

THE PARADOX OF EDUCATIONAL INVESTMENTS: A COMPARATIVE ANALYSIS OF WESTERN AND EASTERN EUROPE

DOI: <https://doi.org/10.36004/nier.es.2024.2-08>

JEL Classification: F43, C24, C29, C34

UDC: 37.014.54(4)

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Received 29 October 2024

Accepted for publication 20 December 2024

SUMMARY

Education is widely recognized as a key driver of economic growth, yet the effectiveness of public spending on education varies significantly across different economic and institutional contexts. The study examines the impact of lagged government investments in education, including higher and secondary education, on GDP per capita based on purchasing power parity (PPP) across European countries in the 21st century. The study differentiates between Western Europe, Eastern European EU member states, and Eastern European non-EU countries, analyzing investment trends and their effects on economic growth. Using a cross-country regression analysis based on data from the World Bank and the International Monetary Fund (2001–2023), the study incorporates lagged variables to establish causality. The findings reveal that while investments in education positively influence GDP growth per capita in Western European countries, their effects in Eastern Europe are more complex. In non-EU Eastern European countries, higher government spending on education does not necessarily translate into economic growth and, in some cases, correlates with lower growth rates. These disparities stem from differences in institutional efficiency, labor market structures, migration patterns, and the extent to which education systems align with economic demands. By providing a comparative perspective, this study contributes to the ongoing debate on the role of education in socio-economic development and highlights the need for tailored educational policies that account for country-specific economic and institutional conditions.

Keywords: *economic growth, education investments, causality, regression model, lagged variables*

INTRODUCTION

Education is one of the key factors of socio-economic development, affecting the level of labor force qualification, labor productivity and competitiveness of the national economy. The question of the degree of impact of public investment in education on economic growth has attracted the attention of researchers since the middle of the 20th century, when the first theoretical justifications of the relationship between the level of human capital and well-being of society appeared. Economists, starting with the theories of Gary Becker, Theodore Schultz and Hirofumi Uzawa, actively investigated the contribution of education to economic development, emphasizing the long-term effects of investment in human capital.

In the second half of the 20th century, research in this area focused mainly on assessing the impact of the overall level of education, as well as the significance of investment in higher education for economic growth. In countries with a high level of industrialization and technological development, it was educational investments that became the basis for the formation of a highly skilled workforce that ensured innovative progress and modernization of production (Schultz, 1961; Becker, 1964). At this time, there was a clear correlation between increased spending on education and GDP growth, which was confirmed by empirical studies (Denison, 1966; Psacharopoulos, 1981). Romer (1990), developing the theory of endogenous growth, emphasized that investment in human capital plays a key role in innovative development and productivity growth.

In the 21st century the very nature of access to knowledge has changed due to the digital transformation and the spread of the Internet. In the industrial era, formal education with well-defined levels was the primary method of acquiring knowledge and skills. Today, information technologies have made knowledge more

accessible beyond the traditional educational system. In this regard, a debate has arisen in the academic community about how effective public investment in education is in the current context, especially in terms of its impact on economic growth.

On the one hand, proponents of continuing investment argue that education remains a critical factor in development, as it provides not only basic knowledge but also the skills needed to adapt to changes in the labor market. Studies show that investment in education contributes not only to GDP growth, but also to lower unemployment and improve public welfare (Bloom, Canning & Chan, 2006). On the other hand, several economists point to the need to reconsider traditional models of investment in education, arguing that new, more flexible forms of education and training may be in demand in the digital economy. For example, Goldin & Katz (2018) argue that traditional educational systems do not always have time to adapt to the rapid development of technology, leading to a gap between the supply and demand of skilled labor. It is also emphasized that the growth of the digital economy necessitates a rethinking of educational approaches, emphasizing the development of skills related to analytical thinking, adaptability and digital literacy, rather than just traditional academic education (McMillan & Rodrik, 2011).

Therefore, the need to reconsider the role and structure of government investment in education is relevant, especially in countries of the European region, where there are significant differences in funding levels, educational reform strategies and their economic impact. This study aims to analyze the relationship between government investment in education and economic growth in Western and Eastern Europe in the 21st century, as well as to identify the factors determining the effectiveness of these investments in the context of modern socio-economic transformations.

THEORETICAL AND CONCEPTUAL FRAMEWORK

The most important theories of economic growth in the mid-twentieth century - the Keynesian Harrod-Domar model (Harrod, 1939; Domar, 1946) and the neoclassical Solow model (Solow, 1956) - are models of exogenous economic growth, so they did not take into account the impact of investment in education on economy. However, by then economic science had already recognized the importance of education for the development of countries. The establishment of gross domestic product (GDP) as a generally accepted macroeconomic indicator of growth became one of the foundations for the development of endogenous economic growth models, including public investment in education. The first quantitative studies in this direction appeared in the 1960s. Along with the development of economic and mathematical models, qualitative analysis assessing the impact of educational expenditures on the economy was actively used. These studies laid the foundation for further research on the relationship between investment in education, labor productivity growth, and sustainable economic development.

Gary Becker (1964) laid the foundations for the concept of human capital, according to which education and training are key factors in economic growth and productivity growth. The benefits of investing in education manifest gradually, but they represent the most important factor for sustainable economic growth. Hirofumi Uzawa (1965) was one of the first to propose a model of endogenous economic growth that considers investment in education a major factor in sustainable development. Subsequently, studies by Nelson & Phelps (1966) showed that the returns to education are higher the more advanced a country's level of technological development. They also emphasized the existence of positive externalities of education, contributing to the acceleration of innovation processes and the diffusion of new technologies.

Lucas (1988) proposed a model of human capital accumulation, emphasizing its crucial role in long-term economic growth. Expanding on this idea, Romer (1990) introduced a model explaining long-term growth through investment in education, research, and technological innovation. He viewed education not only as an independent production factor, but also as a necessary condition for research and progress. In subsequent works, Romer (1994) emphasized that the impact of education on the economy is largely determined by the level of technical and technological development.

Shaw (1992) noted that developing countries can grow faster than developed countries through technological borrowing, as importing and mastering new technologies is less costly than creating them. However, he argued that public funding of education plays an important role in both developed economies (stimulating innovation)

and developing economies (technology adaptation and imitation). Judson (1998) found that countries with high GDP per capita have a higher proportion of human capital formed through education compared to physical capital.

Katchanovski (2000) investigated the divergence of economic growth in post-socialist countries between 1990 and 1998 due to geographical factors. His analysis showed that the economic recession was less severe and reforms were more consistent in Central European countries compared to most of the former Soviet republics, with the exception of the Baltic states. He concluded that macroeconomic stability, political commitment to reform, and cultural proximity to Western Europe contributed to sustainable growth, while military conflicts significantly slowed economic development.

Monteils (2002) criticized endogenous growth models, arguing that while they emphasize the importance of educational expenditures, the empirical evidence does not always support this relationship. In his study, he showed that increased years of schooling in the 19th and 20th centuries did not always lead to accelerated growth of human capital, and in some cases even contributed to its slowdown. Monteils thus questioned the hypothesis of endogenous growth driven by accumulated knowledge.

Modern studies demonstrate a more critical approach to the role of education in economic development. It is noted that the effectiveness of government investment in education varies depending on the level of development of countries. In developed economies, increased funding for all levels of education contributes to GDP growth, with the largest effect observed from investments in secondary and tertiary education. In developing countries, investments in primary and secondary education provide the greatest economic impetus, providing basic training and expanding opportunities for further economic development (Kolosnitsyna and Ermolina, 2021).

A separate example is presented by the countries of Eastern Europe, where, after the collapse of the USSR, significant investments in education did not lead to sustainable economic growth. One of the reasons is the high level of emigration of qualified personnel ("brain drain"), which leads to the fact that investments in education do not pay off within the country, but work for the economy of other states. In this context, Vracic (2018), examining the brain drain in the Western Balkans, argues that the region is likely to remain a donor of highly skilled human resources for many years to come. However, the author notes that migration also stimulates knowledge transfer, increased remittances, and the spread of advanced technologies, which supports economic growth in the long run.

However, given the population decline and demographic aging that most Eastern European countries are facing, researchers emphasize the need for investment in human capital to mitigate the effects of these changes. According to research findings, education has a greater impact on economic growth than demographic factors, and investment in education creates a cumulative effect, promoting sustainable growth through intergenerational knowledge transfer (Lutz et al., 2019).

Agasisti & Bertolotti (2020), in their study of 284 European regions (NUTS 2) for the period 1995–2017, found that the quality of university research has a significant impact on economic growth. The largest effect is associated with the number of universities, especially in the fields of science, technology, engineering and math (STEM). Coman et al. (2022) examined the impact of government investment in education on GDP growth in 11 post-socialist EU countries. The study found a positive relationship in Bulgaria, Croatia, Czechia, Estonia, Hungary and Latvia, but its absence in Lithuania, Poland, Slovakia, Romania and Slovenia. In the long run, investment in education maintains a positive impact in Czechia and Hungary, while it turns out to be negative in Latvia. For Lithuania, although government spending on education is slightly higher than the EU average, no long-run relationship was found between the variables. Although Lithuania has sufficient government investment in education, the level of student training in Lithuania is significantly lower than in other countries. In addition, the large number of educational institutions no longer aligns with the demographic situation, as the number of young people is continuously decreasing.

Bah (2023), analyzing data from 89 countries for 2002–2020, concluded that education has a stronger impact on economic growth in low- and middle-income countries

than in developed economies. However, a bidirectional causal relationship between higher education development and economic growth was identified by using BRICS countries as an example. This means that investment in higher education contributes to economic growth, and economic growth in turn stimulates the development of the higher education sector (Mussaiyib, & Pradhan, 2024). Other studies also emphasize the relationship between higher education and economic growth (Apostu et al., 2022).

Thus, the study of the impact of investment in education on economic development has gone through several phases, the most significant of which was the period from the 1960s up to and including the 1990s. During this time, key theoretical models were developed and empirical evidence generally confirmed the significant contribution of education to the economic development of individual countries and regions.

In the 21st century, this relationship is becoming more ambiguous. Modern researches focus on identifying the relationship between investment in education and economic growth in individual countries or groups of countries, taking into account the specifics of their economic and institutional development. Although the most influential models of economic growth of the second half of the 20th century are not always confirmed empirically, they remain the basis for further research and development of new concepts of the impact of education on economic growth.

This study aims to analyze the impact of government investment in education on economic growth in European countries, taking into account the differences between Western Europe, EU and non-EU Eastern European countries. Special attention is paid to identify differences in the efficiency of investment in secondary and tertiary education.

HYPOTHESES OF THE STUDY

Hypothesis H1. Government investment in education, particularly in higher and secondary education, has a positive impact on per capita economic growth rates in Western European countries because these countries have stable institutions, high quality educational programs and effective integration of graduates into the labor market.

Hypothesis H2. In Eastern European countries, the impact of total government investment in education and government investment in tertiary education on GDP per capita growth rates in PPP terms is insignificant, while government investment in secondary education has a positive effect because secondary education builds the basic competencies of the labor force, while tertiary education may not yield the expected economic returns due to the outflow of university graduates abroad.

DATA AND METHODS

To determine the dependence of the impact of government investment in education on the growth rate of the level of development at the cross-country level, the growth rate of GDP per capita at purchasing power parity (PPP) is used as the dependent variable. This indicator is calculated based on PPP GDP per capita in 2021 US dollars for each country of the European region for which data are available from the “World Development Indicators” database (World Bank). PPP GDP per capita is used as the primary data for the dependent variable because it is one of the most important socio-economic indicators, reflecting both the living standards of a country’s population and the efficiency of its economy in comparison with other countries, regardless of the absolute size of the economy. In this article, the term ‘level of socio-economic development’ is sometimes used instead of ‘GDP per capita PPP,’ and ‘level of economic development’ is sometimes used instead of ‘GDP at PPP.’

The data on government investment in higher and secondary education as a share of GDP were used in the study. They are calculated based on the indicators ‘Government expenditure on tertiary education as % of GDP (%)’ and ‘Government expenditure on secondary education as % of GDP (%)’, respectively, from the database “Education Statistics - All Indicators” (World Bank). The shares of total government investment in education of GDP are calculated based on ‘Government expenditure on education, total (% of GDP)’ from the “World Development Indicators” database (World Bank), which is more comprehensive and includes data up to and including 2023, as opposed to “Education Statistics - All Indicators” World Bank database.

In this study, Western European countries are defined as those that have never been socialist nor part of a socialist country. Eastern European countries are defined as those that were either socialist or part of a socialist country. Germany is categorized as a Western European country. This study excludes Russia, Turkey, and Kazakhstan, which, in addition to having part of their territory in Europe, are also located in Asia. Cyprus, as a member of the EU, and Georgia are included in the study.

Malta, San Marino, and Ireland, where the relationship between investment in education and GDP per capita growth (PPP) deviates significantly from patterns observed in other Western European countries, were

excluded from the analysis. All other countries in both Western and Eastern Europe are included in the analysis of the relationship between GDP per capita growth rates at PPP and government investment in education or government investment in the considered levels of education at the cross-country level, except for those countries for which relevant data are missing from [World Bank](#) databases.

When examining data at the cross-country level, a paired linear regression is used. The dependent variable is the geometric mean of GDP per capita growth (PPP) in 2021 US dollars over 2006–2023, and the independent variable is either the arithmetic mean of the share of government investment in education of GDP over 2001–2023, the arithmetic mean of the share of government investment in secondary education of GDP over 2001–2023, or the arithmetic mean of the share of government investment in tertiary education of GDP 2001–2023.

The geometric mean of GDP per capita growth (PPP) was chosen as the dependent variable, since this parameter reflects the real average growth of wealth of a country per year, as well as the rate at which the inhabitants of a given country became richer or poorer in a given period of time.

The arithmetic mean of government investment in education or its level was chosen as the independent variable for two main reasons. First, the significance of government investment in education in any randomly selected year of the period is usually not equal to its significance in any other year within the period when determining the impact on per capita economic growth in the year following the end of the multi-year period. This is one of the reasons why using an alternative indicator, such as the weighted average share of government investment in education as a share of GDP, does not seem necessary as the dependent variable. Second, applying the weighted average share of government investment in education as a percentage of GDP in practice may lead to a reduction in government investment in education during years of economic recession or zero growth, with the intention of compensating for it in years of economic expansion. This approach, however, could negatively impact socio-economic welfare

To study the factors affecting GDP at PPP in a single country, the Cobb-Douglas model, expressed by the following formula, is used as the basic model:

$$Y = AK^{\alpha}L^{\beta}(1),$$

where Y is the GDP in US dollars at 2021 PPP, K is the capital stock in US dollars at 2017 PPP, L is the number of workers in the economy of the country, α and β are coefficients characterizing the impact of capital and labor, respectively, on the GDP at PPP of the country, A is the level of technology development or progress in the country.

A can take different values across models; however, in this study, its values are defined exclusively or mostly by lagged variables of government investment in education or its levels.

To investigate the factors affecting the level of economic development in an individual country, the value of K

(capital stock) was calculated from IMF (International Monetary Fund) data, the value of L (total number of workers in the economy) of a country from the “World Development Indicators” database (World Bank), the variables characterizing government investment in education from the “World Development Indicators”

database (World Bank) or from the “Education Statistics - All Indicators” (World Bank), depending on which indicator was considered as an independent variable similar to cross-country models, and the value of high-tech exports (ht) was calculated from the “World Development Indicators” database (World Bank).

Different values of A were used for the study, for example,

$$A = \kappa E_5^\gamma (2),$$

where E_5 is the arithmetic mean of the shares of government investment in education of the GDP of the country over the 5 years preceding the year for which E_5 is calculated in natural logarithms in order to create a regression equation,

γ is the coefficient characterizing the influence of the arithmetic mean of the shares of government investment in education on the GDP of the country,

κ is the numerical coefficient such that $\text{Ln}(\kappa) = \varepsilon$, used in all considered models of A value calculation.

Table 1 presents all variables used in the calculation of A. Each of the models considered includes either a single variable representing total government investment in education over a five- or ten-year period, or two variables representing government investment in secondary and tertiary education over the same period.

Table 1

List of variables used to calculate the level of technology development of European countries

Variable	Description of variable
E_5	Arithmetic mean of the shares of government investment in education of the GDP of the country over the 5 years preceding the year for which E_5 is calculated in natural logarithms to create a regression model
$E_{5,sec}$	Arithmetic mean of the shares of government investment in secondary education of the GDP of the country over the 5 years preceding the year for which E_5 is calculated in natural logarithms to create a regression model
$E_{5,tert}$	Arithmetic mean of the shares of government investment in tertiary education of the GDP of the country over the 5 years preceding the year for which E_5 is calculated in natural logarithms to create a regression model
E_{10}	Arithmetic mean of the shares of government investment in education of the GDP of the country over the 10 years preceding the year for which E_{10} is calculated in natural logarithms to create a regression model
$E_{10,sec}$	Arithmetic mean of the shares of government investment in secondary education of the GDP of the country over the 10 years preceding the year for which E_{10} is calculated in natural logarithms to create a regression model
$E_{10,tert}$	Arithmetic mean of the shares of government investment in tertiary education of the GDP of the country over the 10 years preceding the year for which E_{10} is calculated in natural logarithms to create a regression model
h_t	Share of high-tech exports of the country's total exports in the year t

So, if $A = \kappa E_{10,s}^\gamma \varepsilon \gamma E_{10,tert}^\nu$, then the regression model, the coefficients of which are to be found to identify the factors affecting the level of economic development in a single country, takes the following form:

$$\text{Ln}(Y) = \gamma \text{Ln}(E_{10,sec}) + \nu \text{Ln}(E_{10,tert}) + \alpha \text{Ln}(K) + \beta \text{Ln}(L) + \varepsilon (3)$$

The use of arithmetic averages of the share of government investment in education or its levels for the considered models of the level of economic development of a country is due to the same reasons as the use of arithmetic averages of the share of government investment in education or its levels to identify the impact of investment in education on the rate of socio-economic development at the cross-country level.

In this study, non-EU Eastern European countries were considered separately because, based on cross-country analysis, the government investment in education or in certain levels of education could show a negative correlation with the levels of economic development in these countries. The countries included in the analysis are Albania, Belarus, Georgia, Moldova and Serbia. Since the necessary data are not available for Bosnia and

Herzegovina, Montenegro and Northern Macedonia, these countries were not included in the study. Data for Ukraine up to and including 2021 were considered for the cross-country analysis for Eastern Europe, but models of the level of economic development as a function of government investment in education were not built for this country.

For Moldova, linear regressions were first developed after logarithmization of all the above-described models based on Cobb-Douglas model to select only those in which at least one coefficient for a variable characterizing government investment in education was significant at least at the 10% significance level for subsequent comparison of the results with the results of similar models for other countries selected for analysis.

As a result, only one model was selected for Moldova, which is given by the formula:

$$\ln(Y) = -0.4554\ln(E_{10}) + 2.1613\ln(K) + 0.6970\ln(L) - 40.0157 (4), R^2 = 0.9355$$

The natural logarithm of the arithmetic mean of the share of government investment in education over the 10 years preceding the current year for which K and L were calculated is significant at the 10% level, as is the natural logarithm of the working population. The natural logarithm of the capital stock is significant at the 0.1% level.

In order to test whether mean arithmetic share of government investment in education over the 10 years preceding the year for which it is calculated actually exhibits causality with the level of economic development in that year of selected countries, or the effect found is due to the correlation of investment in education with random error, the 2SLS method is used.

As instrumental variable for each of the countries under consideration, the arithmetic mean of the shares of government investment in education over the period

from the 11th to the 20th year preceding the current year is used. This variable is assumed to effectively explain the arithmetic mean of government investment in education over the 1st to 10th years preceding the current year, while not directly affecting GDP at PPP in the current year. The instrumental variable, the level of capital stock K and the number of workers in the economy L are treated as exogenous variables in the 2SLS model, uncorrelated with random error.

The statistical package R was used to build the models and test their significance both at the cross-country level and at the level of individual countries.

Missing values for certain years in the 21st century (from 2001 to 2023, inclusive), both in the cross-country models and for individual countries, were estimated using linear regression with a single independent variable: year.

MAIN RESULTS

In Western Europe, investments in education have a long-term positive effect on economic development. There is a statistically significant relationship between the geometric mean of GDP per capita growth (PPP) for the period of 2006–2023 and the arithmetic mean of the shares of government investment in education of GDP for 2001–2023 (Fig. 1). The share of government investment of GDP is a significant variable in the regression equation at the 5% significance level.

Germany and several Northern European countries (Sweden, Denmark, Iceland) demonstrate a consistent positive relationship between government investments in education and rates of economic growth per capita. These countries are characterized by a strong orientation of the educational system toward practical training and integration with the labor market, as well as a high or very high (in the case of the Scandinavian countries) share of government expenditure on education of GDP.

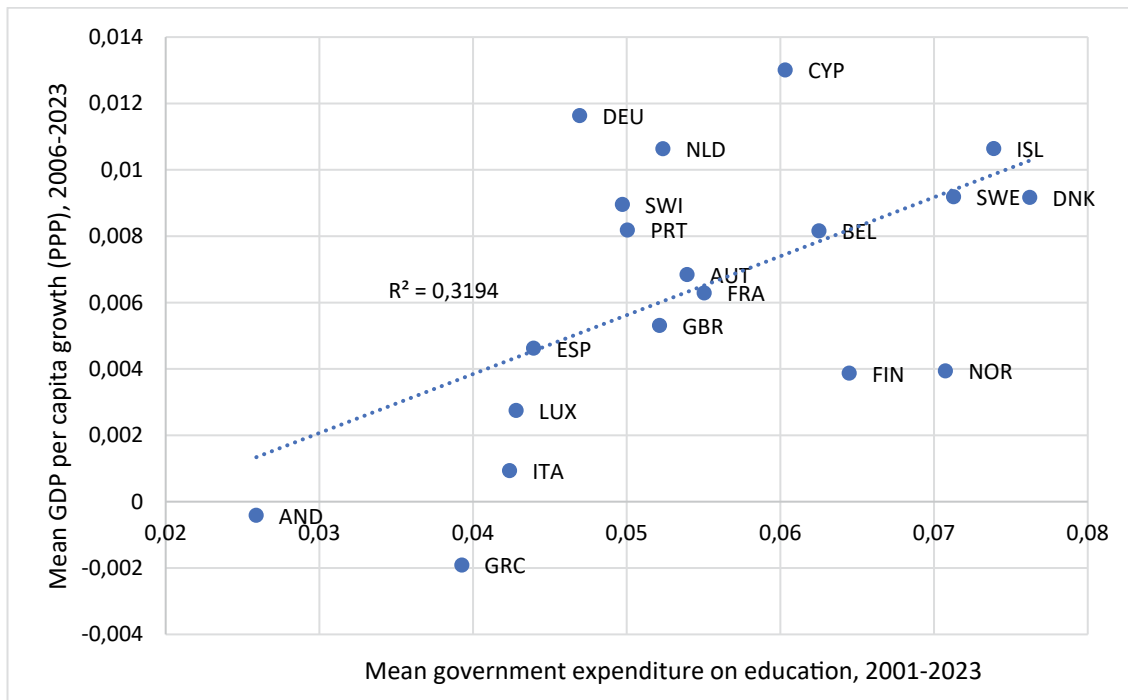
The two largest Benelux countries (the Netherlands, Belgium) show relatively high returns on educational investments, which may be associated with the high degree of digitalization of the educational process and the flexibility of educational programs tailored to economic needs.

France and Spain exhibit a moderate correlation, possibly due to specific characteristics of national education strategies, including varying levels of private-sector involvement in funding different educational programs.

Italy and Greece demonstrate a weaker correlation between educational investments and economic growth, which is linked to challenges in youth employment and the insufficient alignment of educational programs with current labor market requirements. This issue is particularly acute in Greece, where declining economic activity and the emigration of highly skilled workers have persisted since the 2008 crisis.

Figure 1

Relationship between GDP per capita growth rates in Western European countries (2006–2023) and total government investment in education (2001–2023)



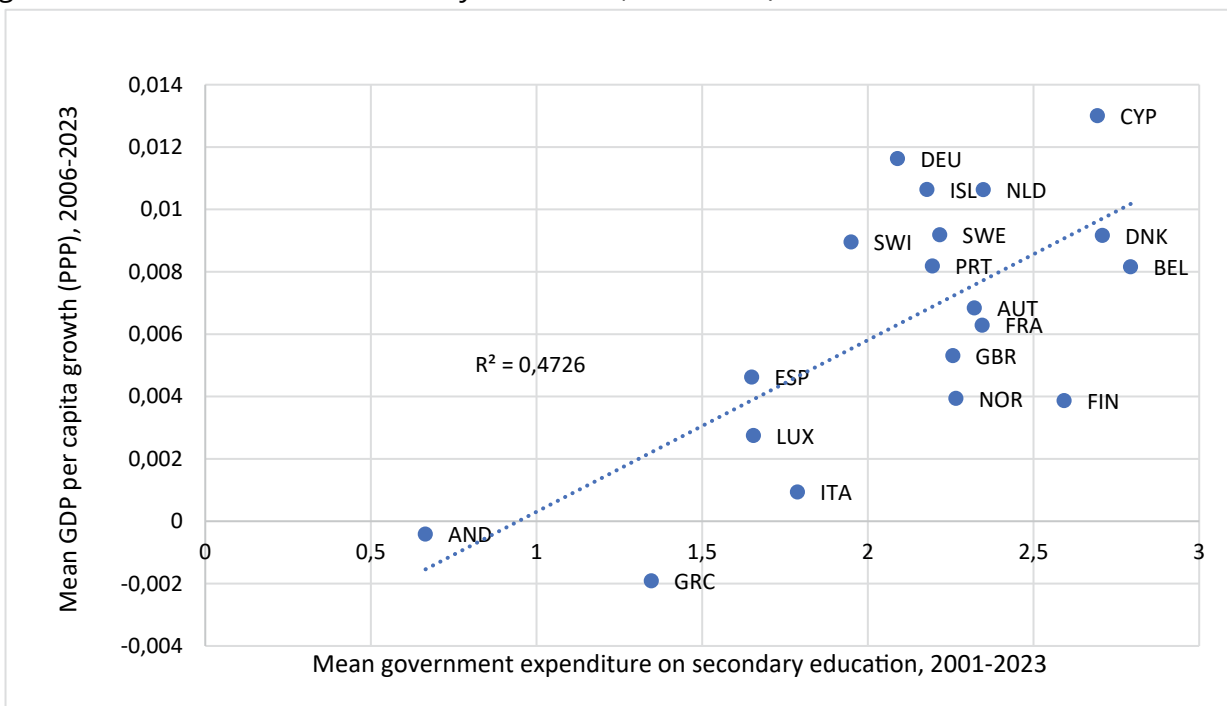
Source: Calculated by the authors

The high significance of investments in secondary education emphasizes its key role in developing foundational skills and knowledge necessary for subsequent professional growth and socio-economic development. Investments in secondary education are statistically significant at the 0.1% significance level,

indicating an extremely strong influence on the level of socio-economic development (Fig. 2). Secondary education lays the foundation for a skilled workforce, which is particularly crucial in a highly competitive economy.

Figure 2

Relationship between GDP per capita growth rates in Western European countries (2006–2023) and government investment in secondary education (2001–2023)



Source: Calculated by the authors

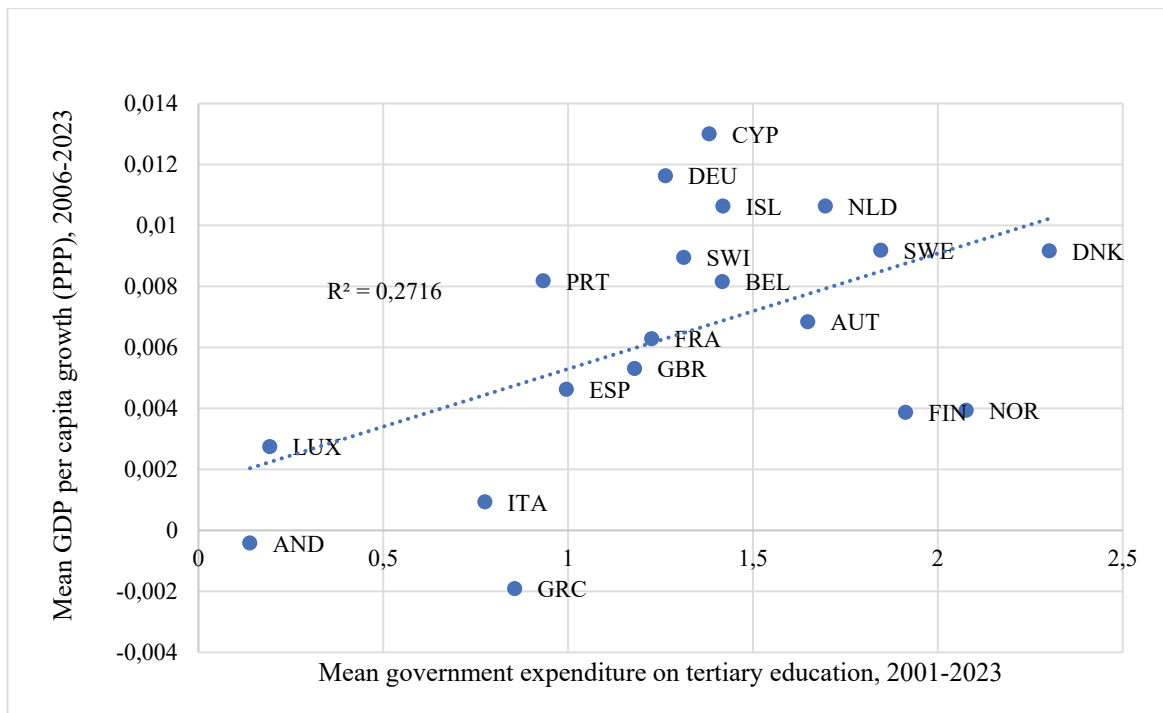
An analysis of the relationship between investments in higher education and economic growth indicated that, in Western European countries, the significance of investments in higher education is slightly lower compared to secondary education. The share of government investment in higher education is statistically significant at the 5% significance level (Fig. 3). Higher education, while a significant growth factor, typically has a more delayed economic impact, particularly in countries with lengthy educational programs and a high proportion of academically oriented education, which is not always directly linked to market demands. Additionally, not all graduates find employment in their field, reducing the effectiveness of investments in the educational system. In countries with high labor mobility (such as within the EU), graduates often relocate to other countries, benefiting economies elsewhere.

The strongest impact from investments in higher education is observed in countries with strong integration between education and business, a high proportion of applied research, and a well-developed innovation sector (Sweden, Denmark, the Netherlands). The Netherlands and Belgium demonstrate a stronger correlation, possibly due to the widespread presence of public-private partnerships in higher education funding and a strong emphasis on international standards for professional education.

France, Spain, and the United Kingdom exhibit a moderate correlation, likely due to a substantial proportion of university programs being academically rather than practically oriented toward economic applications. For Italy and Greece, the impact of higher education investment on economic growth is less pronounced, possibly due to high unemployment rates among university graduates.

Figure 3

Relationship between GDP per capita growth rates in Western European countries (2006–2023) and government investments in higher education (2001–2023)



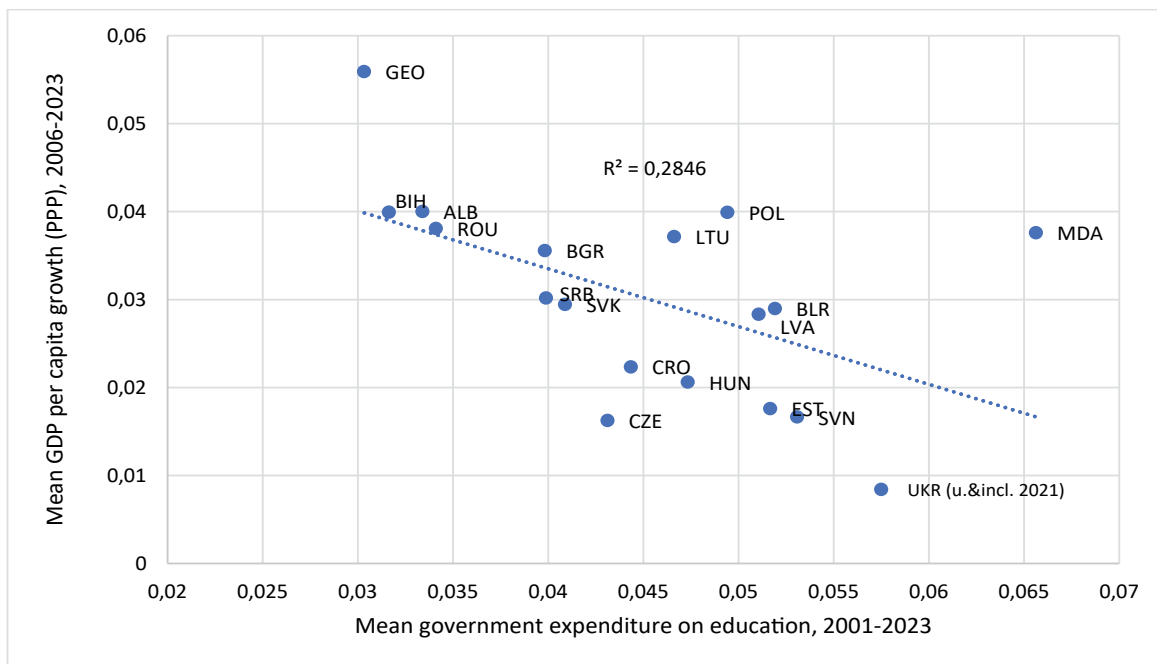
Source: Calculated by the authors

The analysis results presented in Figure 4 demonstrate that government investments in education do not translate into economic growth in Eastern European

countries. The share of government expenditure in education of GDP is statistically significant at the 5% significance level.

Figure 4

Relationship between GDP per capita growth rates in Eastern European countries (2006–2023) and total government investment in education (2001–2023)



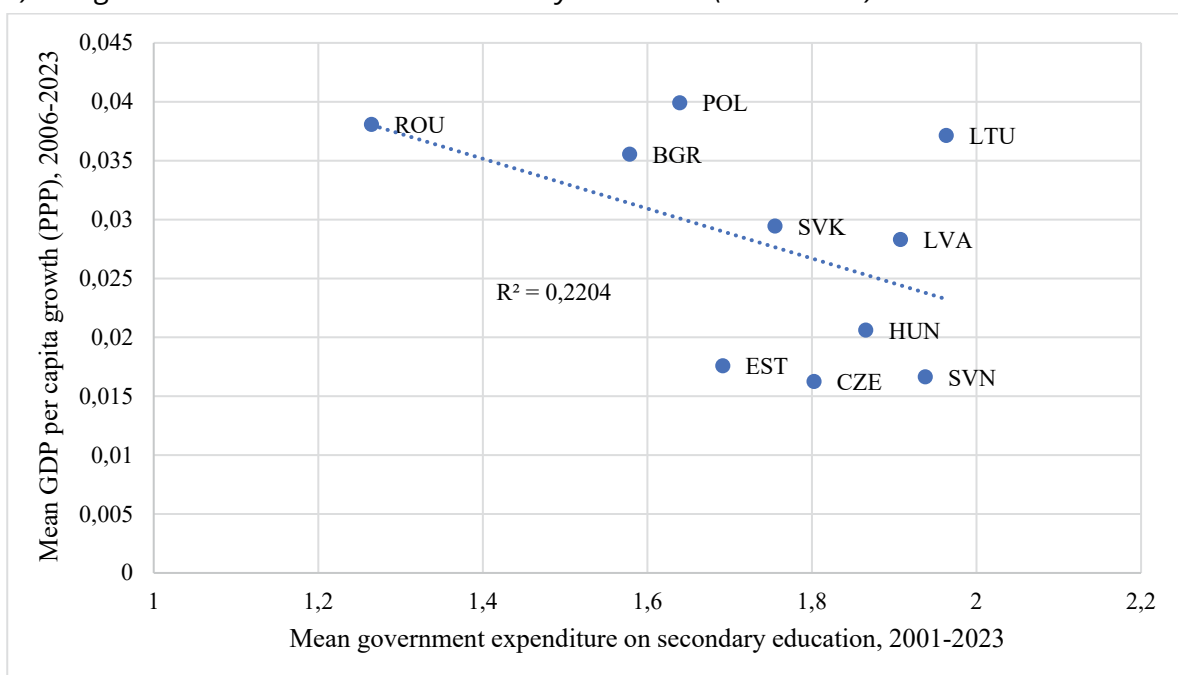
Source: Calculated by the authors

The lack of significance of expenditure in secondary education in Eastern European countries may indicate issues regarding educational system efficiency or inadequate alignment between education and the labor market. The regression itself is significant, but the share of government investment in secondary education of GDP is not a significant variable in the

regression equation for Eastern European countries, even at the 10% significance level (Fig. 5). Adding non-EU Eastern European countries to this model reduces the coefficient of determination. This reduction, when including data from non-EU countries, reflects their economic and institutional heterogeneity, complicating the interpretation of the results.

Figure 5

Relationship between GDP per capita growth rates in Eastern European EU member states (2006–2023) and government investment in secondary education (2001–2023)



Source: Calculated by the authors

For Eastern European countries, no significant cross-country relationship was found between government investment in secondary and higher education and GDP per capita growth rates.

The results of the econometric analysis for Moldova and other examined countries where $\ln(E_{10})$ is significant are presented in Table 2. For Serbia and Belarus, the $\ln(E_{10})$

variable is not significant even at the 10% significance level. For Albania and Moldova, a significant negative correlation was identified between the average share of government investment in education and GDP (PPP). In Georgia, the impact of the average share of government investment in education on economic development is positive.

Table 2

The impact of total government investment on GDP (PPP) in non-EU European countries

	Ln(L)	Ln(K)	Ln(E_{10})	ε	R-squared	Number of obs.
Albania	0.41253**** (0.000856)	0.83205**** (3.24*10 ⁻⁷)	-1.27810** (0.014463)	-6.68156**** (0.071927)	0.9835	13
Georgia	0.5178 (0.35980)	0.6253* (0.05374)	1.3115*** (0.00147)	6.0898 (0.62286)	0.9746	13
Moldova	0.6970* (0.09101)	2.1613**** (5.92*10 ⁻⁵)	-0.4554* (0.05541)	-40.0157**** (0.00142)	0.9355	13

****, ***, **, * denote significance at the 0.1%, 1%, 5%, and 10% levels, respectively.

Note: The first row represents the coefficient; the second row (in parentheses) represents the p-value.

Source: Calculated by the authors

The results obtained from the 2SLS model calculations are presented in Tables 3 and 4.

Table 3

The impact of instrumented total government investment in education on GDP (PPP) in non-EU European countries

	Ln(L)	Ln(K)	Ln(E_{10})	ε	R-squared	Number of obs.
Albania	0.4509*** (0.00198)	0.8970**** (1.77*10 ⁻⁵)	-1.8302* (0.06160)	-10.7272 (0.12752)	0.9804	13
Georgia	0.4566 (0.42597)	0.4817 (0.15090)	1.4710*** (0.00129)	11.1905 (0.40349)	0.9738	13
Moldova	0.7195* (0.08846)	2.1460**** (7.02*10 ⁻⁵)	-0.4739* (0.05674)	-40.0118**** (0.00143)	0.9354	13

****, ***, **, * denote significance at the 0.1%, 1%, 5%, and 10% levels, respectively.

Note: The first row indicates the coefficient; the second row (in parentheses) indicates the p-value.

Source: Calculated by the authors

Table 4

Relevance of instrumental variables in assessing the impact of total government investment on GDP (PPP) in non-EU European countries

	Weak instruments	Wu-Hausman
Albania	0.0878*	0.4374
Georgia	$4.63 \cdot 10^{-5}$ ****	0.199
Moldova	$4.82 \cdot 10^{-6}$ ****	0.792

****, ***, **, * denote significance at the 0.1%, 1%, 5%, and 10% levels, respectively.

Note: The table presents p-values.

Source: Calculated by the authors

Based on the p-values for weak instruments, the average level of government expenditures on education from years 11 to 20 preceding the current year effectively explains the level of government expenditures on education for the previous 10-year period (years 1 to 10) at the 10% significance level for Albania and the 0.1% significance level for Moldova and Georgia. According to the Wu-Hausman test results for Albania, Georgia, and

Moldova, there is no statistically significant difference between the impacts of the average level of government investments in education from years 11 to 20 and from years 1 to 10 on GDP at PPP. Consequently, the estimated effect of the average share of government investment in education over the 1 to 10 years preceding the current year on the level of economic development in these countries is unbiased.

DISCUSSIONS

The research findings indicate a clear relationship between government investment in education and GDP growth per capita (PPP) in Western European countries that never belonged to the socialist bloc. In particular, positive effects are observed from both total government investment in education and investment specifically in secondary education. This aligns with the endogenous growth theory, which identifies human capital accumulation as a key driver of long-term economic growth (Romer, 1990).

The relationship between government investment in higher education and economic development appears weaker, potentially due to the high mobility of graduates, who utilize their skills domestically and abroad. Investments in secondary education have the greatest impact, yet investments in higher education remain important. This aligns with findings by Barro (1998) and Coman et al. (2022), who highlighted not only the significance of higher education investment for highly developed Eastern European countries but also the importance of reforming school education for socio-economic development. Investments in higher education positively influence socio-economic growth, albeit to a lesser extent, due to the high mobility of university graduates who seek employment both domestically and internationally.

Thus, Hypothesis H1, suggesting a positive impact of education government investment on per capita economic growth in Western European countries, is fully confirmed. Long-term investments in human capital promote sustainable growth, especially when supported by a well-developed institutional environment and effective educational programs.

Hypothesis H2 is only partially confirmed: the results did not reveal a significant impact of government investment in higher education on per capita economic growth in Eastern European countries. Investment in secondary education showed no significant impact on economic growth for Eastern Europe EU members at the cross-country level, while total government investment in education in Eastern European countries exhibits a significant negative correlation with per capita GDP growth at PPP.

An analysis of five non-EU Eastern European countries revealed a complex scenario. In two countries (Moldova and Albania), higher levels of government education investment correlated with decreased economic development. In this context, the negative impact of educational expenditures contradicts the researchers' initial expectations. Educational systems in these countries fail to ensure a sustainable relationship between education investments and economic growth. For instance, Moldova has numerous educational institutions, particularly at secondary and tertiary levels, which emerged during rapid demographic growth among younger generations in the late 1990s and early 2000s. Currently, their number does not match the ongoing demographic decline. The quality of secondary and higher education is significantly lower than in other countries, as indicated by international PISA assessments (2022). Under these conditions, financial allocations, despite being high, become ineffective (Jin et al., 2019).

Albania faces similar issues concerning the efficiency of educational investments. Despite substantial government education expenditures, educational

quality remains low, as also confirmed by PISA (2022). The emigration of qualified personnel to EU countries is one of the key reasons why education investments do not translate into anticipated economic growth. Young professionals educated domestically emigrate in search of better economic opportunities, reducing the domestic returns on investment. These findings align with research by Ramallari and Velaj (2023).

It should be noted that such results are not uncommon in the scientific literature. Similar conclusions have been reached by Simionescu et al. (2017), Kolosnitsyna and Ermolina (2021), among others. For example, despite Lithuania's education investments surpassing the EU average, this has not resulted in long-term economic growth (Coman et al., 2022). The example of North Macedonia, where education investments did not foster economic growth, is also illustrative (Shapkova Kocavska, 2023).

Possible reasons for this effect include structural economic problems that hinder the translation of educational investments into sustainable growth. As Bah (2023) noted, insufficient institutional resilience can lead to low returns on educational investments. Additionally, the high emigration rate of skilled professionals, resulting in a "brain drain," decreases domestic returns on human capital investments. This situation effectively leads national economies to subsidize labor markets abroad. Under these conditions, higher education investment may be ineffective if significant emigration prevents the domestic absorption of skilled graduates.

CONCLUSIONS

This study used data on lagged government investments in education across European countries, which allowed to demonstrate the positive impact of government education investments, particularly in secondary and higher education, on the growth rates of socio-economic development.

The research findings suggest that classical endogenous growth models effectively explain long-term economic growth in developed Western European countries but are less applicable to countries characterized by high migration and significant international remittances. Although Georgia aligns more closely with traditional endogenous growth model predictions, Moldova and Albania exhibit a limited role for educational investments, based on average government education spending value as indicated by the derived economic level of development models. For Moldova and Albania, GDP formation is significantly influenced by migration flows and international financial transfers, overshadowing domestic education investments. This raises questions about traditional models linking human capital to economic growth and highlights the necessity for new modeling approaches that incorporate migration and international financial flows.

Georgia demonstrates that a modest level of government education spending (increase from 1.9% of GDP in 2012 to 3.7% of GDP in 2023) does not necessarily prevent positive economic returns from education. Moldova, despite reducing government investments in education from 9.5% of GDP in 2009 to 6.25% in 2023, still allocates more funding to education than Georgia. However, the economic efficiency of government investments in education in Moldova leaves much to be desired. Georgia's moderate increases in education funding, combined with comprehensive education reforms—including curriculum modernization, increased university autonomy, improved funding structures, and an emphasis on quality—have successfully enhanced professional training and reduced structural mismatches between the education system and the labor market. In contrast, Moldova and Albania have not achieved similar outcomes, largely due to continued emigration of educated graduates seeking better opportunities abroad, thus reducing the effectiveness of domestic educational spending.

Therefore, Eastern European post-socialist countries require a balanced approach to educational expenditures. Reducing investments due to fear of a "brain drain" could undermine long-term growth prospects, while excessive spending without ensuring efficiency is unlikely to yield desired economic outcomes. Optimally, educational investments should align closely with institutional quality and labor market demands.

Moreover, the research underscores the importance of not reducing educational spending solely due to concerns over the brain drain, as this could negatively affect long-term economic growth prospects. Simultaneously, excessively increasing educational expenditures without ensuring efficiency will likely fail to achieve the desired economic outcomes. Consequently, it is essential to optimize educational investment strategies based on the effectiveness of resource utilization.

The study emphasizes the need for future research to determine which educational programs—such as vocational, technical, higher education in IT, economics, or medicine—most effectively foster economic growth, particularly in Eastern European countries where migration and remittances play substantial roles. Determining optimal educational investment strategies under these conditions remains an open question requiring further investigation.

ACKNOWLEDGEMENT

The paper was written as part of the Research Subprogram 030102 „Demographic transition in the Republic of Moldova: particularities, socioeconomic implications and strengthening demographic resilience” (TDRM, 2024-2027)

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APPENDICES

Appendix 1. List of Western European countries considered in the study of the relationship between per capita economic growth rates (2006–2023) and government investment in education (2001–2023)

Country	Outlier Status	Country	Outlier Status
Austria	No	Germany	No
Andorra	No	Greece	No
Belgium	No	Ireland	Yes
Cyprus	No	Iceland	No
Denmark	No	Italy	No
Finland	No	Luxembourg	No
France	No	Malta	Yes

Country	Outlier Status
Netherlands	No
Norway	No
Portugal	No
San-Marino	Yes

Country	Outlier Status
Spain	No
Sweden	No
Switzerland	No
United Kingdom	No

Appendix 2. List of Western European countries considered in the study of the relationship between per capita economic growth rates (2006–2023) and government investment in secondary education (2001–2023)

Country	Outlier Status
Austria	No
Andorra	No
Belgium	No
Cyprus	No
Denmark	No
Finland	No
France	No
Germany	No
Greece	No
Iceland	No

Country	Outlier Status
Italy	No
Luxembourg	No
Netherlands	No
Norway	No
Portugal	No
Spain	No
Sweden	No
Switzerland	No
United Kingdom	No

Appendix 3. List of Western European countries considered in the study of the relationship between per capita economic growth rates (2006–2023) and government investment in tertiary education (2001–2023)

Country	Outlier Status
Austria	No
Andorra	No
Belgium	No
Cyprus	No
Denmark	No
Finland	No
France	No
Germany	No
Greece	No
Iceland	No

Country	Outlier Status
Italy	No
Luxembourg	No
Netherlands	No
Norway	No
Portugal	No
Spain	No
Sweden	No
Switzerland	No
United Kingdom	No

Appendix 4. List of Eastern European countries considered in the study of the relationship between per capita economic growth rates (2006–2023) and government investment in education (2001–2023)

Country	Outlier Status
Albania	No
Belarus	No
Bulgaria	No
Bosnia and Herzegovina	No
Croatia	No
Czechia	No
Estonia	No
Georgia	No
Hungary	No

Country	Outlier Status
Latvia	No
Lithuania	No
Moldova	No
Poland	No
Romania	No
Serbia	No
Slovakia	No
Slovenia	No
Ukraine (up to and including 2021)	No

Appendix 5. List of Eastern European countries, EU members, considered in the study of the relationship between per capita economic growth rates (2006–2023) and government investments in secondary education (2001–2023)

Country	Outlier Status	Country	Outlier Status
Bulgaria	No	Lithuania	No
Czechia	No	Poland	No
Estonia	No	Romania	No
Hungary	No	Slovakia	No
Latvia	No	Slovenia	No

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- Conceptualization: GAGAUZ Olga, SAMOHVALOV Artiom
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- Formal analysis: SAMOHVALOV Artiom
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