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THE IMPACT OF EMPLOYEES' EDUCATION LEVEL ON ACQUIRING DIRECT INVESTMENTS IN THE VISEGRAD GROUP COUNTRIES

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Purpose: Following the transition to a market economy in the 1990s, the Visegrad Group countries (V4: Czechia, Hungary, Poland, and Slovakia) began to narrow the economic gap with developed nations. After their accession to the European Union, this convergence accelerated. This article examines the impact of employees' education levels on changes in human capital efficiency and the attraction of foreign investments in the V4 countries.
Design/methodology/approach: The study draws on data from Eurostat, UNCTAD (2025), and Stooq.com (2025) for the period 2004-2024. It investigates the relationship between employees' education levels, human capital efficiency, and foreign investment inflows in the V4 countries using descriptive statistics, as well as correlation and determination analyses.
Findings: The results indicate that VAIC, as a measure of human capital efficiency in long-term, macroeconomic analyses, has limited applicability. Based on the ratio of real GDP growth to employment, the study finds that an increase in human capital (employees' educational attainment) and its efficiency is positively associated with the attraction of foreign investments.
Research limitations/implications: The generalizability of the findings is constrained by the specific characteristics of the V4 economies. The measures recommended in this study may have weaker effects in less developed countries due to their lower technological sophistication.
Practical implications: Since education, particularly higher education, enhances human capital efficiency and increases the scale of foreign investment inflows, governments should promote high participation in tertiary education. Fiscal interventions that reduce the wage share in GDP should be limited, as they discourage employees from investing in their own human capital.
Social implications: Citizens should be encouraged to improve their educational attainment, as it benefits both them and the entire economy, making it easier to attract foreign investments.
Originality/value: The article challenges the suitability of VAIC for long-term international comparisons. It underscores the significance of employees' education in driving economic development and advocates for restrained fiscal intervention by the state.
Keywords: Visegrad Group countries; VAIC; real GDP-to-employment ratio; employees' education level; human capital efficiency; foreign direct investment.
Category of the paper: Research paper.

1. Introduction

The interest in the concept of intellectual capital management and its element in the form of human capital, is related to the formation of a new civilization, the main attribute of which is knowledge and its effective use, resulting in the achievement of competitive advantage. Success and competitive advantage of an enterprise and country is not created by knowledge itself, but by its skillful use, transformation and exploitation (Mačerinskienė, Aleknavičiūtė, 2017).

The efficiency of human capital determines the competitiveness of human resources available to individual economies (Dakhli, De Clercq, 2004; Huggins et al., 2017). The aim of the article is to assess the relationship between the level of education of employees, changes in human capital efficiency (understood as average employee productivity) and the acquisition of foreign direct investment. It was assumed that an increase in employees' educational attainment facilitates the attraction of foreign investments, which in turn contributes to long-term growth in labor productivity. The article employs two indicators of human capital efficiency: the ratio of real GDP to employment, and Pulic's VAIC index (Pulic, 2000, 2004). A comparative analysis of these indicators, from the perspective of their usefulness in illustrating long-term macroeconomic changes, served as the basis for selecting one of them as a reference point for further research. The article contributes to the existing literature in several ways. First, we verify the usefulness of the Pulic' method in determining the value and efficiency of human capital in international comparisons over a long period. The subject of the study are the Visegrad Group (V4) countries, which are similar to each other in terms of development level, institutional conditions, economic structure and employment. Therefore, most of the limitations (wage gap, structural, institutional differences) for using VAIC as a measure of the value and efficiency of human capital in international comparisons are absent. Second, we complement theoretical work on the importance of the employees' education level on economic outcomes, including attracting foreign investment. Third, we complement empirical work using macroeconomic data to examine the relationship between the structure of employment by educational level (distinguishing between higher and secondary education) and the rate of economic growth and attracting foreign investment. Finally, our article contributes to the extensive and intensified policy and academic literature on the profitability of investing public funds in higher education and its economic effects.

The article consists of a theoretical introduction based on a literature review, a presentation of the method used and the sources of data acquisition, an empirical section, a discussion and conclusions.

2. Literature review

Investment in human capital by increasing resources for education is crucial for economic development, especially in the long term (Kraay, 2018; Lenkei, 2020; Andrijauskiene, 2021). Education increases people's productivity and preparing them for the challenges of advanced economies (Becker, 1993; Goldin, 2016; Habib et al., 2019), facilitating innovation and absorption of new technologies (Mulliqi, 2018; Castell´o-Climent, 2019; Diebolt, Hippe, 2019; Rossi, 2019; Sasso, Ritzen, 2019).

Outside the education system, employees can improve their human capital through: independent education, on-the-job training, public training in labor market policy, work experience in various types of organizations, social environment, peers, intergenerational transmission of human capital within the family, etc. (Hanushek, Woessmann, 2008; Antonelli et al., 2010; Flabbi, Gatti, 2018).

All the above-mentioned factors only create opportunities for human capital building, it is the workers themselves who decide how much they want to use them. Like the state and businesses, households devote time and resources to human capital development taking into account current benefits (consumption, acquisition of skills required in the labor market), but also about future monetary returns and non-monetary benefits. When it comes to deciding on university enrollment, individual returns are not fully known to students until they enter the labor market, making entering and completing studies a risky investment (Lee et al., 2015). Such a decision depends, among other things, on the magnitude of the income gap between university graduates and those with a high school education.

Higher education is seen as a prerequisite for access to higher segments of the occupational structure, requiring knowledge and greater skills. From the employee's perspective, higher education enables performing more complex tasks, allowing for higher incomes. From a macroeconomic perspective, higher productivity and development potential of employees with higher education support the development of the economy (Bal-Domańska, 2022; Schultheiss et al., 2023; Manuel, 2024). Based on studies covering both the OECD and developing countries, it was found that in countries that double the average number of years of secondary education, output per worker increases by a third.

Automation and digitalization increase the demands on employees, which entails the expansion of higher education in developed countries, contributing to increased productivity and innovation (Schultheiss et al., 2023). The level of actual earnings is influenced by the match between graduates' human capital and employers' requirements. University graduates working in positions related to their field of study earn more than those working in fields unrelated to their completed field of study (Somers et al., 2019; Manuel, 2024).

Potentially, the return on investment in human capital should be higher in developing countries, as it enables faster economic growth by attracting foreign investment. These contribute to increased labor productivity and raising funds for investment in human capital (Lim et al., 2018). According to neoclassical growth theory, when similar technologies are used, capital returns in richer regions (countries) are reduced, which attracts it to poorer locations. This leads to convergence in the long term within and between countries (Vatsa, Pino, 2023).

Technology transfers (direct investment) will not occur if the level of skills available in a country is not sufficient to assimilate and appropriately use the technology (Ali et al., 2018; Diebolt, Hippe, 2019; Mei, 2023). This is supported by studies showing that greater benefits from globalization accrue to those developing countries that have high secondary and higher education enrollment rates and high levels of health capital (Olagunju et al., 2019). A country receiving foreign direct investment (FDI) usually gains benefits in the form of further improving the level of human capital and applied technology (Mei, 2023), increasing its share in foreign trade, reducing unemployment, increasing prosperity and reallocating the labour force to more productive sectors (Carrère et al., 2020).

From the perspective of the article's focus, it is important to select an appropriate measure to assess changes in the value and efficiency of human capital. The most frequently proposed methods in the literature are cost or income methods of valuing human capital and its efficiency. In the cost approach, the human capital of an individual employee is defined as the outlay on acquiring: knowledge, experience and skills acquired at school, at work and in other forms of further education (Østergaard, Marinova, 2018; Naval et al., 2020), supplemented by costs incurred by the state and family (for education, health care), companies that employed the employee (expenditures on training and development at work) and the employee's own expenses. The income approach identifies human capital with the employee's productivity, which is manifested by their wage rate (Buesselmann, 2009; Škare, Lacmanović, 2015).

The GDP to employment ratio can be used to assess the efficiency of human capital on a macroeconomic scale in the long term (Klinger, Weber, 2019; Vladušić et al., 2020). An alternative measure of human capital efficiency is the Value Added Intellectual Coefficient (VAIC), proposed by Pulic (Pulic, 2000, 2004). Critics of Pulic's model point out that VAIC is not a good tool for international comparisons, under conditions of strong wage diversification (Ståhle et al., 2011, Iazzolino, Laise, 2013; Marzo, 2022). Proponents of the VAIC model, on the other hand, point out that estimates are based on market data (Ulum et al., 2014; Singla, 2020).

The V4 countries compared in the article are linked by geographical, historical and cultural proximity, a similar level of development, institutional similarities and a similar structure of the economy and employment (Dmytrów, Bieszk-Stolorz, 2019). In addition, at the same time (in 2004) the V4 countries joined the EU, which accelerated the acquisition of foreign direct investment (FDI), which created new jobs and contributed to wage growth (Kónya, 2018;

Antohi et al., 2019). The Visegrad Group countries rarely coordinate their positions on issues decided at the European Union level because their political and economic priorities differ (Dangerfield, 2008).

Despite relatively rapid economic growth in the 1990s and early 21st century, initiated by the transition from a socialist to a market economy, the V4 countries were characterized by a low level of GDP per capita, especially compared to the EU15 countries (Schmidt, 2016). Accession to the EU accelerated V4 economies' growth through access to the EU Common Market, EU structural funds, and foreign investments driven by relatively low labor costs (Prohorovs, Bistrova, 2022; Schwabe, 2021).

3. Research methods

The literature study allowed the following research hypotheses:

H1: The Real GDP to Employment and VAIC are reliable measures of changes in human capital efficiency in international comparisons.

H2: The growth in education of employees in the economies of the V4 countries facilitates the acquisition of foreign investments.

Verification of the first hypothesis was based on Eurostat data (Eurostat, 2025), i.e.:

- employment by sex, age and educational attainment level – sex: Total; age: 15-64; educational attainment level: Upper secondary and post-secondary non-tertiary education (levels 3-4), Tertiary education (levels 5-8); all in thousand persons.
- Gross Domestic Product (GDP) and main components: output (including Gross Value Added), expenditure and income (including Compensation of employees, Gross Operating Surplus and Mixed Income, Taxes on Production and Imports Less Subsidies) – current prices, chain linked volumes (2010); all in million euro.
- UN data (UNCTAD, 2025) and EURUSD quotes from Stooq.com (Stooq.com, 2025) were used to verify the second hypothesis:
- foreign direct investment: inward and outward flows and stock – Stock; annual; current prices, million US dollars.

For the verification of the first hypothesis, the initial assumption was made that the depiction of the efficiency of human capital (understood as the ratio of outputs to inputs), is the efficiency (productivity) of labor, which can be expressed using an indicator based on the size of employment (1), as well as, analogous to the VAIC model, on employee compensation (2) and (3):

$$Real\ GDP\ to\ Employment = \frac{GDP\ in\ Market\ Prices\ (Constant\ Prices\ from\ 2010)}{Employment} \quad (1)$$

$$Nominal\ Gross\ Value\ Added\ to\ Compensation\ of\ Employees = \\ = \frac{Nominal\ Gross\ Value\ Added}{Nominal\ Compensation\ of\ Employees} = \frac{Gross\ Value\ Added\ (Current\ Prices)}{Compensation\ of\ Employees\ (Current\ Prices)} \quad (2)$$

$$Nominal\ GDP\ to\ Compensation\ of\ Employees = \\ = \frac{Nominal\ GDP\ in\ Market\ Prices}{Nominal\ Compensation\ of\ Employees} = \frac{GDP\ in\ Market\ Prices\ (Current\ Prices)}{Compensation\ of\ Employees\ (Current\ Prices)} \quad (3)$$

A comparison of these indicators was made in order to decide which one to use later in the study. To determine the reasons for the variation in the analyzed indicators, changes in the structure of GDP in terms of income over the analyzed period were presented (Compensation of Employees, Gross Operating Surplus and Mixed Income, Taxes on Production and Imports Less Subsidies). Then the correlation between Real GDP and different measures of human capital efficiency (1-3) were calculated, what allowed for the verification of the hypothesis concerning the reliability of VAIC as a long-term measure of human capital efficiency in international comparisons.

For the purpose of verifying hypothesis 2 data on education levels for the 15-64 age group (Eurostat, 2025) as well as data on foreign direct investments (UNCTAD, 2025) were used. The groups of "upper secondary and post-secondary non-tertiary education" (3-4 education level) were used as secondary education, and "tertiary education" (5-8 education level) was used as tertiary education. The scale of direct investment sourced was related to the indicators used earlier, including the share in employment of people with higher education. Shares among employees with tertiary education and persons with at least secondary education (sum of persons with secondary and tertiary education) were next contrasted with data on Foreign Direct Investments.

Relationships between the considered quantities (indicators) were examined using Pearson's linear correlation coefficient ($p < 0.05$ was used as the level of significance), at the same time providing the coefficient of determination R^2, as a measure of the fit of the regression function to the empirical data.

4. Results

The research began by testing the hypothesis of whether the Real GDP-to-Employment ratio and VAIC-based measures accurately reflect changes in human capital efficiency in international comparisons for the V4 countries (Figure 1). As can be seen, in the analyzed economies between 2004 and 2024 (excluding Hungary) there was a significant difference in trend depending on the indicator adopted. In the first case, *Real GDP to Employment* (1),

one can see in all the economies under consideration a systematic increase throughout the study period. In contrast, measures based on VAIC, *Nominal Gross Value Added to Compensation of Employees* (2) as well as *Nominal GDP to Compensation of Employees* (3), show an increase over the entire period only for Hungary.

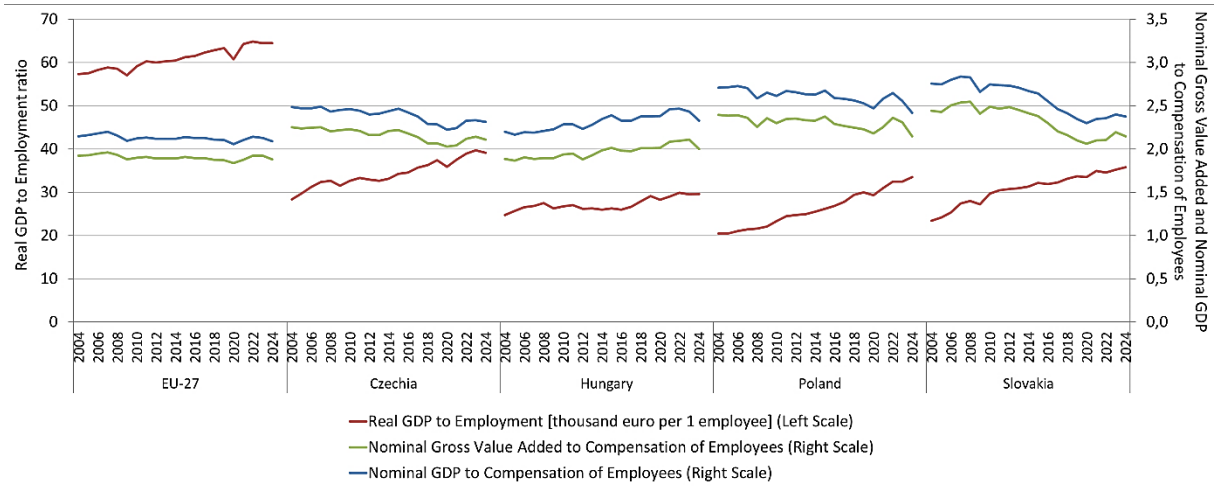

Figure 1. Labor productivity from various perspectives in the EU-27 and Visegrad Countries, 2004-2024.

Source: own compilation based on Eurostat data: Population and social conditions, Labor market, Employment and unemployment, GDP and main components (output, expenditure and income).

To explain the reasons for these discrepancies, it is necessary to look at the structure of GDP in terms of income (Figure 2). The data in Figure 2 (the structure of GDP in income terms by employee compensation, corporate operating surplus and indirect taxes) indicate that, unlike in the other analyzed economies, the dynamics of employee compensation in Hungary was systematically lower than the dynamics of GDP, which was positively reflected in the values of the corresponding indicators of labor efficiency (productivity) in relation to employee compensation.

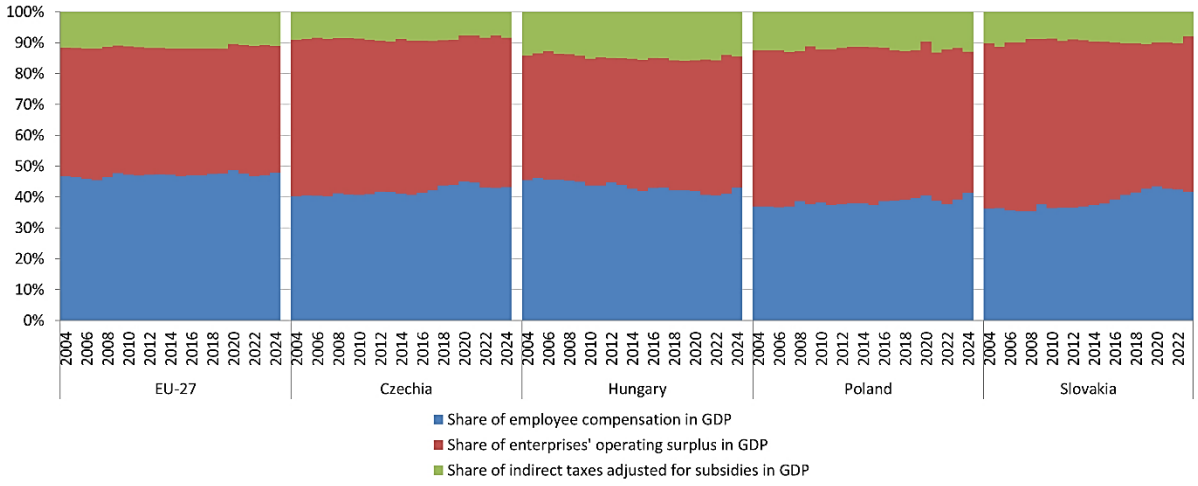

Figure 2. Income Structure of GDP in the EU-27 and Visegrad Countries, 2004-2024.

Source: own compilation based on Eurostat data: GDP and main components (output, expenditure and income).

Due to faster growth in the share of compensation in GDP (than the EU-27 average), for the Czechia, Poland and Slovakia, the VAIC-based indicators for these countries declined compared to the EU average. Hungary, which was the only country to see an improvement in VAIC-based indicators, was at the same time characterized by the lowest growth in *Real GDP* and *Real GDP to Employment* (1) during the period under review (Figure 1).

This confirms that the improvement in VAIC-based indicators for Hungary was mainly the result of a decline in the share of employee compensation in GDP. In addition, VAIC-based indicators show declines in human capital efficiency in the three V4 countries, which are successively reducing the gap to the EU-27 average (Figure 3 and Figure 4). Therefore, it does not correctly reflect the long-term trends in human capital efficiency in the analyzed economies.

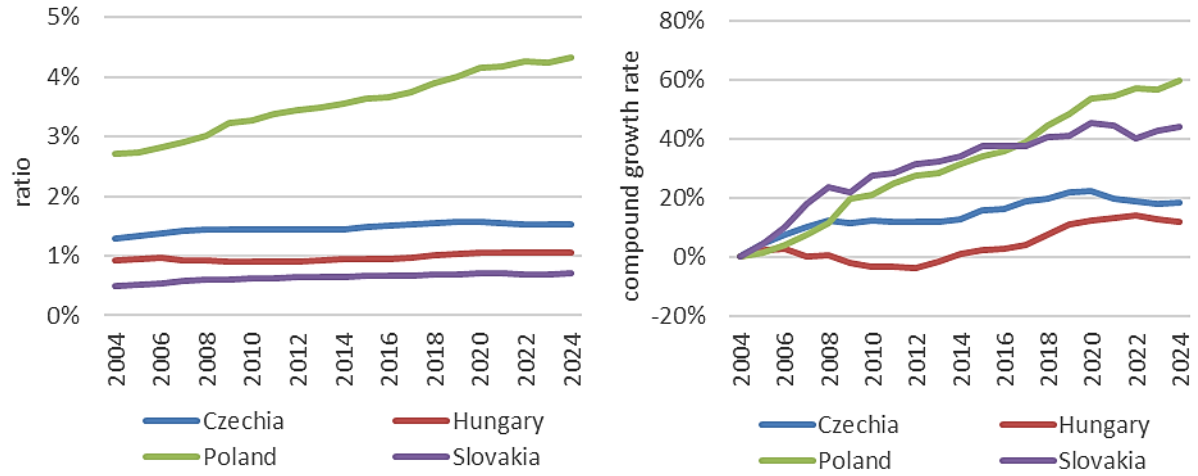

Figure 3. *GDP* of each V4 country to *GDP* of EU from 2004 to 2024. Cumulatively (year 2004 = 0%). GDP data at constant market prices from 2010.

Source: own compilation based on Eurostat data (as in Figure1).

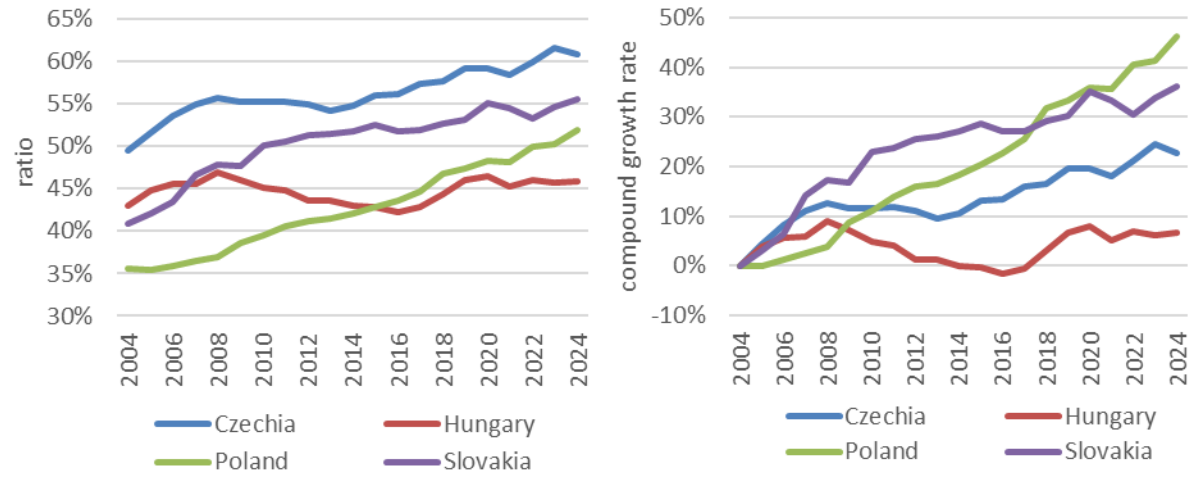

Figure 4. *Real GDP to Employment ratio* of each V4 country to *Real GDP do Employment ratio* of EU from 2004 to 2024. Cumulatively (year 2004 = 0%). GDP data at constant market prices from 2010.

Source: own compilation based on Eurostat data (as in Figure1).

In all the economies considered, there is a statistically significant, strong, positive and confirmed by high R^2 readings, correlation between *Real GDP* and the *Real GDP to Employment indicator* (1) (Table 1). A statistically significant correlation, although no longer necessarily positive and not as strong, also exists for the V4 economies between *Real GDP* and the other two indicators considered, based on the level of employee compensation. It should be noted that in the case of Hungary, the correlation for the indicators relating to the level of wages was strong and positive (which is due to the aforementioned falling share of compensation in GDP). In the other three V4 countries, the correlation for these indicators turned out to be relatively strong, but of a negative nature. Taking into account the above conclusions, we assume that the first hypothesis is not confirmed. *Real GDP to Employment* ratio (1) is a better long-term measure of changes in human capital efficiency than VAIC in international comparisons.

Table 1.
Pearson correlation (r) and determination coefficients (R2) between Real GDP and selected human capital efficiency indicators (1,2,3) in the Visegrad countries and the EU-27

		Real GDP				
		EU-27	**Czechia**	**Hungary**	**Poland**	**Slovakia**
Real GDP to Employment (1)	*r*	0,9650*	0,9876*	0,9153*	0,9960*	0,9859*
	R^2	0,9312	0,9754	0,8378	0,9921	0,9720
Nominal Gross Value Added to Compensation of Employees (2)	*r*	-0,3376	-0,8244*	0,8824*	-0,6642*	-0,8263*
	R^2	0,1140	0,6796	0,7787	0,4411	0,6827
Nominal GDP to Compensation of Employees (3)	*r*	-0,4005	-0,8447*	0,8194*	-0,7674*	-0,8726*
	R^2	0,1604	0,7135	0,6715	0,5888	0,7614

* correlation significant at the 0.05 level.

Source: own compilation based on Eurostat data (as in Fig.1).

Given these conclusions, further research focuses only on the *Real GDP to Employment* ratio (1), as an indicator showing the efficiency of human capital across economies.

Hypothesis H2 presented in the article assumes that growth in education of employees in the economies of the V4 countries is associated with the acquisition of foreign investment.

It should be emphasized that, during the period under analysis, there was a significant change in the educational composition of the workforce in the V4 countries as well as in the EU as a whole. These changes were accompanied by variations in real GDP relative to employment (Figure 5). The share of employees with at least a secondary education (the sum of those with secondary and higher education) was higher in the V4 countries than the EU-27 average throughout the analyzed period. In recent years, the proportion of employees with higher education in Poland has exceeded the EU-27 average.

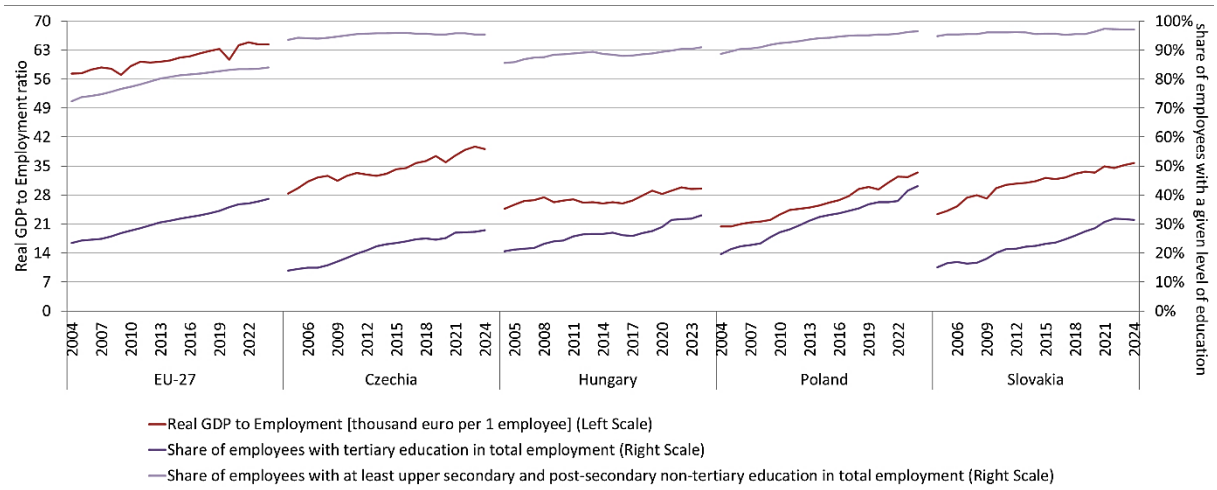

Figure 5. Real GDP to Employment and changes in the share of employees with secondary and tertiary education in the EU-27 and Visegrad Countries, 2004-2024.

Source: own compilation based on Eurostat data: Population and social conditions, Labor market, Employment and unemployment, GDP and main components (output, expenditure and income).

One of the factors supporting economic growth and labor productivity is the foreign investment attracted by individual economies. The economies of the V4 countries were characterized by a simultaneous increase in the scale of direct investment and the *Real GDP to Employment ratio* (1) during the analyzed period (Figure 6).

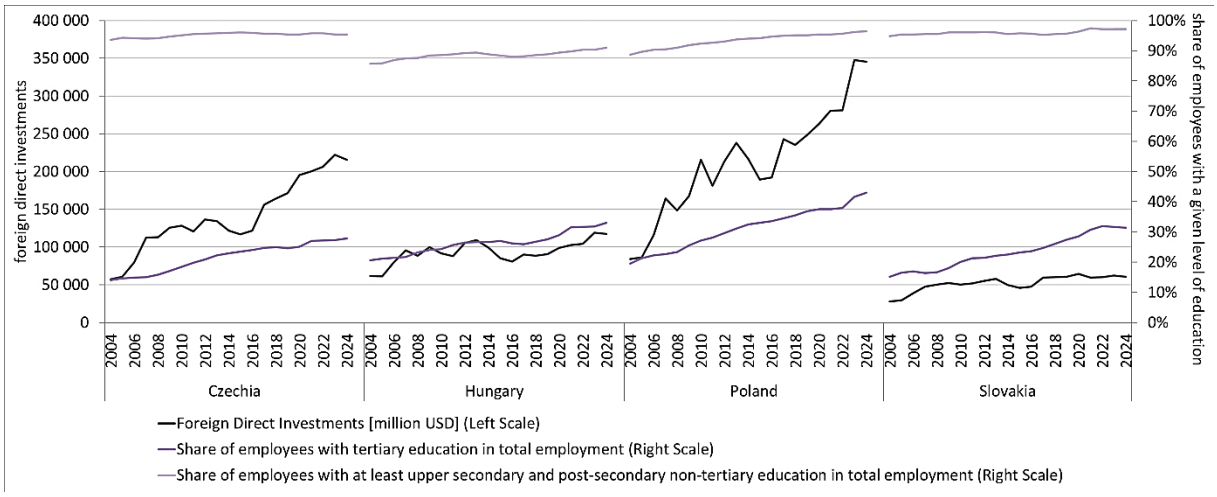

Figure 6. Foreign Direct Investment and the Employment Share of Employees by Education Level in the EU-27 and Visegrad Countries, 2004-2024.

Source: own compilation based on data from Eurostat (Population and social conditions. Labor market, Employment by sex, age and educational attainment level), UN (UNCTAD stat: Foreign direct investment. Inward and outward flows and stock, annual) and Stooq.com.

Table 2 shows the correlation between direct investment and employment structure from the perspective of education level. The correlation between the scale of direct investment and the *Real GDP to Employment ratio* (1) for all V4 countries turned out to be generally strongly positive, statistically significant and confirmed by generally high R^2 values (Table 2).

Table 2.
Pearson correlation (r) and determination coefficients (R^2) between direct investment and selected indicators in Visegrad countries

		Foreign Direct Investments (stock)			
		Czechia	**Hungary**	**Poland**	**Slovakia**
Share of employees with tertiary education in total employment	*r*	0,8847*	0,7627*	0,9428*	0,7900*
	R^2	0,7827	0,5817	0,8890	0,6240
Share of employees with at least upper secondary and post--secondary non-tertiary education in total employment	*r*	0,6049*	0,9112*	0,9238*	0,6444*
	R^2	0,3660	0,8302	0,8535	0,4153

* correlation significant at the 0.05 level.

Source: own calculations based on Eurostat data (as in Fig. 5).

In all cases considered (EU-27 and V4 countries), there is a statistically significant, strongly positive correlation between the share of workers with tertiary education and the value of foreign direct investment (assets at the end of the period), confirmed at the same time by high values of R^2. Such a high correlation did not occur in Czechia and Slovakia with regard to the share of employment of people with at least secondary education.

The results obtained indicate that hypothesis H2 should be considered confirmed. The acquisition of foreign investment is accompanied by an increase in the efficiency of human capital. The observed correlations indicate that direct investment in the V4 countries is largely concentrated in sectors requiring highly educated workers.

5. Discussion

The motivation to write this article was to check whether the reduction of the difference between the economic development of the V4 countries (Czech Republic, Poland, Hungary, Slovakia) and the EU-27 average can be explained by the employees' education level affecting the efficiency of human capital and direct investment. Statistical data indicate that the pace of "catching up" the economic backwardness is different, depending on the increase in the efficiency of human capital, the share of wages in GDP and the starting position. The Real GDP to Employment ratio (1) is growing the fastest in the case of Poland, which at the beginning of the period under review was in last place in the ranking, which is consistent with the neoclassical growth theory (Kokocinska, Puziak, 2018; Vatsa, Pino, 2023).

The reason for Hungary's peculiar situation can be attributed to the fact that the share of indirect taxes adjusted with subsidies in GDP during the period under review increased in this economy by 3%, reaching 16% (Poland was second, where this share increased by 1%, to 14%). Increasing state fiscal interference in the economy was accompanied by relatively high employment growth (although lower than in Poland and Slovakia) (Eurostat database: Population and social conditions, Labor market, Employment and unemployment). The weakest relationship between GDP and compensation in Hungary may affect the limited

motivation to undertaking studies by employees (Lee et al., 2015), which the long term results is the slowest catch-up with the EU-27 average. Such conclusions in the case of Hungary are supported by definitely the lowest growth in the number of employees with higher education among the V4 countries during the analyzed period (although slightly higher than the EU average) and the highest growth in employment of people with secondary education (Eurostat database: GDP and main components i.e. output, expenditure and income).

High-quality jobs are created, in part, as a result of direct investment, requiring adequately prepared personnel (Ali et al., 2018; Diebolt, Hippe, 2019; Mei, 2023). The high correlation between the level of direct investment and the share of people with higher education among those employed indicates that they are located in sectors requiring highly educated workers.

From the perspective of investors' assessment of human capital before making an investment decision, it is important to conclude that in all V4 countries there was a strongly positive, statistically significant correlation of the level of investment with the share of employment of people with higher education, which in the case of the share of employment of people with at least secondary education was observed only in Hungary and Poland.

The generalization of the results of this study is limited by the nature of the V4 economies, catching up with the most developed and benefiting from participation in the EU common market since 2004. The measures recommended in the last part of the article may have less effect in the case of underdeveloped countries, which attract direct investment with lower levels of technological sophistication. The article uses only macroeconomic data, without delving into a number of issues affecting the effectiveness of human capital (e.g., the quality and structure of education, changes in the sectoral structure of economies, the structure of direct investment).

6. Conclusions

Strong correlations between the analyzed data indicate that an increase in the efficiency of human capital and the attraction of foreign investment have contributed to narrowing the economic gap between the V4 countries and the average (UE-27). Such conclusions arise from the analysis of the relationship between the Real GDP to Employment ratio (1) and other indicators characterizing human capital, the situation in the economy and the labor market. The VAIC as a measure of human capital efficiency in relation to research in the long term at the macroeconomic scale has not worked well. This may be partly due to the variation in wage levels across the V4 countries (Ståhle et al., 2011), but a more important factor seems to be long-term changes in the share of compensation in GDP. This conclusion contributes to the discussion on the usefulness of the VAIC model for estimating human capital efficiency.

An important conclusion of the presented research is the significantly higher impact on the growth of human capital efficiency of the share in employment of people with higher education than those with secondary education.

The results allow two recommendations to be made for the economic and social policies of the countries under consideration. First of all, since education (especially higher education) affects the efficiency of human capital and the scale of direct investment attracted, the state should support a high level of enrollment in higher education (Bal-Domańska, 2022; Schultheiss et al., 2023). Second of all, fiscal interference accompanied by a decline in the share of compensation in GDP should be limited, as this leads to a reduction in investment in human capital on the part of workers and, consequently, a reduction in the rate of growth of human capital efficiency.

Directions for further research in the topic undertaken are to include in the analysis of changes in the efficiency of human capital an in-depth analysis of the quality of teaching (the level of teaching in the first years of education, the structure of higher education), the structure of foreign investment, changes in the sectoral structure of economies, as well as adjustments and linkages between these factors. Such research will enable more precise definition of recommendations for educational and economic policy aimed at increasing the effectiveness of human capital.

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