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Quality of Education and Economic Growth – Evidence from Southeast European Countries

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Abstract

This study seeks to ascertain the importance of educational quality over quantity in influencing economic growth, with a special focus on Southeast European countries. Traditional approaches have often emphasized the quantity of education, primarily the years of schooling. However, emerging evidence points towards the quality of education, represented by cognitive skills, as a more significant predictor of economic prosperity. The research evaluates global educational datasets that measure both qualitative and quantitative aspects of human capital. A notable emphasis is placed on the Harmonized Learning Outcomes (HLO) database by the World Bank, which reflects educational achievements, serving as a proxy for the quality of human capital.

Keywords: Human Capital, Educational Quality, Economic Growth, Cognitive Skills, Southeast Europe, HLO Index.

JEL: I21

Introduction:

Human capital, commonly defined by Angrist et al. (2021) as "*resources associated with knowledge and skills of individuals in a given country*", has been widely agreed upon as a driver of economic growth. Along with physical capital, technological progress, and institutional and other factors, cognitive skills are considered an important contributor to a nation's prosperity (Lucas, 1988; O'Neill, 1995).

For many decades, scholars focused on the importance of the *quantity* of education – measured by the number of years of schooling or average enrollment rates. Barro (1991), and Mankiw, Romer, and Weil (1992) are among the few economists who suggested that the *quantity* of schooling has a positive effect on economic development.

Yet, there is growing evidence that it is the *quality* of education, rather than quantity, that has a long-term impact on economic growth (Bils & Klenow, 2000; Krueger & Lindahl, 2001; Nelson & Phelps, 1966). Hanushek and Kimko (2000), Pritchett (2001), Hanushek and Woessmann (2008, 2012), and Cohen and Soto (2007) provide evidence from more than 150 countries that students' cognitive skills

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(a measure of the quality of human capital) are highly correlated to GDP (and hence economic) growth.

In this article, our focal point is to assess the weightage of educational achievements (gauged by cognitive skills levels) in economic growth, as opposed to sheer educational attainment. Our principal objective is to gauge the repercussions of enhancing educational quality on prospective economic dividends, specifically in Southeast European countries.

Our proposition is that in these countries, GDP growth showcases a more pronounced association with the quality of human capital (measured by educational achievements) than with its quantity (indexed by mean years of schooling). Consequently, we'll be exploring two hypotheses:

Hypothesis 1:

Educational quality (students' cognitive skills), rather than quantity (years of schooling, etc.), reflects better the quality of human capital.

Hypothesis 2:

Economic growth in Southeast European countries correlates more strongly with the quality (rather than quantity) of human capital (excluding environmental, political, and other external factors from the analysis).

To confirm these hypotheses, we examined some ready-available global educational data and performed empirical studies on the impact of improved quality of education on economic growth. We also carried out a comparative analysis of Southeast European countries' educational achievements based on the HLO index data available.

Literature Review

The quality of education is widely recognized in the literature as a critical factor for economic growth.

The connection between the quality of education and economic growth is deeply rooted in the idea of human capital formation. At the very essence of education is the development of human capital, which consists of the skills, knowledge, and competencies that individuals gain. When the education system emphasizes quality, it ensures that this human capital is of a high standard. In turn, individuals are better equipped to contribute effectively to the economy.

The relationship is not just about the quantity or years of schooling but rather the cognitive skills and competencies gained during the educational process. Countries that invest in improving the quality of education stand to benefit substantially in terms of long-term economic progress. We make a concise review of the most prominent scholarly articles on the topic below:

In his treatise, *On the Mechanics of Economic Development*, Lucas (1988) champions the idea that human capital accumulation, facilitated through both education and training, is indispensable for economic growth. He underscores the significance of not only the quantity but also the quality of education.

Later on, Barro's seminal work (1991), *Economic Growth in a Cross-section of Countries* delves into the determinants of economic growth using cross-country data. He uncovers that school enrollment rates, especially in secondary and higher education, are positively associated with growth. This suggests a vital role of education quality in fostering economic advancement.

Mankiw, Romer, & Weil (1992) delve into the Solow growth model, integrating it with human capital. They offer invaluable insights into how both the quality and quantity of education can be substantial levers for economic growth.

Drawing from aggregate cross-country data, Benhabib & Spiegel (1994) also unearth that countries with pre-existing higher education levels witness a more pronounced impact of human capital growth rate on economic development.

Zeroing in on US data, Acemoglu & Angrist (2000) contemplate the externalities of human capital. They discover that elevations in the average education of a US state's residents lead to augmented returns to education, thereby shining a spotlight on the vitality of education quality.

Krueger & Lindahl (2001) in *Education for growth: Why and for whom?*, meticulously review the empirical relationships between education and growth. They tackle various facets of education quality and explore their ramifications on economic outcomes.

In a broader perspective, Sala-i-Martin, Doppelhofer, & Miller (2004), while not exclusively concentrating on education, emphasize educational attainment as a pivotal determinant of long-term growth.

Psacharopoulos & Patrinos (2004) also furnish an exhaustive evaluation of returns on investment in education across a multitude of countries. Their analysis fortifies the assertion of the paramount importance of education quality in realizing economic advantages.

A pivotal paper by Hanushek & Woessmann (2008) titled *The Role of Cognitive Skills in Economic Development* stresses that the quality of education, gauged by cognitive skills attained, overshadows mere school completion in terms of significance for economic growth. By leveraging international student achievement tests to assess cognitive skills, the authors discern a robust connection between these skills and prolonged economic growth.

Furthering this sentiment, in their paper *Education and Economic Growth*, Hanushek and Woessmann (2010) correlate the cognitive skills of a nation's populace with its long-term economic growth. They suggest that while the years of schooling can be seen as a quantitative indicator, the average cognitive skills level represents the quality of human capital. Their conclusion is evident: the quality of education outweighs its quantity when assessing its impact on a nation's economic growth.

In yet another insightful paper titled *Education and Economic Growth: It's Not Just Going to School but Learning That Matters*, Hanushek and Woessmann, along with Jamison and Jamison (2008), use math and science test performances as metrics for cognitive skills across various nations. Their comprehensive analysis, spanning from 1960 to 2000 over 50 countries, denotes that cognitive skills correlate more strongly with GDP growth than mere schooling duration.

This literature review is by no means exhaustive, and many other valuable works explore this topic in-depth. However, the listed articles provide a solid foundation for understanding the pivotal role education quality plays in economic growth.

Global Datasets Measuring Human Capital

Adopting qualitative measures of human capital (students' cognitive skills and educational achievements) is a comprehensive approach to explaining the variations in the well-being and growth prospects of nations. Several global learning datasets maintain specific comparable indicators targeted towards educational results. They are a reliable source for various research on the cognitive skills – economic growth relationship. To examine this relationship, we explore three global datasets on education – a compilation

of international human capital measures that will allow us to make meaningful comparisons across countries (in Southeast Europe in particular).

The major benefit of using international learning metrics (rather than compiling country-generated indicators) is that one gains access to comparable data on a global level. The increasing use of international tests on educational achievements calls for constructing global learning datasets, which, in turn, allows for a better and more in-depth analysis of the results. The three most comprehensive global educational datasets (covering the highest number of countries and the longest timeframe) are as follows:

1. *Barro-Lee Educational Attainment Dataset*

The Barro-Lee Dataset summarizes the results of educational attainment from 146 countries (and it is constantly being updated). It contains data about the adult population in those countries split into two categories – below the age of 15 and over the age of 25.

Major indicators stored include the average years of schooling at all levels (primary, secondary, and tertiary education), as well as % of the population that completes the respective level of education (drop-out %, respectively).

Overall, the database contains data related to quantitative measures of human capital in these countries.

2. *Penn World Table (HCI)*

The Penn World Table (PWT) was developed by Robert Summers and Alan Heston (1991). They aimed at summarizing and synchronizing international economic development indicators. It has relative data on the levels of income, output, input, and productivity indicators (48 in total), covering 183 countries.

All these indicators are combined to form the so-called Human Capital Index (HCI). Similar to the Barro and Lee Dataset, the HCI is quantitative in nature, rather than a qualitative measure of human capital, as it is based on the average years spent in the educational system.

3. *Harmonized Learning Outcomes (HLO) Database (developed by the World Bank)*

This database collects harmonized student assessment data all over the world. It was produced by the World Bank and includes 164 countries or roughly 98% of the global population. Harmonized learning outcomes are generated using a conversion factor, meaning that students' performance in international achievement tests[1] can be used on a comparative basis. The database includes mean scores of students' achievements (hence cognitive skills), which makes it the largest database in the world that measures the quality (rather than quantity) of human capital in the respective region/country.

To sum it up, each of these databases compiles data that can be used as an indicator of human capital (HC):

- *Barro & Lee Dataset* – Years of Total Schooling (a quantitative measure of HC)
- *PWT* – Human Capital Index HCI (a quantitative measure of HC)
- *World Bank Dataset* – Harmonized Learning Outcomes HLO (a qualitative measure of HC)

Therefore, if we want to measure the quality of human capital (as opposed to quantity), the HLO World Bank Dataset is the best dataset to be used. The HLO Index (Harmonized

[1] PISA, TIMMS, PIRLS, etc.

Learning Outcomes Index) compiles average scores of many international assessment tests to construct globally comparable results. The HLO Index measures students' skills and achievements; therefore, it can be used as an index for the quality of human capital in those countries.

Barro&Lee Data Set and the HCI Index, on the other hand, measure the number of years spent in school, or % of school dropouts. These datasets compile quantity, rather than quality indicators of human capital.

Data from these global learning datasets are being continuously used in a number of empirical studies that aim to confirm the relationship between the quality of education and economic growth. The most vivid work in the field has been performed by Eric Hanushek[2] – an internationally recognized economist known for his vast analysis of the relationship between the quality of education and economic growth. He is the author, co-author, or is acknowledged in numerous, highly cited studies on the effect of improved educational performance on economic development. In 2021, he received the *Yidan Prize for Education Research*, the world's highest accolade in the world of education.

Comparative Analysis of Southeast European Countries' Educational Achievements

The Harmonized Learning Outcomes (HLO) is a dataset developed by the World Bank to measure learning outcomes across countries in a comparable manner. Instead of merely evaluating educational access or years of schooling, the HLO offers insights into actual learning outcomes as measured by international assessments (PISA, TIMMS, PIRLS, and others). So, the HLO is safely considered a proxy for the quality of human capital across countries. Data on HLO for Southeast European countries covers the period from 2000 to 2018, as shown in *Table 1*. This data is released once every three years, with 2018 being the most recent year available.

Central and Eastern European countries like Poland, Hungary, and Slovenia generally have higher HLO scores than their Balkan counterparts like Albania and North Macedonia. This could potentially reflect differences in educational investment, policies, or other socio-economic factors.

Analyzing the HLO index trend for the Southeast European region, we observe that most countries have shown growth in their HLO indices over the years (Figure 1). Countries like Bulgaria, Latvia, and Serbia have witnessed significant growth, showcasing efforts to improve educational outcomes. However, countries like North Macedonia and Albania have relatively lower average HLOs, indicating challenges in their educational sectors.

Another observation considers the range of scores (difference between highest and lowest) which has generally increased over the years, indicating a widening gap

[2] Eric Alan Hanushek is an internationally recognized economist who is known for his extensive analyses and empirical contribution to the relationship between the quality of education in a country and its long-term economic growth. Through his work, he has broad influence on education policy not only in developed but also in a lot of developing countries.
He is among the first scholars to introduce the idea of measuring qualitative indicators of human capital (cognitive skills), as opposed to quantitative measures. He uses data from international tests on student achievements (PISA, TIMMS, TALIS, and others) to confirm that the quality of human capital is a key driver for economic growth.

Table 1. HLO Index by year/by country

Column1	2000	2003	2006	2009	2012	2015	2018
Albania	390.87	-	-	405.80	415.92	433.99	-
Bulgaria	453.45	477.51	462.96	449.95	457.62	486.01	551.54
Greece	476.70	481.46	479.45	488.30	481.46	474.87	-
Hungary	501.52	522.43	516.82	508.79	500.48	516.47	554.16
Latvia	476.18	515.73	509.41	500.36	506.95	500.68	557.75
Lithuania	543.39	516.78	505.80	492.84	497.71	513.17	548.28
North Macedonia	405.75	442.18	442.40	-	-	404.25	403.96
Poland	492.04	508.22	514.97	513.86	531.79	526.38	564.63
Romania	449.33	472.44	444.01	444.92	457.67	455.05	-
Serbia	-	-	441.78	459.64	463.56	521.25	-
Slovakia	518.09	497.89	504.72	501.65	486.69	490.74	534.79
Slovenia	-	-	518.78	511.16	511.15	527.02	542.47

Source: World Bank Data Catalog

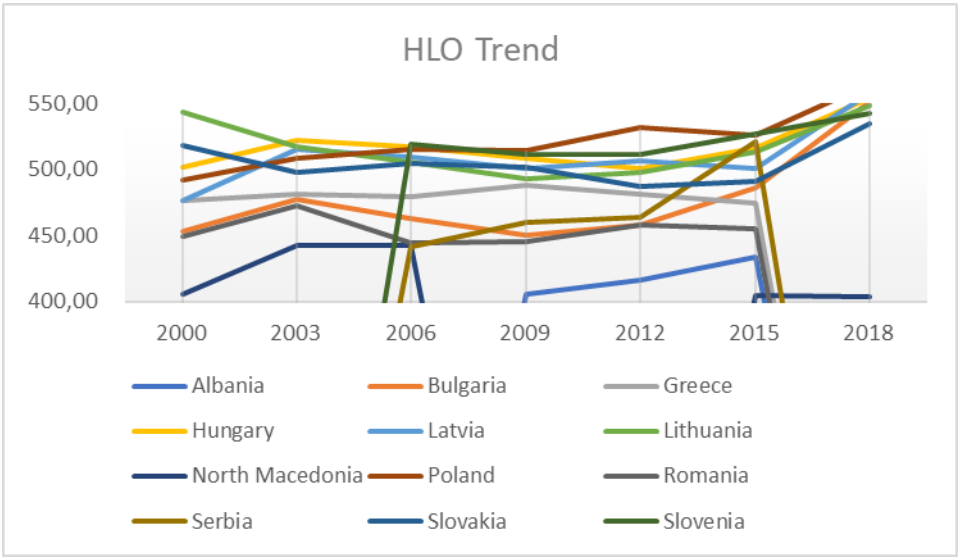

Figure 1. HLO Index by country (2000 – 2018)
Source: own presentation

between the best and worst performers. This suggests that while some countries (Poland, Hungary, Slovenia) are rapidly improving their educational outcomes, others (North Macedonia and Albania) are lagging behind.

Key Findings

Initial comparative analysis suggests variations in the quality of human capital across Southeast European nations. Countries such as Poland, Hungary, and Slovenia typically fare better on the HLO index compared to

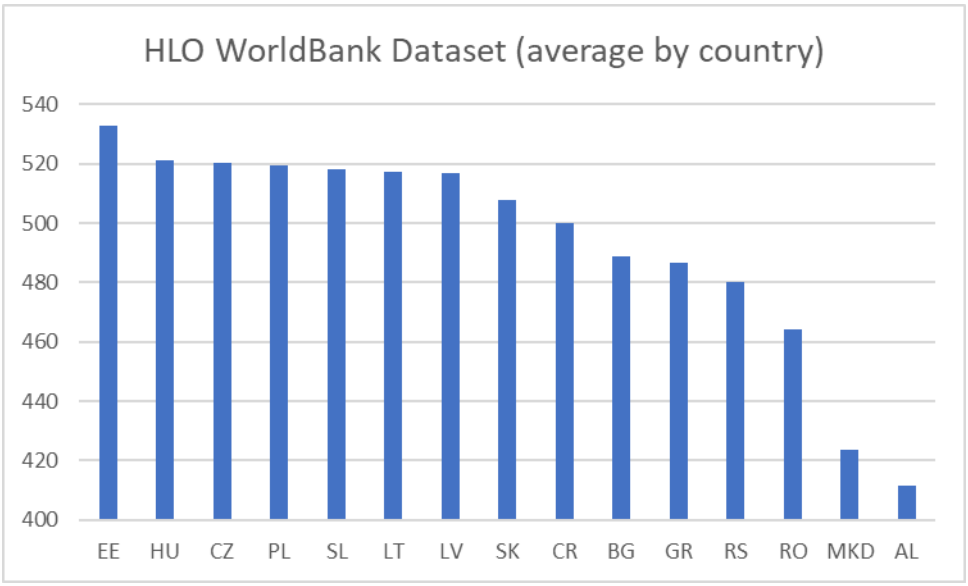

Figure 2. Average HLO Index by country (2000 – 2018)
Source: own presentation

nations like Albania and North Macedonia, suggesting disparities in educational quality. Most Southeast European countries have demonstrated growth in their HLO values over time, indicating an enhanced focus on elevating educational outcomes.

To gain deeper insights, one might look into the education policies, investments, socio-economic factors, and other potential variables that can influence these scores for each country. It would also be insightful to further analyze factors such as teacher quality, curriculum standards, and educational infrastructure, which can be influential in the HLO scores of these countries.

Empirical Analysis of the Quality of Education – Economic Growth Relationship

An important parameter for the relationship between economic growth and educational performance is measuring the quality of human capital using global learning data.

Angrist, Djankov, Goldberg, and Patrinos (2021) also examine the relationship between the quality of education and economic growth. Unlike Hanushek, though, who uses results from international student achievement tests (PISA, TIMMS, etc.), they run a couple of regression analyses based on global learning datasets (synchronized data) and GDP growth:

- Between the HLO Index (from the World Bank Dataset) and GDP
- Between HCI (from PWT) and GDP
- Between Years of Schooling (from the Barro & Lee DataSet) and GDP
- Between HDI and GDP

A summary of the results of these studies is illustrated in the following extract:

As per the table above, the regression coefficient is significantly higher when the HLO is used as an independent variable (from 0.059 to 0.072), compared to the cases when the Human Capital Index (from Penn World tables) or the Years of schooling are being

Table 2. Comparing Measures of Human Capital and Economic Growth

	Annual growth rate (2000–2010)							
	1	2	3	4	5	6	7	8
Human capital (harmonized learning outcomes)								
Regression coefficient	0.072				0.059	0.061	0.069	0.066
Standard error	0.018				0.023	0.022	0.023	0.024
P value	0.000				0.011	0.007	0.003	0.006
Human capital (Penn world tables)								
Regression coefficient		0.033			0.012			0.019
Standard error		0.011			0.013			0.035
P value		0.003			0.358			0.597
Human capital (schooling[32])								
Regression coefficient			0.016			0.006		0.014
Standard error			0.006			0.007		0.020
P value			0.004			0.382		0.494
Human capital (HDI)								
Regression coefficient				0.020			0.002	−0.028
Standard error				0.008			0.010	0.022
P value				0.013			0.844	0.914
Control for GDP at the start of the time period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	107	107	107	107	107	107	107	107
R^2	0.300	0.261	0.255	0.240	0.306	0.305	0.301	0.318

Source: Noam Angrist, Simeon Djankov, Pinelopi K. Goldberg & Harry A. Patrinos (2021), Measuring human capital using global learning data: Measuring human capital using global learning data | Nature

used as such. When quantitative measures of human capital are used as independent variables in the regression model, the regression coefficients fall in the range of 0.002 to 0.033. This is one piece of evidence of the strong relationship between the quality of human capital (measured through Harmonized Learning Outcomes - HLO) and economic growth. Put differently, all else being equal, the quality of education (students' knowledge and skills) has a greater impact on GDP growth compared to the quantity of education (students' years of schooling or % of people that stay in education) in any given country.

Furthermore, the authors found out that the model fit (R-squared, or coefficient of determination) improves only slightly when all measures are included in a multivariate regression - R^2 increases to 0.32, whereas it is 0.30 in a single linear regression when the HLO is used as a sole independent variable. This result confirms that the HLO index is a good enough explanator of GDP growth.

Based on this research (Angrist et al., 2021), we can say that the quality of human capital (better students' achievements) appears to have a stronger relationship with economic growth. The World Bank HLO index is significantly correlated with GDP growth worldwide.

Southeast Europe human capital-economic growth relationship presented via correlation analysis - GDP per capita and human capital measures

To identify the trends and verify the links between cognitive skills and economic growth, a correlation analysis between GDP per capita (the dependent variable) and the three previously discussed global measures of human capital (independent variables) has been performed. The analysis covers **Southeast European countries** operating by:

Table 3. Correlation Matrix

Pearson correlation coefficient	*Log GDP per Capita*	*Score - HLO (WorldBank Dataset)*	*HCI (PWT)*	*Years of Total Schooling (Barro and Lee)*
Log GDP per Capita	1			
Score - HLO (WorldBank Dataset)	**0,40759236**	1		
HCI (PWT)	**0,559841971**	0,431734173	1	
Years of Total Schooling (Barro and Lee)	**0,390693223**	0,439761482	0,857294795	1

Source: own calculations

- *Score - HLO (WorldBank Dataset)*
- *HCI (PWT)*
- *Years of Total Schooling (Barro and Lee)*

Out of these global learning datasets, the data for 14 countries covering the years 2000 – 2018 from Southeast Europe[3] has been treated.

Then, we perform correlation analysis using the Pearson correlation coefficient[4] to determine the strength of the relationship between GDP per Capita and the three independent variables (human capital indicators).

Based on the performed analysis, we identified a positive correlation between the change in GDP per capita and the level of cognitive skills. The results are as follows:

- Significant correlation between **Log GDP per Capita** and **HCI (PWT)** with Pearson correlation coefficient of r = **0,56**
- Moderate correlation between **Log GDP per Capita** and **Score - HLO (WorldBank Dataset)** with Pearson correlation coefficient of r = **0,41**
- Moderate correlation between **Log GDP per Capita** u **Years of Total Schooling (Barro and Lee)** with Pearson correlation coefficient of r = **0,39.**

The established positive correlation between GDP per capita and cognitive skill indicators provides a foundation to delve deeper into their relationship using regression analysis. For this purpose, we employ the least squares method, which optimizes the fit of our data points by minimizing the sum of the squared discrepancies between predicted and observed values.

Linear Regression Analysis of GDP per Capita and HLO Index in Southeast European Countries

The relationship between GDP per capita and the HLO index for Southeast European countries has been quantified using a linear regression analysis. Detailed results are presented in the following:

The Linear Regression Model:

$$GDP = 0.0084 * HLO\ \text{Score} + 4.9787$$

From the regression statistics table (Table 3), we see that **R-squared = 0.166132.** This means that the **Score -HLO** variable explains

[3] Albania, Bulgaria, Croatia, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Serbia, Slovakia and Slovenia

[4] We use Pearson correlation coefficient to evaluate the strength of the relationship between quantitative random variables

Table 4. Linear regression analysis (GDP / HLO) results

Regression Statistics	
Multiple R	0,407592
R Square	**0,166132**
Adjusted R Square	0,158338
Standard Error	0,622318
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	***Significance F***
Regression	1	8,255863524	8,255864	21,317599	**0,00001**
Residual	107	41,43887791	0,387279		
Total	108	49,69474143			

	Coefficients	*Standard Error*	*t Stat*	***P-value***
Intercept	4,978671	0,911274374	5,463416	**0,0000003**
Score - HLO (WorldBank Dataset)	0,008358	0,001810246	4,617099	**0,0000109**

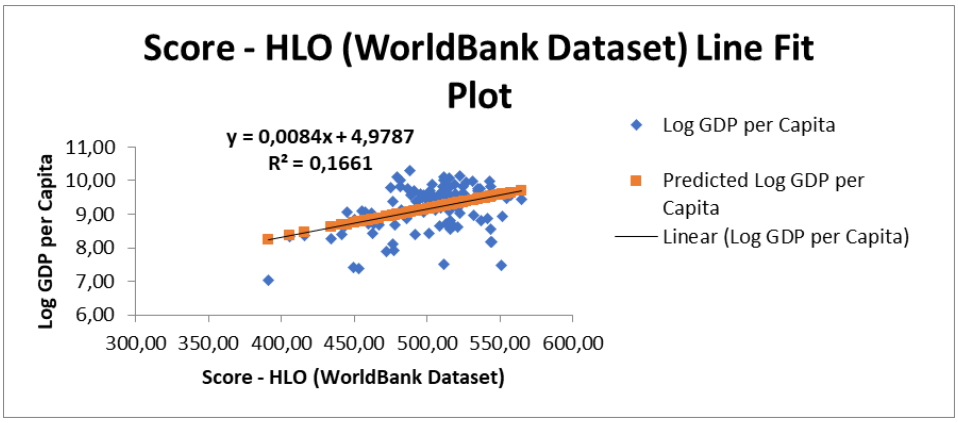

Figure 3. Linear Regression Line Fit Plot
Source: own calculations

16.6% of the change in **GDP per capita,** which is a statistically significant result.

Furthermore, the regression model is characterized by **F-stat = 21.32** and **P-value = 0.00001**. Working with a 95% confidence interval, we can (as the P-value < 0.05) reject the null hypothesis (Ho).

*The null hypothesis states that all the coefficients in front of the independent variables in the regression model are 0.

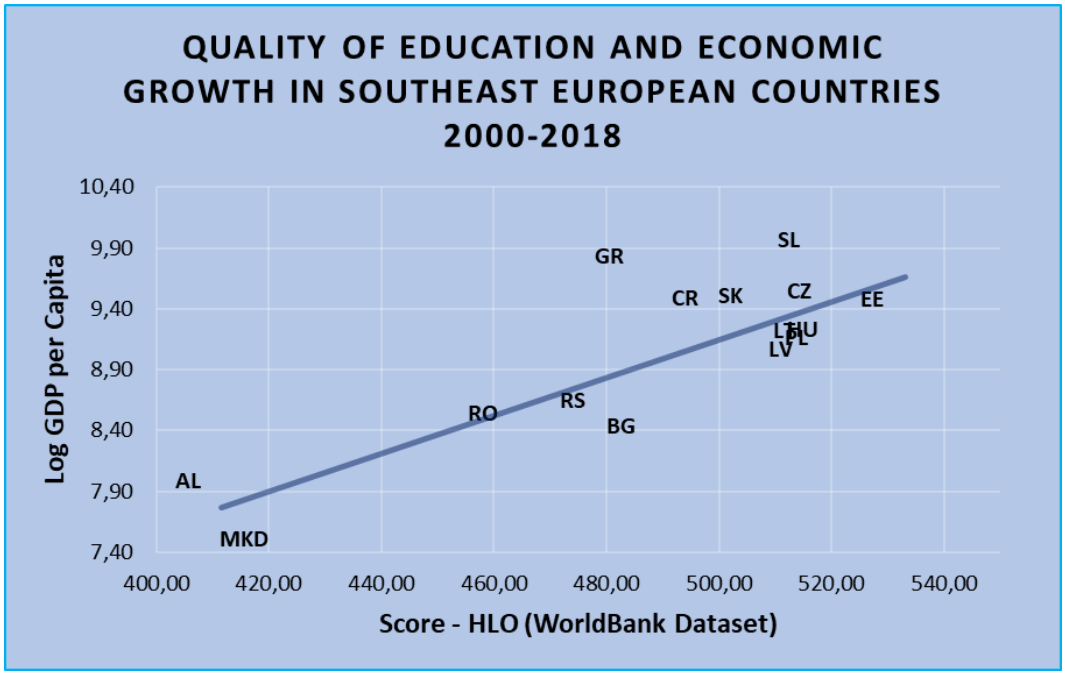

Figure 4. Quality of Education and Economic Growth – SEE Countries 2000 - 2018

Therefore, we reject the null hypothesis H0 (and fail to reject the alternative hypothesis H1), which means that at least one of the coefficients in front of the independent variables is different from 0. In other words, we can safely say that any model that includes at least one of the independent variables is better than a model without independent variables (Y = b0).

⇨ **the predictive value HLO Score is statistically significant. This is evident from its P-values (T = 4.6171 and P-value = 0.0000109)**

In terms of the intercept b0, the model is characterized by T = 5.4634 and **P-value = 0,0000003,** therefore b_0 is significantly different from 0.

⇨ **The intercept b0 is statistically significant**

Discussions

Adopting qualitative measures of human capital (students' cognitive skills and educational achievements) is a comprehensive approach to explaining the variations in the well-being and growth prospects of nations.

Several global learning databases maintain learning-related data of students of various ages, genders, and countries and are reliable sources for various research on the cognitive skills – economic growth relationship. They should be analyzed regularly aiming at identifying the most recent trends and developments in educational systems around the world.

As a result of the study, it can be claimed that:

Hypothesis 1 has been confirmed, as we found out that the World Banks' HLO Index (Harmonized Learning Outcomes Index) has a stronger correlation to GDP/economic growth

than the other human capital measures. Given that these other measures of human capital (HCI, Barro, and Lees' dataset measures) rely mostly on quantitative indicators (such as years of schooling) but not on qualitative indicators (such as students' achievements), we can safely say that the "quality" of education is more important for economic growth than the "quantity" of education.

Hypothesis 2 has also been confirmed based on the performed regression analysis; we identified a strong positive relationship between the quality of education (measured through the HLO index or learning achievements) and economic growth (measured by GDP per capita) in Southeast European countries.

Conclusions

The significance of assessing the quality of education and its potential influence on economic growth has taken center stage in global discussions. It is a topic that will continue to be vastly researched and empirically tested.

Based on the performed research and analyses, several key takeaways emerge:

1. To facilitate economic development and make meaningful comparisons on a global level, it is important that countries monitor and analyze recent trends in students' educational achievements.
2. Measuring and improving the quality of human capital (cognitive skills) is an important factor that contributes to the long-term economic well-being of a nation.
3. While the quantity of education, captured by metrics such as years spent in school or dropout rates, provides insights, it is often an insufficient gauge of the depth and value of human capital.
4. Cognitive skills (or students' educational achievements) are a more reflective metric of the quality of human capital in a given country.

In a nutshell, the quality of education, as gauged by cognitive skills and educational achievements, is potentially a more robust predictor of economic growth than mere educational duration. This relationship is evident in Southeast European countries, suggesting a need for policymakers in the region to pivot their educational strategies from expanding access to enhancing quality.

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List of abbreviations

HLO - Harmonized Learning Outcomes Index

HC – Human Capital

HCI – Human Capital Index

PISA – Program for International Student Assessment

PIRLS – Progress in International Reading Literacy Study

TIMMS – Trends in International Mathematics and Science Study