph shows a positive trend in the Education Index, mainly in Poland and Slovakia. Until 2016, the Visegrad Group demonstrated better values than the EU27. The research indicates that Poland consistently displayed the best values in the time period, surpassing the other V4 countries and the EU27 average since 2014. In 2016, the EU27 reached a value of 2.15 and Hungary only 2.14, which puts it below the EU27 level until 2020. Despite a slight growth experienced by Poland, Slovakia, Hungary and the EU27, the Czech Republic stagnated and even declined in the educational attainment index in 2019. Between 2005 and 2020, the education index in the EU27 and Poland increased by 0.21, on the other hand, Hungary recorded the lowest increase in the index, by 0.11.

Economic performance of Visegrad Group countries

Macroeconomic theory claims that the gross domestic product is one of the most important indicators that shows and evaluates the economic development in a country (Kovárník & Hamplová, 2016). GDP per capita is often used as an indicator to express the average real income per person in a country. The evolution of GDP per capita in the Visegrad countries is illustrated in Figure 3.

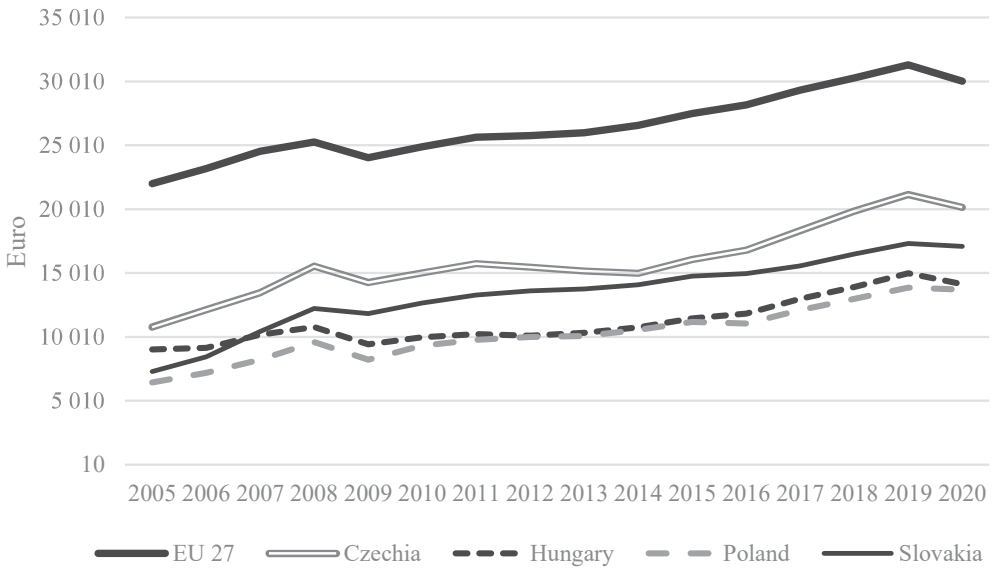

Figure 3. GDP per capita in Visegrad Group countries

Source: Eurostat (2023), authors' own graph

From 2005 to 2020, no Visegrad Group country reached the level of the EU27 average in terms of GDP per capita. Figure 3 shows the fluctuations in GDP per capita in both the 2009 financial crisis and the COVID-19 pandemic in 2019. The former crisis was caused by the financial industry's meltdown, while the latter was due to a non-economic trigger. The Czech Republic had the best values over the whole period, followed by the Slovak Republic. Hungary and Poland had roughly the same values between 2012 and 2015, and the situation in 2016 was slightly in Hungary's favour, and in 2020 GDP per capita was about EUR 420 in Hungary's favour.

Assessment of the impact of educational level on the performance of the Visegrad Group countries

The Pearson correlation coefficient was used to assess the impact of the educational attainment of the V4 countries on their performance. The results are shown in Table 1.

Table 1. Dependence of educational attainment and economic performance

	EU 27	Czechia	Hungary	Poland	Slovakia
PCC	0.9360	0.8113	0.6579	0.9438	0.9293
CD	0.8761	0.6583	0.4329	0.8907	0.8636

Source: Authors' own calculations

Based on the results of the Pearson correlation coefficient, a direct correlation between educational attainment and economic performance can be concluded. The highest values of the coefficient were in Poland, Slovakia, and the EU27. A high positive dependence was also found in the Czech Republic. In the case of Hungary, the Pearson correlation coefficient reached the value of 0.6579 over the specified time frame. The result indicates a moderate level of dependence between the variables.

The coefficient of determination results shows that in the case of Poland, 89% of the variability was explained by the given linear model, while in the case of Hungary, only 43% of the variability was explained by the given linear model.

Conclusions

Economic growth is affected by a variety of factors explored by many researchers and authors and our aim was to add to their work. Numerous studies have investigated the relationship between public expenditure on education and science funding or the impact of educational attainment on job creation. Previous research has shown that a factor influencing the formation of intellectual potential is the higher education system and research, which is influenced by government spending at all levels of education. In the same way, we consider the educational structure of the population an important measure of a country's development and maturity. It prompted us to contribute to the ongoing scientific discourse with our research results on this subject matter. The study evaluates the educational attainment of the economically active population in the V4 nations in contrast to the EU27 average during 2005 and 2020. It also investigates the impact of educational attainment on their economic performance. To achieve our goal, we monitored several variables, including the educational attainment index. While the index does not reflect the quality or efficiency of educational institutions in a particular place, it is closely linked to economic or social topics related to education and the labour market. The following conclusions emerged from our research:

- In the share of economically active persons with a tertiary education indicator in the V4 countries until 2012, no V4 nation reached the level of the EU27 average. During the time period analysed, only Poland managed to do so. Poland has been slightly above the EU27 average since 2013. Poland experienced the largest increase in tertiary-educated economically active population (by 15.70 p.p.) compared to the EU27 average of 11.5 p.p. Slovakia saw a 12.0 p.p. increase, while Hungary experienced a rise of only 7.7 p.p.
- In the Education Index, which is used to assess the educational attainment of economically active persons, a positive trend, especially in Poland and Slovakia, was observed. Between 2005 and 2020, the educational attainment index in the EU27 and Poland increased by 0.21, whereas Hungary recorded the lowest increase (by 0.11).
- GDP per capita: in the period from 2005 to 2020, the V4 nations failed to reach the EU27 average. Among the four nations, the Czech Republic performed the best throughout the period, followed by the Slovak Republic. The correlation

coefficient analysis highlights Poland, Slovakia and the EU27 as having the highest correlation between educational attainment and economic performance, which is seen as a positive piece of information. A high positive dependence was also found in the Czech Republic. The situation was different in the case of Hungary with the Pearson correlation coefficient of 0.6579, i.e. a moderate dependence.

We are aware that the evaluation of human resources based only on the level of education is narrow, and that the level of human resources is influenced by many other factors and specificities of the given state in addition to the educational level. There is a need for more research into education and educational attainment on economic growth and performance, both at the macro and enterprise levels, including human resource management and enterprise performance. In further research, we would like to focus on the multi-criteria evaluation of human capital based on quantitative and qualitative indicators and its impact on economic performance and competitiveness.

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ANALIZA WPŁYWU WYKSZTAŁCENIA NA WYNIKI GOSPODARCZE KRAJÓW GRUPY WYSZEHRADZKIEJ

Streszczenie: Kraje Grupy Wyszehradzkiej są często przytaczane jako przykład udanego przejścia od gospodarki centralnie planowanej do gospodarki rynkowej. Edukacja ma kluczowe znaczenie dla podnoszenia jakości kapitału ludzkiego, który bezpośrednio wpływa na gospodarkę kraju. Artykuł dotyczy wpływu wykształcenia na produkt krajowy brutto w krajach Grupy Wyszehradzkiej. Aby ocenić poziom wykształcenia osób aktywnych zawodowo, obliczono wskaźnik wykształcenia. Analizowany okres to szereg czasowy od 2005 do 2020 roku. Monitorowano zmiany udziału osób aktywnych zawodowo z wykształceniem wyższym, przy czym najlepsze wartości na tle innych krajów osiągnięto w Polsce. Polska wyprzedziła pozostałe kraje Grupy Wyszehradzkiej pod względem wskaźnika wykształcenia, ale Słowacja i Czechy również uplasowały się powyżej średniej unijnej. Pod względem produktu krajowego brutto per capita kraje Grupy Wyszehradzkiej wykazywały wartości poniżej średniej unijnej w całym badanym okresie. Analiza wykazała, że Polska ma najwyższy, spośród czterech krajów, współczynnik korelacji Pearsona między wskaźnikiem wykształcenia a produktem krajowym brutto na mieszkańca oraz średnią unijną.

Słowa kluczowe: wyniki gospodarcze, wykształcenie, produkt krajowy brutto, zasoby ludzkie, kraje Grupy Wyszehradzkiej