Human Capital as a Driver of Productivity Convergence

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Abstract

This paper aims to examine how human capital contributes to both labor productivity growth and the process of economic convergence with the European Union. The research employs an empirical methodology that combines two complementary methods. First, the effect of human capital on labor productivity in Albania is examined to evaluate its significance as a factor influencing the country's economic performance. Second, using a panel analysis involving Albania and four chosen Western Balkan nations, the study investigates whether human capital plays a role in the process of productivity convergence towards the level of EU nations. The study provides empirical evidence on the function of human capital as a mechanism that supports both productivity growth and economic convergence with the most developed European countries by integrating the analysis conducted within the nation with the comparative regional perspective. The findings suggest that human capital exerts a positive and statistically significant

effect on labor productivity, while evidence of conditional convergence indicates that human capital contributes to productivity catch-up dynamics.

Keywords: *human capital, productivity, convergence, transition country, Albania, Western Balkan Countries*

Introduction

Albania's economy has changed significantly during the last thirty years as it transitioned from a centrally planned to a market-oriented structure. European Union integration has continued to be a primary national objective during this time, influencing institutional growth, policy agendas, and economic changes. In this situation, economic convergence with the EU is both a political goal and an economic requirement. A crucial prerequisite for long-term economic development and sustained integration is achieving better productivity levels and closing the income gap with EU member states.

Economic theory suggests that countries starting from lower levels of development should grow faster and gradually catch up with more advanced economies (Barro & Sala-i-Martin, 1992). Transition economies were expected to benefit from technology adoption, capital accumulation, and structural reforms that would accelerate productivity growth. Since the 1990s, Albania has gone through periods of volatile growth, but overall macroeconomic stability has improved. However, compared to theoretical expectations, the anticipated process of quick convergence has been less consistent and slower (Meksi & Xhaja(Gjika), 2017; Cakrani & Shehu, 2025). In the framework of post-transition economics, Albania represents a case where the initial gains from liberalisation and stabilisation have not been followed by the deeper structural and institutional reforms necessary for second-stage convergence (EBRD, 2023). Despite growth performance, according to OECD labor productivity in Albania is over four times lower than the European Union (EU) average and around 35% lower than the regional average (OECD,2025). Much of the country's economic growth has been driven by consumption, remittances, migration-related income, construction activity, and expanding service sectors that typically generate relatively low productivity gains. As a result, economic expansion has not always translated into sustained improvements in productivity, and periods of stagnation have interrupted the convergence process. Economic activity continues to be concentrated in low-skill services and non-tradable sectors, which provide employment opportunities but offer weaker potential for productivity growth and technological upgrading. This structural pattern raises important questions about the underlying drivers of Albania's growth model.

Although the relationship between human capital and economic growth has been widely studied, limited research has examined how this relationship

operates within Albania's post-transition context. This paper seeks to fill this gap by exploring whether improvements in human capital have contributed to productivity convergence and by analyzing the structural conditions that shape this relationship. Although Albania has increased tertiary education, the country's productivity is still low. The question of whether human capital translates into actual productivity is thus brought up.

Therefore, the purpose of this study is to investigate the effect of human capital on labor productivity in Albania as a factor influencing the country's economic performance. On the other hand, in order to assess whether human capital acts not only as a determinant of productivity growth, but also as a mechanism that plays a role in the dynamics of catching up with the most advanced economies of the EU, we have included in the analysis, along with Albania, 4 other Western Balkan countries North Macedonia, Bosnia and Herzegovina, Montenegro, and Serbia. These countries were selected because they have similar institutional and structural traits, are transition economies with comparable levels of economic development, and want to join the EU.

To achieve these objectives, the study addresses two main research questions: (i) whether human capital has a statistically significant effect on labor productivity in Albania, and (ii) whether human capital contributes to productivity convergence toward European Union standards.

By providing empirical data on the role of human capital on labor productivity and productivity convergence, this study contributes direct implications for public policy. This study investigates whether improvements in education boost productivity and encourage convergence toward productivity levels within the European Union, in contrast to prior research that mostly focuses on macroeconomic growth indicators. By analyzing Albania as a post-transition economy, the study sheds light on the structural components that could lessen the productivity advantages of building human capital.

The paper is organized into five sections as follows: Section one presents the research problem, research questions, and the study's significance. In the context of the study, the second section reviews the theoretical and empirical literature, outlining the various conclusions on human capital and productivity convergence. Section three of the study discusses the research methodology and model estimation, while section four offers empirical results, analyses, and results. The conclusions are shown in section five.

Literature review

Human capital is broadly defined as the combination of individuals' innate abilities, education, skills, and accumulated experience, as well as the ongoing process of learning and personal development throughout their lives, according

to (Laroche, M., & Mérette, M., 1999).The first authors of modern human capital theory (Schultz, 1961) and (Becker, 1962) argued that education and training are investments that enhance individuals' skills, productivity, and earnings over time. According to them, a more skilled workforce leads to higher production capacity and economic growth. (Spence, 1973) contributed with his signaling theory, suggesting that education may not only increase productivity directly, but also act as a signal to employers about an individual's ability or productivity. Furthermore, recent studies have underscored the importance of education as a fundamental factor in economic growth. (Nikolli, E., & Shehu, E., 2022)

Many economists have developed a wide range of theories to explain the process of economic growth and the impact of human capital on it. Early contributions from classical economists such as (Smith, 1776) ,(the first classical economist to explicitly include human capital in the definition of capital) and (Ricardo, 1817) emphasized the importance of capital accumulation, labor, and specialization as key drivers of economic growth. These theories primarily focused on long-term expansion of output and the role of productive efficiency, but they treated labor as largely homogeneous and did not explicitly account for differences in skills or education.

The development of the neoclassical growth model by (Solow, 1956) and (Swan, 1956) introduced a more formal framework in which economic growth is driven by capital accumulation, labor growth, and exogenous technological progress. The model also implies the concept of convergence, whereby economies with lower levels of capital per worker tend to grow faster and gradually approach a steady-state equilibrium. In this framework, sustained long-run growth in output per capita can only be achieved through continuous advances in technological progress, as capital accumulation alone is subject to diminishing returns.

A significant extension of the neoclassical growth framework was provided by (Mankiw, N. Gregory, Romer, David, & Weil, David N., 1992), who augmented the traditional Solow model by incorporating human capital as an additional factor of production. Their model demonstrates that differences in human capital, alongside physical capital and population growth, help explain variations in income levels and growth rates across countries, thereby improving the empirical performance of the neoclassical growth model.

To overcome the shortcomings of neoclassical growth theory, particularly its inability to fully explain the long-run drivers of economic growth, endogenous growth models emerged in the mid-1980s.Pioneering contributions by (Lucas, 1988) and (Romer, 1990) introduced the idea that technological progress is not exogenous but rather the result of intentional economic decisions within the model, emphasizing the critical role of investing in technological progress as a key driver of human capital accumulation.

Unlike the neoclassical framework, endogenous growth theory emphasizes that economic growth is influenced by a broader set of internal factors, not solely by technological change. In particular, variables such as human capital play a

central role. (Lucas, 1988) explicitly incorporates human capital as a distinct input in the production function, highlighting its formation through education and on-the-job training. In his model, the accumulation of human capital is identified as a key determinant of productivity growth and long-term economic performance.

These models argue that human capital contributes not only to individual productivity but also to broader economic performance through positive externalities. Such spillover effects include innovation, knowledge diffusion, and the adoption of new technologies, all of which enhance overall economic efficiency. In this context, the quality of education becomes particularly important. Empirical evidence provided by (Hanushek, E. A., & Woessmann, L., 2012)shows that cognitive skills, rather than merely years of schooling, play a decisive role in explaining differences in economic growth across countries. Their findings suggest that higher-quality education systems foster stronger skill formation, which in turn supports long-term economic development. Over the past few decades, economic development has been increasingly shaped by structural changes linked to technological innovation, global integration, and the expansion of knowledge-intensive sectors. In this evolving context, human capital has emerged as a fundamental source of productivity and competitive advantage. Rather than being viewed solely as a supporting factor, it is now considered a central element influencing countries' capacity to adapt, innovate, and sustain economic growth. Institutions such as the (World Bank, 2020) emphasize that the quality of education systems, health outcomes, and workforce skills play a decisive role in determining long-term development prospects.

A similar perspective is reflected in the development agenda promoted by the (United Nations Development Programme, 2020), where human capital is positioned at the core of sustainable development strategies. The focus on improving education and health conditions highlights the idea that economic progress cannot be separated from broader social outcomes. In this sense, strengthening human capital is not only a means to increase productivity but also a pathway toward more inclusive and resilient economies. However, despite its recognized importance, the accumulation of human capital remains uneven across countries. Limited access to quality education and healthcare continues to constrain economic performance in many developing and transition economies, reducing their ability to converge toward higher productivity levels. These challenges have become even more pronounced in the aftermath of the COVID-19 pandemic. (World Bank, 2021), which disrupted schooling, weakened labor market outcomes, and exposed structural weaknesses in health systems.

Although human capital is a key determinant of productivity, trade openness and investment are equally important, as they promote technology transfer, capital accumulation, and more efficient resource allocation. In the long run, the benefits of trade are primarily realized through improvements in total factor productivity. These gains are closely linked to mechanisms such as technological diffusion,

learning, and innovation. (Kim, D. H., & Lin, S. C., 2009). Although trade openness creates opportunities for accessing new technologies and knowledge, as emphasized by (Lucas, 1988), The extent to which countries benefit from these opportunities depends on their absorptive capacity. This absorptive capacity is shaped by several structural factors, including the level of human capital, investment in research and development, financial sector development, and the quality of institutions. (Aghion, P., Howitt, P., & Mayer-Foulkes, D, 2005).In this regard, countries with stronger education systems, better governance, and more developed financial markets are better positioned to adopt and utilize new technologies effectively.

The relationship between trade liberalization and economic growth is closely linked to productivity dynamics and convergence processes. While short-term adjustments may involve transitional costs due to sectoral reallocation, long-term gains are primarily driven by improvements in total factor productivity. Trade openness facilitates access to foreign technologies, knowledge spillovers, and innovation, thereby creating opportunities for less developed economies to catch up with more advanced ones. However, the extent to which these gains materialize depends on a country's absorptive capacity.

In this context, human capital plays a critical enabling role, as a more educated and healthier workforce is better equipped to adopt and implement new technologies. At the same time, investment, particularly foreign direct investment, supports capital accumulation and accelerates the transfer of advanced production techniques. As highlighted by (Lucas, 1988) The interaction between human capital accumulation and external factors such as trade and investment is essential for sustaining productivity growth. Therefore, productivity convergence is not driven by a single factor but by the combined effects of human capital, trade openness, and investment. For a transition economy such as Albania, these elements are particularly important, as integration into European and global markets increases exposure to technological diffusion while simultaneously requiring sufficient domestic capacity to absorb these benefits. Without adequate levels of human capital and supportive institutional conditions, the potential gains from trade and investment may remain limited, slowing down the convergence process.

Human capital plays a crucial role in facilitating structural transformation within an economy, particularly in the shift from agriculture to more productive industrial and service sectors. A workforce equipped with higher levels of education and skills is more adaptable and capable of meeting the demands of these sectors, thereby supporting economic diversification and productivity growth. (Lewis, 1954). In this regard, the experience of China illustrates how sustained investments in education and vocational training can enable large-scale labor reallocation from low-productivity agricultural activities to higher value-added manufacturing and services, contributing significantly to long-term economic development (Abrha,T; Weldeyohans,B, 2025). (Moro, 2015) analyzes how the sectoral composition of gross domestic product influences cross-country differences in growth performance and

macroeconomic stability. The study finds that a higher share of the service sector in GDP is associated with lower growth in total factor productivity (TFP), as well as reduced volatility. As a result, economies with a larger service sector tend to experience more stable but comparatively slower GDP growth.

Empirical evidence on GDP per capita dynamics suggests that convergence across countries tends to occur more rapidly in economies where production is increasingly concentrated in sectors that require higher levels of human capital, such as industry and services. These "modern" sectors, as emphasized by (Rodrik, 2013) They are more conducive to productivity growth compared to traditional agricultural activities. Furthermore, lower-income countries—typically characterized by larger agricultural shares often undergo structural transformation by reallocating resources toward non-agricultural sectors. This transition, which is closely linked to rising human capital requirements, appears to be an important mechanism supporting convergence in per capita income. In this context, the accumulation of human capital enhances the ability of these economies to shift toward more productive activities, thereby accelerating the catch-up process. In addition to structural change, financial development also plays a significant role in facilitating convergence. Well-functioning financial systems improve the allocation of resources, support investment, and enable firms to expand into more productive sectors. Taken together, the reallocation of economic activity toward higher value-added sectors and improvements in financial development provide strong evidence for the persistence of convergence trends over time.

Research on economic convergence in the Balkan region has drawn some scholarly attention, though studies specifically examining convergence between these countries and the European Union remain relatively scarce. Among the key contributions, El Ouardighi, J., & Somun-Kapetanovic, 2007) investigate both β- and σ-convergence using a limited sample of countries over a period that predates the Great Recession. Their findings indicate the presence of convergence, although it fluctuates over time.

In a similar vein, Szeles, M.R.,& Marinescu, N., 2010) and Eftimoski (Eftimoski, 2020) analyze convergence across a broader group of Central, Eastern, and Southeastern European (CESEE) countries, including several Balkan states. Their results suggest exhibited convergence toward European benchmarks between 1997 and 2016, identifying democracy and foreign direct investment (FDI) as important drivers of this process.

Further contributions support these conclusions. (Gockov, G.,& Antovska, A., 2019) stress that, to speed up convergence, Balkan countries should prioritize structural reforms, particularly in the agricultural and banking sectors. Likewise, (Šiljak, D.,& Nagy, S.G., 2023) underline the importance of increasing trade openness and improving macroeconomic conditions by reducing inflation, unemployment, public debt, and corruption.

More recently, (Grodzicki, T., & Jankiewicz, M., 2024) examining the period from 1997 to 2020, provide additional evidence pointing to a gradual—albeit slow—process of convergence toward the European Union. A cohort-based indicator of expected human capital can be defined as the number of years lived between ages 20 and 64, adjusted for educational attainment, quality of education, and functional health status, covering a large sample of countries over the period 1990–2016. The evidence shows that greater improvements in human capital are associated with faster economic growth (Lim et al., 2018).

(Dańska-Borsiak, 2023) findings indicate that European regions are converging in terms of human capital, although the speed of convergence differs significantly across regions. Evidence points to the existence of multiple steady states rather than a single common equilibrium, with outcomes strongly influenced by structural factors—particularly the distribution of employment across sectors. Regions with higher shares of employment in agriculture tend to experience slower human capital convergence, likely due to the outflow of skilled labor or inefficiencies such as over-education. In contrast, a greater concentration of employment in the service sector—especially in knowledge- and technology-intensive activities—supports faster human capital accumulation and convergence. Overall, the results suggest that sectoral composition plays a crucial role in shaping both the pace and the long-term equilibrium of human capital convergence across European regions.

Research Methodology

Research approach

The aim of this analysis was twofold: to empirically test whether human capital has a statistically significant effect on labor productivity in Albania, and second, by complementing Albania with other Western Balkan economies, the study investigates whether human capital promotes the process of productivity convergence toward the European Union. If human capital boosts domestic productivity, in the Albanian case, it might also help economies converge toward more developed ones. To accomplish these objectives, the study used a two-step empirical strategy that integrates time-series and panel-data approaches. This two-fold approach allows the research to capture both country-specific dynamics and regional convergence tendencies.

Human Capital and Labor Productivity in Albania

In order to address the first empirical study question, we employed an Autoregressive Distributed Lag (ARDL) approach stranded in the Cobb–Douglas production

function. Given that it allows for the analysis of both long-term equilibrium relationships and short-term dynamics without the requirement for all variables to be integrated of the same order, the ARDL approach is especially useful in this situation. Also, the ARDL methods are very useful and efficient since they have advantages over other methods even when sample sizes are modest (Pesaran & Shin, 1999). We used a sample of 25 observations of annual macroeconomic data of Albania, ranging from 2000 to 2024, obtained from the World Bank and the United Nations Development Programme databases. Additionally, the ARDL framework supports in capturing the delayed effects of macroeconomic variables on labor productivity, which is crucial in developing and transitional economies where policy effects frequently take time to manifest.

The model assumes that labor productivity is influenced by investment activity, economic openness, and education and skills, all of which have an impact on efficiency improvements and technological adoption.

The empirical specification is as follows:

$$ln(PROD_t)=\alpha_0+\alpha_1 HCI_t+\alpha_2 GFCF_t+\alpha_3 OPEN_t+\varepsilon_t$$

Where:
$PROD_t$ = labour productivity (measured by GDP per employed person)
HCI_t= human capital indicator
GFCF= gross fixed capital formation as a proxy variale for investment intensity
$OPEN_t$= trade openness
ε_t= error term

Human Capital and Productivity Convergence

To address the second empirical study question, we employed a convergence model (Western Balkans – panel data analysis). The study investigates whether human capital promotes the process of productivity convergence toward the European Union for Albania and four selected Western Balkan countries. This study uses a convergence framework based on the neoclassical growth model to examine the contribution of human capital in the process of productivity convergence.

Labor productivity growth is modeled as a function of initial productivity and human capital accumulation:

$$Growth_t=f(PROD_{t-1},HC_t)$$

Convergence occurs when economies in less productive nations grow more quickly than those in more productive nations.

The convergence equation estimated using panel data is:

$$Growth_{i,t}=\beta_0+\beta_1 PROD_{i,t-1}+\beta_2 HC_{i,t}+\mu_i+\lambda_t+\varepsilon_{i,t}$$

Where:

$Growth_{i,t}$= productivity growth rate in the country
$PROD_{i,t-1}$= initial productivity level (lagged)
$HC_{i,t}$= human capital indicator
μ_i= country fixed effects
λ_t= time effects
$\varepsilon_{i,t}$ = error term

Albania and four other Western Balkan nations are included in the panel dataset over a shared observation period. By combining cross-country and time variance, panel estimates provide a more comprehensive understanding of convergence dynamics than single-country analysis. Panel analysis helps capture both the similarities and the country-specific impacts driving productivity convergence because Western Balkan countries differ in terms of institutional development, education systems, and economic performance while also sharing several shared transition issues. Additionally, by increasing the number of observations, panel data improves the dependability of the results. This is particularly crucial when researching relatively small economies with little annual data. Lastly, this approach enables us to more clearly see if advancements in human capital enhance the process of catching up to EU productivity levels over time and accelerate productivity growth. Together, these empirical methods capture different facets of the productivity-human capital link, strengthening the conclusions' robustness.

Results and Findings

Time series ARDL Approach, Albania 2000-2024

We used a sample of 25 observations of Albania's yearly macroeconomic data from 2000 to 2024 that were taken from databases provided by the World Bank and the United Nations Development Program. This study uses an Autoregressive Distributed Lag (ARDL) framework based on the Cobb–Douglas production function to investigate whether human capital significantly contributes to labor productivity increase in Albania. This approach is particularly useful and efficient since they outperform other methods even when sample sizes are modest (Pesaran et al., 2001).

Stationary tests

Most co-integration techniques begin by pre-testing the data series' stationarity in order to determine the best co-integration methodology. According to the ARDL method of co-integration, none of the variables can be integrated in the second order, and they must all be I (0) or I (1). In summary, the results of the stationary tests are shown in Table 1.

TABLE 1. Unit root test Results

Series	ADF Test statistic (p-value)		
	Level I (0)	First difference I (1)	Order
Labor productivity	-2.381	-3.847**	I (1)
Human capital index	-3.164**	-1.710	I (0)
Gross Fixed Capital Formation	-1.767	-3.258*	I (1)
Trade Openness	-2.341	-4.693***	I (1)

Source: Author's calculation

Table 1 shows that the Human Capital Index is stationary at level, and the ADF test shows that all other variables are stationary following initial differencing.

ARDL Bounds Test to Cointegration

To find out whether LP, HCI, GFCF, and TO have a long-term relationship, the border test is employed. By calculating the statistic F-value and comparing it to the upper and lower boundary values, we are able to choose cointegration (Pesaran et al., 2001).

TABLE 2. ARDL Bounds Cointegration Test

	Critical Value Bounds for K=4					
F-statistic=129.42	significance 1%		significance 5%		significance 10%	
	I(0) Bound	I(1)Bound	I(0) Bound	I(1)Bound	I(0) Bound	I(1)Bound
	5.61	5.06	4.35	3.23	3.77	2.72

Source: Author's calculation

F = 129.42 exceeds the upper bound critical value at all significance levels (1%, 5%, 10%). This indicates that there is a long-run cointegrating relationship between labor productivity, human capital, gross fixed capital formation, and trade openness in Albania.

Results for ARDL Short and Long-run Models

The results verify that our variables have a long-term cointegrating relationship based on the ARDL bounds testing method. Table 3 displays the long-term estimated coefficients of the ARDL model. At the 1% level, the coefficient ln(HCI) is statistically significant. Accordingly, there is a 1.30% improvement in labor productivity for every 1% increase in the Human Capital Index score. This outcome is in line with the critical part that human capital plays in developing countries like ours and also with theories that highlight how human capital facilitates technological adoption and innovation, in addition to being a direct input.

TABLE 3. Estimated long-run Coefficients ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	1.5829	1.7239	0.918	0.3689
Ln(HCI)	1.3000	0.2419	5.373	0.0000
Ln(GFCF)	-0.1282	0.1893	-0.677	0.5056
Ln(TRADE)	0.6056	0.1864	3.249	0.0038
$Ln(LP_t) = 1.583 + 1.300 \cdot ln(HCI_t) - 0.128 \cdot ln(GFCF_t) + 0.606 \cdot ln(TRADE_t)$				

Source: Author's calculation

Furthermore, Table 3 demonstrates a robust and favorable relationship between labor productivity and trade openness. This suggests that for every 1% increase in trade openness, labor productivity would rise by 0.6056%. However, physical capital formation (GFCF) is not statistically significant over the long term, which may be due to crowding-out dynamics or problems with investment efficiency in Albania.

The other step is to calculate the error-correction coefficient when variables have a long-term relationship.

TABLE 4. Estimated Short-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0545	0.0288	1.889	0.0743
$\Delta\ln(HCI_t)$	-1.0612	1.4346	-0.740	0.4685
$\Delta\ln(GFCF_t)$	-0.0193	0.1673	-0.115	0.9094
$\Delta\ln(GFCF_t)$	-0.0193	0.1673	-0.115	0.9094
$\Delta\ln(TRADE_t)$	0.1560	0.1201	1.299	0.2096
ECT(-1)*	-0.2856	0.1439	-1.985	0.0617
$R^2 = 0.2709$	Adj. $R^2 = 0.1173$	DW = 1.5978		

Source: Author's calculation

At the 10% level, the ECT coefficient = -0.286 is negative and significant, meaning that every year, about 28.6% of the disequilibrium is corrected when the system deviates from its long-run equilibrium.

Diagnostic tests

We perform a few diagnostic tests to confirm the precision and dependability of the econometric analysis's conclusions. These tests are crucial since the model might not be suitable for analysis and prediction. Autocorrelation, heteroscedasticity, and long-term stability tests were all passed by our model.

Descriptive statistics for the Human Capital and Productivity Convergence: Panel Evidence from Western Balkans

According to Table 5, the sample's average GDP per capita is roughly 11,900 with a standard deviation of 3,200, indicating moderate fluctuation over time and between nations. The standard deviation (4.2) is rather large, indicating economic unpredictability, especially during times of crisis like 2009 and 2020. The average economic growth rate is approximately 3.6%. There is some degree of human development convergence across the Western Balkan countries, as indicated by the Human Capital Index, which has an average value of 0.765 with low dispersion. Bosnia and Albania fall behind Montenegro, which has the greatest GDP per capita and HCI among the nations. Over the period under observation, Serbia's growth performance has been comparatively constant. All five nations are forthcoming candidates to join the EU. The initial conditions are equivalent since all of these countries have similar structural starting points. Every economy is open and small with a service sector that dominates, a high reliance on tourists and remittances, and comparable degrees of economic informality.

TABLE 5. Descriptive statistics by countries — 2000–2022

Country	GDP Mean	Growth Mean	HCI Mean
ALB	10,800	3.70%	0.76
SRB	12,900	3.80%	0.79
MNE	14,800	3.50%	0.82
MKD	11,500	3.00%	0.755
BIH	10,900	3.40%	0.75

Source: Author's calculation based on data from the WBI and UNDP

Convergence Model

The dataset, which consists of 120 observations, covers Albania, Serbia, Montenegro, North Macedonia, and Bosnia and Herzegovina from 2000 to 2023. Growth in labor productivity is the dependent variable, and the lagged logarithm of GDP per capita in terms of purchasing power parity (PPP) is the primary explanatory variable. Pooled OLS and fixed effects estimations are used in this analysis, which is based on the neoclassical growth model. The results of convergence are presented in Table 6.

TABLE 6. Regression results – convergence model

Variable	M1: OLS Absolut	M2: OLS Conditional	M3: Fixed Effects	M4:Random Effects
Constant (α)	0.3618***	0.5096***	—	—
	(0.1177)	(0.1047)		
ln(GDPpc) t-1 (β – Beta-Convergence)	-0.0355***	-0.0913***	-0.1335**	0.0001
	(0.0129)	(0.0225)	(0.0564)	(0.0193)
HCI (Human Capital – γ)	—	0.4836**	0.9506*	0.0391
		(0.2192)	(0.5326)	(0.2359)
Model Statistics				
R^2 (Within / Total)	0.0793	0.123	0.1241	0.465
F-statistic	7.59	11.53	7.65	—
Observations (N)	115	115	115	115
Countries (i)	5	5	5	5
Years (t)	23	23	23	23
Method	Pooled OLS	Pooled OLS	FE	Random Effects
Robust Error Rate (HC)	(HC1)	(HC1)	robust	robust

Source: Author's calculation

The beta convergence hypothesis is supported by the regression results, which demonstrate a strong negative impact of the starting GDP per capita (PPP) level on labor productivity growth. In the Fixed Effects paradigm, this effect is more powerful and reliable. Productivity growth is positively and significantly impacted by the Human Capital Index (HDI), particularly in the Fixed Effects model. This suggests that enhancing human capital aids in the region's nations' process of economic convergence.

Convergence speed and half-life comparison

We assess the speed of convergence to determine how quickly less developed economies catch up with more developed ones. Additionally, the "half-life" measurement illustrates how long it takes to cut the gap in development between them in half, which aids in determining the true rate of economic advancement and the efficacy of development initiatives, as is shown in Table 7.

TABLE 7. Convergence speed and half-life

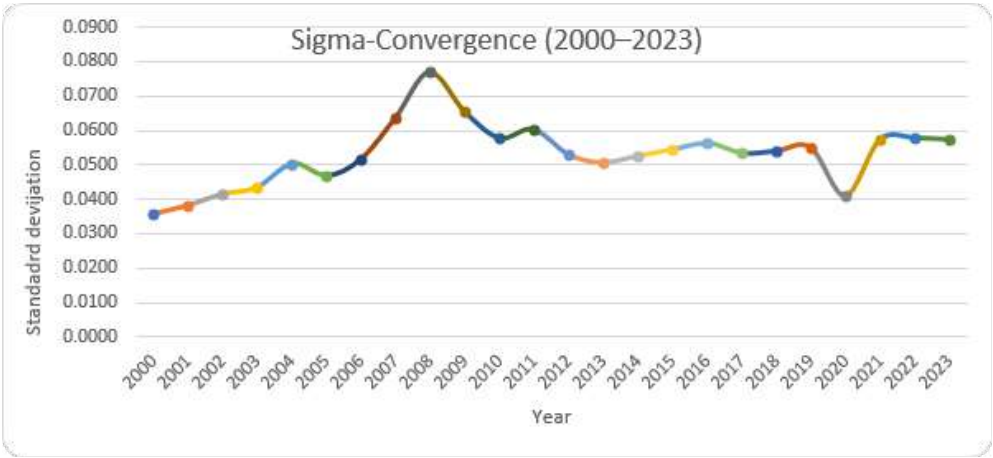
Parameter	M1 (OLS Abs)	M2 (OLS Cond)	M3 (FE)
Beta Coefficient (β)	-0.0355	-0.0913	-0.1335
λ – Convergence Speed	0.0361	0.0957	0.1433
λ × 100 (%/year)	3.6105	9.5712	14.3278
Half-life (years)	19.1982	7.242	4.8378
Effect Of Human Capital (HDI) On Convergence			
Coefficient HDI (M2 OLS)	0.4836	p = 0.027	
Coefficient HDI (M3 FE)	0.9506	p = 0.077	

Source: Author's calculation

In all three models, the coefficient β is negative and statistically significant. This coefficient confirms that there is economic convergence: countries with lower initial productivity grow faster, although this convergence is gradual. The rate of convergence is consistent with data from international organizations, which show an annual speed of 2–10%. However, the model does not account for elements like sectoral composition, migration, and institutional quality, which could restrict the degree of convergence.

Further, Figure 1 demonstrates that convergence has not been linear. The Western Balkan countries have also been negatively impacted by events like the 2002 energy crisis, COVID-19, and the global financial crisis of 2008. The standard deviation of relative productivity shows fluctuations, so convergence is not linear.

FIGURE 1. Standard Deviation of Relative Productivity



Source: Author's calculation based on data from the World Bank Indicators

Also, according to the findings of Table 7, it takes 5 to 19 years to close half of the income disparity. Convergence is actually a long-term process that necessitates institutional and political stability, among other factors. This is illustrated by the fact that, despite economic growth, incomes and benefits still diverge significantly from those in the EU.

Additionally, the HCI results demonstrate that it is both statistically significant and positive. This supports the fact that Human capital is a crucial component of convergence. Furthermore, the beneficial effects of human capital demonstrate that advancements in education, health, and general human development, in addition to economic growth, are what promote convergence.

Conclusions

Through the integration of national analysis with a comparative regional perspective, the study offers empirical evidence on the role of human capital as a mechanism that supports both productivity growth and economic convergence with the most developed European countries. The outcomes of the ARDL approach were consistent with theories that emphasize the importance of human capital as a driver of productivity. These results offer support to policies that enhance healthcare, lower skill emigration, increase vocational training, and invest in high-quality education—all of which contribute to the stock of human capital and, consequently, sustainable productivity growth.

On the other side, the analysis of panel data for the 5 Western Balkan countries reveals a clear process of labor productivity convergence, positively influenced by human capital. These results underline the importance of development policies

that focus on investing in education and improving social conditions to boost regional economic growth and narrow the development gap between countries. One of the main drivers of convergence is investments in human capital (training, health, and education). The quality of human resources should be a priority in addition to raising GDP per capita. All this findings may help address policy implications for the countries under consideration. First, they suggest that governments in the Western Balkans should consider a long-term human capital development strategy to improve labor productivity and increase competitiveness. The results of this paper also show that in order to maintain productivity growth, these countries should aim for policies to both prevent brain drain and retain skilled and qualified people. The longer such measures and policies are postponed, the more the pace of convergence towards EU productivity levels will be delayed.

At the same time, the results of this paper suggest that GDP growth or physical capital accumulation alone cannot lead to productivity convergence. It must be supported by measures that affect the quality of the institution, the efficiency of their work, innovative capabilities and equal access to education.

However, elements that can have a big impact on the degree of convergence, like sectoral composition, migration, and institutional quality, are not included in the model. These elements would allow for more thorough research and in-depth analysis of the convergence process.

Declaration of Generative AI and AI-Assisted Technologies

> During the preparation of this work, the author(s) used Google Gemini for proofreading purposes. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the final content.

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