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Assessment of the Impact of GDP, Employment, and Unemployment on the Human Development Index (HDI) for Western Balkan Countries (2006-2023)

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Abstract

This study analyzes and presents the concrete relationships that emerge from the reciprocal linkages between the Human Development Index (HDI) and GDP per capita (constant 2015 US$), Unemployment, total (% of total labor force) (modeled ILO estimate), and the Employment-to-population ratio, 15+, total (%) (modeled ILO estimate), for Western Balkan countries during the period 2006-2023. The study also examines the correlation between the ranking positions of GDP and HDI for each Western Balkan country. Based on regression analyses, the results indicate that the upward trend of GDP per capita (constant 2015 US$) is significant for the upward tendencies of HDI, but is not a sufficient condition on its own to explain HDI growth patterns. Moreover, deviations-although not substantial-from annual ranking positions display a highly significant correlation. The weight of GDP's impact on HDI, despite varying among the Western Balkan countries, ranges between 71.38% (Albania) and 88.02% (Bosnia and Herzegovina), while the rank correlation coefficients between these two variables range from 0.875 to 0.980. Additionally, it can be stated that the (positive) impact weight of the Employment-to-population ratio, 15+, total (%) (modeled ILO estimate), on HDI also differs noticeably across Western Balkan countries, ranging from 27.67% to 72.11%. Meanwhile, the negative impact of unemployment on HDI likewise shows evident variation among countries. Separate analyses were

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conducted for each Western Balkan country included in the study, as well as a comprehensive comparative analysis.

Keywords: Human Development Index (HDI), Gross Domestic Product (GDP), Employment, Unemployment

Introduction

Evaluating the trajectory of a country's economic and social development is conceptually linked to indicators of economic growth and indicators that assess human well-being.

From a macroeconomic perspective, comparative assessments (typically presented annually) rely on indicators that reflect the internal dynamics of a country's development, while also enabling cross-country comparisons. GDP (Gross Domestic Product) is one of the most fundamental indicators used in macroeconomics to measure the magnitude of economic capacity capturing the total value of goods and services produced within a country during a given year (Bryniuk, 2023).

One representation of GDP is GDP per capita, which indicates the average amount of production or income attributed to each individual. GDP per capita is also used to compare average income levels across countries. The aim of assessing developmental progress is not merely to depict economic output or national income indicators, but also to evaluate improvements in overall human well-being. GDP may signal economic growth, but not necessarily quality of life. By its nature, GDP cannot measure human well-being (Stiglitz et al., 2009). Components related to individuals' ability to live long and healthy lives, access to education, and secure adequate living standards are not reflected in GDP. This limitation extends to its inability to capture income inequality. A country may demonstrate high GDP while still having segments of the population living in poverty, which may also be influenced by environmental factors. The extent of the informal economy likewise varies across countries (Stiglitz et al., 2009; Sen, 1999).

These limitations of GDP led the United Nations Development Programme (UNDP) in 1990 to introduce the foundational concepts of the Human Development Index (HDI) (United Nations Development Programme**,** 1990), inspired by the ideas presented in (Sen, 1999). HDI defines thresholds for low and high levels of human development. Countries are classified as having low human development when the HDI value is less than 0.550; medium human development when the index ranges from 0.550 to 0.699; high human development when the HDI is between 0.700 and 0.799; and very high human development when the index ranges from 0.800 to 1(United Nations Development Programme, 2025).

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According to UNDP methodology, the Human Development Index (HDI) is structured across three core dimensions:

1. Health, which reflects access to healthcare services and overall living conditions;
2. Education, which evaluates both mean years of schooling and expected years of schooling;
3. Standard of living, measured by GDP per capita adjusted for purchasing power parity (PPP).

The HDI offers a clearer and more comprehensive representation of the qualitative dimensions of social development, providing a balanced framework for assessing human well-being. As such, it serves as an essential tool for policymakers in shaping strategies aimed at enhancing educational outcomes, strengthening healthcare systems, and promoting social equity. These three dimensions collectively constitute a pivotal foundation for addressing global development challenges, including increased employment opportunities, poverty reduction, lower unemployment levels, and the capacity to adapt to advances in innovative technologies that support efficient resource utilization and improved living standards.

The contemporary literature documents a consistent relationship between human development and economic growth. Shome & Tondon, (2010) investigate the equilibrium between human development and economic expansion for selected ASEAN countries during 2000-2009. Pham et al. (2016) assess the impact of HDI on economic growth for the period 1999-2014 across 30 countries-13 of which were classified as developed and 17 as underdeveloped countries. In the study, the authors, in addition to the GDP variable, also evaluated three variables—the percentage of workers, physical capital (investment), and the Human Development Index (HDI)—and concluded that, alongside the mutual effects of each variable on GDP, HDI exerted a substantial influence on economic growth and stability. Furthermore, they emphasize the importance of capital investment, which should also be directed toward the human factor, given that the Human Development Index (HDI) represents one of the key indicators influencing economic growth and promoting economic stability.

Elistia & Syahzuni (2018) examine the correlation between HDI and economic growth during 2010-2016 for 10 countries. In the study, the authors conclude that there is a significant and reciprocal relationship between the two variables, GDP and the Human Development Index (HDI).

Taqi et al. (2021) conduct a long-term analysis of the HDI–economic growth relationship for the period 1980-2018, identifying a strong and statistically significant correlation. The authors examine and assess the causal relationships and reciprocal effects observed between GDP and the Human

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Development Index (HDI), where HDI is evaluated as a significant factor in the trajectory of economic development. Furthermore, Singh et al. (2025) investigate the determinants of the Human Development Index using regression analysis, concluding that GDP per capita exerts a positive influence on HDI while recognizing that social determinants such as healthcare and education remain critical factors in improving human development outcomes. Jednak et al., (2018) provide a comparative evaluation of development patterns in Southeast European countries by scrutinizing the relationship between HDI and economic growth indicators. The authors of the study emphasize the highly significant effects of the Human Development Index (HDI) on the economic empowerment and stability of each country included in the study.

In addition to studies on the relationship between the impact of GDP per capita to HDI, empirical research also examines the effects of additional socioeconomic determinants including unemployment and poverty on HDI levels (Priambodo, 2021; Damayanti & Asmara, 2025; Arianto & Cahyono, 2025, Dhanyalakshmi & Sandhya, 2025; *Giyasova et al., 2025*). In contemporary literature, there are numerous articles and scientific publications that study the reciprocal effects of the Human Development Index (HDI) on economic factors.

The present study provides an analytical assessment of Western Balkan countries, evaluating the relationships and impact magnitudes between HDI and GDP per capita, as well as estimating the relative weight (in percentage terms) of GDP's contribution to HDI formation. The analysis further investigates the rank correlation between these two variables to detect long-term tendencies, interdependencies, and deviations in their annual trajectories. The study covers the period 2006-2023. In addition, the influence of employment and unemployment on HDI performance across the Western Balkans is examined.

When viewed through the lens of economic development, Western Balkan countries continue to lag behind the economic performance of European Union member countries. In the 2023 HDI ranking, Western Balkan countries occupy positions ranging from 48th to 74th, while in terms of GNI per capita, they rank between 62nd and 87th out of 193 countries. By contrast, all EU member states hold substantially higher rankings. Investment levels in education and healthcare in Western Balkan countries also remain considerably lower than EU averages. This disparity underscores the pressing need for more comprehensive and structured reforms aimed at advancing both economic and social development across the region.

The fundamental objective of this study is to conduct a comprehensive and detailed research analysis in order to examine the interrelationships and mutual effects among selected economic development variables conditioned

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by the human factor (including GDP per capita; the Human Development Index (HDI); the percentage of workers; employment; and unemployment). Furthermore, the study seeks to present the empirical findings alongside appropriate recommendations that may be derived from the results. In line with the fulfillment of this objective, the following hypotheses are proposed.

- H1: A statistically significant and positive correlation exists between HDI and GDP per capita in the Western Balkan countries included in the study.
- H2: A positive correlation exists between HDI and employment levels in the Western Balkan countries.
- H3: A negative correlation exists between HDI and unemployment, accompanied by notable cross-country variation within the Western Balkans.
- H4: A strong rank correlation exists between annual GDP per capita rankings and annual HDI rankings for the period 2006-2023.

Methodology and Empirical Results

The methodological framework of the study consists of the following stages:

- Step 1: Identification of the variables under examination, the study period, and the selected Western Balkan countries. Corresponding data tables for each variable are presented.
- Step 2: Formulation of the research hypotheses derived from the proposed analytical model.
- Step 3: Specification of the empirical models, determination of the conditions required for their application, and selection of the statistical tests to be employed.
- Step 4: Practical implementation of the models and analytical evaluation of the empirical results, including hypothesis testing for each estimated model across all Western Balkan countries.

Finally, the study presents the concluding findings and implications.

The empirical analysis employs two main methodological approaches: linear regression and rank correlation analysis are applied separately to each Western Balkan country. The independent variables (X) included in the regression models are:

1. GDP per capita (constant 2015 US$)
2. Employment to population ratio, 15+, total (%) (modeled ILO estimate)
3. Unemployment, total (% of total labor force) (modeled ILO estimate) *(Data source: World Development Indicators, last updated 7 October 2025.)*

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The dependent variable (Y) of the study is the: Human Development Index (HDI) *(Data source: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI, extracted on 25 October 2025.)*

Data were collected for each Western Balkan country for the period 2006-2023. The application of linear regression requires compliance with the assumptions of the Gauss-Markov Theorem, including: linearity of the relationship between variables, independence of errors, normality of residuals, homoscedasticity of residuals, and absence of multicollinearity.

To assess the normality of the residuals, the Shapiro-Wilk test and the Jarque-Bera test are applied. Homoscedasticity is examined using the Breusch-Pagan test, while autocorrelation is evaluated through the Durbin-Watson test. Each regression model is estimated for a pair of variables (X, Y). For each model examined in the study, the number of observations (18 observations) relative to the number of independent variables satisfies Evans' Rule, which suggests that $n/k \geq 10$ (where n is the number of observations and k is the number of independent variables), requiring at least ten observations per predictor.

For each regression model applied to the respective Western Balkan countries, the correlation between the independent variable and the dependent variable was examined to determine the existence of a relationship between them, using Pearson's correlation coefficient and the Student's t-test to assess the significance of the Pearson coefficient.

For the assessment of rank correlation, examined separately based on the rankings of GDP and HDI over the period 2006-2023, the Spearman rank correlation coefficient was used.

Numerical Application

Table 1 presents the statistical indicators of the variables included in the study for each Western Balkan country over the period 2006–2023.

Table 1: Statistical summary of variables

Variable	Statistical indicators	Country				
		Albania	Bosnia and Herzegovina	North Macedonia	Montenegro	Serbia
HDI	Min.	0.732	0.701	0.726	0.785	0.753
	Max.	0.810	0.804	0.815	0.862	0.833
	Average	0.784	0.758	0.781	0.830	0.795
	Median	0.797	0.767	0.792	0.836	0.799
	Std Dev	0.023	0.032	0.027	0.021	0.022
GDP per capita (constant 2015 US$)	Min.	2894.36	3418.76	3866.75	5435.89	5016.41
	Max.	5444.93	6493.22	6393.77	8304.26	8210.55
	Average	4045.85	4761.34	5168.92	6604.90	6236.86
	Median	3932.68	4536.82	5158.22	6389.33	5768.43
	Std Dev	694.04	937.38	756.06	790.01	881.16
	Min.	43.78	35.51	33.87	36.19	38.12

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Employment to population ratio, 15+, total (%)	Max.	54.32	44.16	45.66	46.30	52.77
	Average	49.13	38.87	39.72	41.09	44.80
	Median	44.865	36.47	39.48	42.75	41.93
	Std Dev	3.411	2.542	3.605	2.626	4.603
Unemployment, total (% of total labor force)	Min.	10.11	10.67	13.17	14.62	8.27
	Max.	18.06	31.11	36.39	24.79	24.00
	Average	13.70	22.63	25.73	17.94	15.63
	Median	17.62	27.61	27.31	17.80	18.44
	Std Dev	2.300	6.370	7.731	2.486	5.186

Table 2 presents the average values of the variables by sub-periods for the Western Balkan countries included in the study.

Table 2: Average values of variables over the given period

Countries	a, b, c, d	2006-2010	2011-2015	2016-2020	2021-2023
Albania	a	0.750	0.792	0.799	0.803
	b	3277.06	3810.83	4376.27	5168.18
	c	46.69	47.01	51.01	53.58
	d	14.48	15.59	12.90	10.57
Bosnia and Herzegovina	a	0.715	0.753	0.782	0.795
	b	3773.40	4322.17	5282.12	6271.91
	c	37.58	36.69	40.00	42.78
	d	26.98	27.66	19.18	12.74
North Macedonia	a	0.747	0.782	0.802	0.802
	b	4277.50	4919.86	5668.89	6236.44
	c	35.55	38.50	42.06	44.80
	d	34.21	29.25	20.47	14.48
Montenegro	a	0.802	0.830	0.843	0.852
	b	5851.13	6224.30	7015.42	7811.35
	c	38.56	40.72	44.13	40.84
	d	20.02	18.95	16.40	15.34
Serbia	a	0.768	0.792	0.811	0.822
	b	5490.47	5761.30	6494.20	7844.54
	c	42.91	40.02	47.07	52.14
	d	17.58	21.20	12.17	8.85

a-HDI; b- GDP per capita (constant 2015 US$); c-Employment to population ratio, 15+, total (%) (modeled ILO estimate); d-Unemployment, total (% of total labor force) (modeled ILO estimate)

Table 3 presents the frequency distribution of HDI values across the specified intervals.

Table 3: Frequency distribution of HDI values in given intervals

Countries Intervals	Albania	Bosnia and Herzegovina	North Macedonia	Montenegro	Serbia
[0.700-0.725]	-	5-years	-	-	-
[0.726-0.750]	3 -years	2-years	2-years	-	-
[0.751-0.775]	2-years	3-years	5-years	-	5-years

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[0.776-0.800]	9-years	7-years	6-years	2-years	4-years
[0.801-0.825]	4-years	1-year	5-years	5-years	7-years
[0.826-0.850]	-	-	-	8-years	2-years
[0.851-0.875]	-	-	-	3-years	-
[0.875-0.900]	-	-	-	-	-

The results obtained for each Western Balkan country, applying the model with GDP per capita (constant 2015 US$) as the independent variable and HDI as the dependent variable, are presented in the following tables for each country.

Table 4(1): Summary of regression model Statistics, **Albania**

R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
0.8449	0.7138	0.6959	0.0131	39.9009	1	16	1.02E-05	$\hat{Y}$ = 0.6668+3E-0.5 x GDP

Regression coefficients

Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
Intercept	0.6668	0.0188	35.4591	1.23E-16	[0.626917245	0.706643606]
GDP	2.896E-05	4.58451E-06	6.3167	1.02E-05	[1.92403E-05	3.86778E-05]

The Pearson correlation coefficient, $\rho = 0.8449$, indicates a very strong positive relationship between HDI and GDP per capita. The significance test of the correlation coefficient (Student's *t*-test) shows that $t = 6.3178 > t_{0.025,16} = 2.120$. . From Table 4(1), R^2 indicates that 71.38% of the variance in the dependent variable Y is explained by GDP. This suggests that the model fits the data well. The F-value, $F = 39.9009 > F_{0.05,1,16} = 4.49$, and Sig.F= 1.02E-05 < 0.01 indicate that the model is statistically significant; in other words, GDP has a substantial effect on the dependent variable Y. The regression equation is: HDI= 0.6668 + 2.896E-05 x GDP. The validity of the model was verified using the following tests:

Residual Normality Tests:
Shapiro-Wilk $p > 0.05$, indicating that the residuals are normally distributed.
Jarque-Bera $p > 0.05$ indicating no deviations from normality.
These results confirm that the normality assumption is satisfied.

Homoscedasticity Test (Breuch-Pagam): p-value > 0.05, indicating no evidence of heteroskedasticity; thus, the variance of the residuals remains constant.

In conclusion, the model can be considered statistically robust and valid for economic interpretation, where an increase in GDP per capita is associated with a significant and consistent rise in HDI.

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Table 4(2): Summary of regression model Statistics, **Bosnia and Herzegovina**

R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
0.9382	0.8802	0.8727	0.0117	117.5356	1	16	8.8E-09	$\hat{Y}$ = 0.6017+ 3E-05 x GDP

Regression coefficients

Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
Intercept	0.6017	0.0146	41.0952	1.18E-17	[0.570663938	0.632741884582004]
GDP	0.000033	0.0000030	10.8414	8.82E-09	[2.63E-05	3.91E-05]

The Pearson correlation coefficient, $\rho = 0.9382$, indicates a very strong positive relationship, and the significance test of the correlation coefficient (Student's *t*-test) shows that t = 10.842 $> t_{0.025,16} = 2.120$. From Table 4(2), R^2 indicates that 88.02% of the variance in the dependent variable Y is explained by GDP. This suggests that the model fits the data well. The F-value, F = 117.5356 $> F_{0.05,1,16} = 4.49$, and Sig.F= 8.8E-09 < 0.01 indicate that the model is statistically significant; in other words, GDP has a substantial effect on the dependent variable Y. The regression equation is: HDI = 0.6017 + 3E-05 x GDP.

All assumptions of the linear model (normality, homoscedasticity, linearity) are fully satisfied.

Therefore, the model can be considered statistically robust.

Table 4(3): Summary of regression model Statistics, **North Macedonia**

R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
0.8851	0.7835	0.7700	0.0128	57.8984	1	16	1.05E-06	$\hat{Y}$ = 0.6191+3E-05 x GDP

Regression coefficients

Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
Intercept	0.6191	0.0215	28.7860	3.28E-15	[0.573500707	0.664685175]
GDP	0.0000313	4.119E-06	7.6091	1.05E-06	[2.2612E-05	4.01E-05]

The Pearson correlation coefficient, $\rho = 0.8851$, and the significance test of the correlation coefficient (Student's *t*-test) show that t = 7.609 $> t_{0.025,16} = 2.120$. From Table 4(3), R^2 indicates that 78.35% of the variance in the dependent variable Y is explained by GDP, suggesting a good fit of the model to the data. The F-value, F = 57.8984 $> F_{0.05,1,16} = 4.49$ and Sig.F = 1.05E-06 < 0.01, indicate that the model is statistically significant. The regression equation is: HDI = 0.6191 + 3E-05 x GDP.

All assumptions of the linear model (normality, homoscedasticity, linearity) are fully satisfied.

Therefore, the model is considered statistically robust.

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Table 4(4): Summary of regression model Statistics, **Montenegro**

R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
0.8837	0.7808	0.7671	0.0100	57.0080	1	16	1.16E-06	$\hat{Y}$ = 0.676 +2E-05 x GDP

Regression coefficients

Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
Intercept	0.675962	0.020472	33.0188	3.79E-16	[0.632563477	0.719361144]
GDP	2.32E-05	3.08E-06	7.55036	1.16E-06	[1.67193E-05	2.97728E-05]

The Pearson correlation coefficient, ρ = 0.8837, and the significance test of the correlation coefficient (Student's *t*-test) indicate that t = 7.550 > $t_{0.025,16}$ = 2.120. From Table 4(4), R^2 shows that 78.08% of the variance in the dependent variable Y is explained by GDP, indicating a good fit of the model to the data. The F-value, F = 57.0080 > $F_{0.05,1,16}$ = 4.49 and Sig.F = 1.16E-06 < 0.01, demonstrate that the model is statistically significant. The regression equation is: HDI = 0.676 + 2E-05 x GDP.

All assumptions of the linear model (normality, homoscedasticity, linearity) are fully satisfied. Therefore, the model is considered statistically robust.

Table 4(5): Summary of regression model Statistics, **Serbia**

R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
0.8687	0.7547	0.7393	0.0112	49.2138	1	16	2.92E-06	$\hat{Y}$ = 0.6601 + 2E-05 x GDP

Regression coefficients

Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
Intercept	0.660146	0.0194591	33.9248	2.46E-16	[0.618895386	0.701398415]
GDP	2.1684E-05	3.09102E-06	7.0153	2.92E-06	[1.51316E-05	2.8237E-05]

The Pearson correlation coefficient, ρ = 0.8687, and the significance test of the correlation coefficient (Student's *t*-test) indicate that t = 7.016 > $t_{0.025,16}$ = 2.120. From Table 4(5), R^2 shows that 75.47% of the variance in the dependent variable Y is explained by GDP, indicating a good fit of the model to the data. The F-value, F = 49.2138 > $F_{0.05,1,16}$ = 4.49 and Sig.F = 2.92E-06 < 0.01 demonstrate that the model is statistically significant. The regression equation is: HDI = 0.6601 + 2E-05 x GDP.

All assumptions of the linear model (normality, homoscedasticity, linearity) are fully satisfied. Therefore, the model is considered statistically robust. Ultimately, for all five Western Balkan countries, the first hypothesis is confirmed: there is a significant positive correlation between HDI and GDP per capita for the countries included in the study.

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Table 5 presents the rankings of GDP and HDI throughout the period 2006-2023 for all countries included in the study. For each Western Balkan country, the Spearman rank correlation coefficient was calculated.

Table 5: Rankings of GDP and HDI by year for each Western Balkan Country

Year	Country									
	Albania		Bosnia and Herzegovina		North Macedonia		Montenegro		Serbia	
	GDP Ranking	HDI Ranking	GDP Ranking	HDI Ranking	GDP Ranking	HDI Ranking	GDP Ranking	HDI Ranking	GDP Ranking	HDI Ranking
2006	18	18	18	18	18	18	18	18	18	18
2007	17	17	17	17	17	17	17	17	17	17
2008	16	16	16	16	16	16	11	16	13	16
2009	15	15	15	15	15	15	16	15	16	15
2010	14	14	14	14	14	14	15	14	15	14
2011	13	13	13	13	12	13	13	13	12	13
2012	12	12	12	12	13	12	14	12	11	12
2013	11	11	11	11	11	10	12	11	10	11
2014	10	7	10	10	10	9	10	10	14	10
2015	9	7	9	9	9	7	8	8	9	9
2016	8	7	8	8	8	6	7	9	8	8
2017	7	5	7	7	7	4	6	5	7	6
2018	5	4	6	4	6	2	4	4	6	4
2019	4	3	4	3	4	5	3	3	4	3
2020	6	9.5	5	5.5	5	8	9	6	5	5
2021	3	9.5	3	5.5	3	11	5	7	3	7
2022	2	2	2	2	2	3	2	2	2	2
2023	1	1	1	1	1	1	1	1	1	1
Spearman's rho	ρ_{sp} = 0.913		ρ_{sp} = 0.980		ρ_{sp} = 0.875		ρ_{sp} = 0.948		ρ_{sp} = 0.947	

From the table of critical values for Spearman's rank correlation coefficient (ρ) at α = 0.05 (two-tailed), for n = 18 observations, we have $|\rho_{sp}| > \rho_{critical} = 0.467$, indicating that the correlation is statistically significant. This conclusion holds for each country included in the study. The results in Table 5 show that Hypothesis H4 is satisfied: there is a strong rank correlation between the annual rankings of GDP per capita and the annual rankings of HDI for the period 2006-2023.

The tables below present a summary of regression model statistics for the relationships between employment, unemployment, and HDI. Model 1 shows the relationship between employment and HDI, while Model 2 presents the relationship between unemployment and HDI for the countries included in the study.

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Table 6(1): Summary of regression model Statistics of (HDI, Employment-Model 1) and (HDI, unemployment-Model 2); **Albania**

Model	R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
1	0.52599	0.27666	0.23146	0.02086	6.11973	1	16	0.02495	$\hat{Y}$ = 0.6037 + 0.0037 x X_1
2	0.3456	0.1194	0.0644	0.0230	2.1696	1	16	0.1602	$\hat{Y}$ = 0.8329 - 0.0036 x X_2

Regression coefficients

Model	Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
1	Intercept	0.6037	0.0730	8.2694	3.6E-07	[0.448970598	0.758515986]
	X_1	0.0037	0.0015	2.4738	0.0250	[0.000524748	0.006811287]
2	Intercept	0.8329	0.0337	24.7253	3.56E-14	[0.761503555	0.904328955]
	X_2	-0.0036	0.0024	-1.4730	0.1602	[-0.008719326	0.00157004]

X_1 −Employment to population ratio, 15+, total (%); X_2 - Unemployment, total (% of total labor force)

Table 6(2): Summary of regression model Statistics of (HDI, Employment-Model 1) and (HDI, unemployment-Model 2); **Bosnia and Herzegovina**

Model	R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
1	0.7080	0.5013	0.4701	0.0238	16.0831	1	16	0.0010	$\hat{Y}$ = 0.4034 + 0.0091 x X_1
2	0.7934	0.6296	0.6064	0.0205	27.1914	1	16	8.5E-05	$\hat{Y}$ = 08498 – 0.0041 x X_2

Regression coefficients

Model	Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
1	Intercept	0.4034	0.0885	4.5582	0.0003	[0.21579	0.591017532]
	X_1	0.0091	0.0023	4.0104	0.0010	[0.004295156	0.013928034]
2	Intercept	0.8498	0.0183	46.3528	1.76E-18	[0.810959192	0.888691239]
	X_2	-0.0041	0.0008	-5.2145	8.51E-05	[-0.005732147	-0.002418575]

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Table 6(3): Summary of regression model Statistics of (HDI, Employment-Model 1) and (HDI, unemployment-Model 2); **North Macedonia**

Model	R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
1	0.8492	0.7211	0.7036	0.0146	41.3625	1	16	8.3E-06	$\hat{Y}$ = 0.5307 + 0.0063 x X_1
2	0.8106	0.6571	0.6356	0.0162	30.6567	1	16	4.5E-05	$\hat{Y}$ = 0.8533 - 0.0028 x X_2

Regression coefficients

Model	Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
1	Intercept	0.5307	0.0391	13.5739	3.38E-10	[0.447781525	0.613532034]
	X_1	0.0063	0.0010	6.4314	8.30E-06	[0.004227218	0.008384182]
2	Intercept	0.8533	0.0136	62.7963	1.40E-20	[0.824527182	0.882141693]
	X_2	-0.0028	0.0005	-5.5368	4.51E-05	[-0.003882175	-0.00173248]

Table 6(4): Summary of regression model Statistics of (HDI, Employment-Model 1) and (HDI, unemployment-Model 2); **Montenegro**

Model	R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
1	0.7389	0.5460	0.5177	0.0144	19.2443	1	16	0.0005	$\hat{Y}$ = 0.5893 + 0.0058 x X_1
2	0.8398	0.7052	0.6868	0.0116	38.2747	1	16	1.3E-05	$\hat{Y}$ = 0.9554 – 0.007 x X_2

Regression coefficients

Model	Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
1	Intercept	0.5893	0.0549	10.7389	1.01E-08	[0.472931556	0.705574381]
	X_1	0.0058	0.0013	4.3868	0.0005	[0.003021488	0.008672542]
2	Intercept	0.9554	0.0205	46.5209	1.66E-18	[0.91188359	0.998958567]
	X_2	-0.0070	0.0011	-6.1867	1.30E-05	[-0.009425737	-0.004614678]

Table 6(5): Summary of regression model Statistics of (HDI, Employment-Model 1) and (HDI, unemployment-Model 2); **Serbia**

Model	R	R Square	Adjusted R square	Std. Error	F	df1	df2	Sig. F	regression equation
1	0.6931	0.4803	0.4479	0.0163	14.7890	1	16	0.0014	$\hat{Y}$ = 0.647 + 0.0033 x X_1
2	0.7011	0.4916	0.4598	0.0162	15.4689	1	16	0.0012	$\hat{Y}$ = 0.8419 – 0.003 x X_2

Regression coefficients

Model	Variable	Coefficient	Std. Error	t-statistic	p-value	95% Confidence Interval	
1	Intercept	0.6470	0.0388	16.6885	1.53E-11	[0.564836648	0.729218036]
	X_1	0.0033	0.0009	3.8456	0.0014	[0.001486066	0.005137037]
2	Intercept	0.8419	0.0124	67.8044	4.12E-21	[0.81554456	0.868186411]
	X_2	-0.0030	0.0008	-3.9331	0.0012	[-0.004576629	-0.001370916]

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Following the analysis and interpretations as presented in Tables 4, it can be observed that there is a strong positive relationship between HDI and employment for four Western Balkan countries, with the exception of Albania, where the relationship is moderately positive.

Regarding the relationship between HDI and unemployment, a negative effect is observed in four of the studied countries, while in Albania the relationship is weak but still negatively oriented. These conclusions are also supported by the statistical indicators, particularly the values of R, R^2 and F. For these models, all assumptions of the linear model (normality, homoscedasticity, linearity) were evaluated and found to be satisfied for the four countries included in the study, with the exception of Albania in the analysis of the relationship between HDI and unemployment. Therefore, the models can be considered statistically robust.

From Table 3, considering the HDI classification, Montenegro is classified as having very high human development for 16 years, Serbia for 2 years, North Macedonia for 5 years, Albania for 4 years, and Bosnia and Herzegovina for 1 year.

Based on the assessment of the relationship between HDI and employment, Hypothesis H2 is confirmed: there is a positive correlation between HDI and employment for the Western Balkan countries included in the study. Regarding the relationship between HDI and unemployment, Hypothesis H3 is confirmed for four countries. For Albania, however, the regression analysis shows that although the unemployment coefficient has a negative sign, suggesting a possible inverse relationship with HDI, this effect is not statistically significant (p = 0.1602). Therefore, there is insufficient evidence to support the hypothesis that unemployment is significantly negatively associated with HDI in Albania. Table 7 presents the correlation matrix between the variables according to the countries taken into the study.

Table 7: Matrix of correlations between variables for the period 2006-2023

Countries		GDP	HDI	Employment	Unemployment
Albania	GDP	1			
	HDI	0.8449	1.0000		
	Employment	0.7719	0.5260	1.0000	
	Unemployment	-0.6872	-0.3456	-0.8972	1.0000
Bosnia and Herzegovina	GDP	1.0000			
	HDI	0.9382	1.0000		
	Employment	0.8722	0.7080	1.0000	
	Unemployment	-0.9306	-0.7934	-0.9867	1.0000
North Macedonia	GDP	1.0000			
	HDI	0.8851	1.0000		
	Employment	0.9868	0.8492	1.0000	
	Unemployment	-0.9844	-0.8106	-0.9915	1.0000
	GDP	1.0000			
	HDI	0.8837	1.0000		

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Montenegro	Employment	0.6326	0.7389	1.0000	
	Unemployment	-0.8802	-0.8398	-0.7609	1.0000
Serbia	GDP	1.0000			
	HDI	0.8687	1.0000		
	Employment	0.8699	0.6931	1.0000	
	Unemployment	-0.8291	-0.7011	-0.9657	1.0000

The table below provides two of the indicators of values that enable the composition of the human development index (HDI), such as education and health expenditures realized as a percentage of GDP, for each Western Balkan country studied for the period (2006-2023).

Table 8. Indicators for expenditure on education and healthcare (% GDP) for the period 2006-2023

Indicator		Albania	Bosnia and Herzegovina	North Macedonia	Montenegro	Serbia
Education expenditure (% of GDP)	Min.	2.1	4.1	2.7	4	3.6
	Max.	3.9	4.8	4	5.7	4.5
	Average	3.15	4.56	3.64	4.53	4.12
Healthcare expenditure (% of GDP)	Min.	2.9	5.7	3.9	5.8	6.5
	Max.	3.7	6.8	4.6	6.9	7.9
	Average	2.99	6.39	4.24	6.42	7.08

(Source: UNESCO, World Bank, WHO)

Investment in education is linked to human capital, contributing to the development of innovation and the application of new technologies in increasing long-term productivity. Studies show that a 1% increase in GDP in education has a significant impact on long-term productivity. The European Union average (for education expenditure) fluctuates around 5% of GDP for 2023. From the data of the Western Balkan countries taken in the study on education expenditure, it is found that: Albania is below the average of the European Union and the region; at the end of the period it fluctuates around the figure of 2.1% of GDP. North Macedonia is below the European Union figures for education expenditure and this has a long-term downward trend; at the end of the period it fluctuates at the figure of 2.7% of GDP. Bosnia and Herzegovina is one of the countries with the highest average expenditure on education in the region; Montenegro and Serbia also have expenditure on education of 4.2% and 4% of GDP, respectively.

Even in terms of health expenditure, the Western Balkan countries are below the average level of the European Union. The European Union average for health expenditure for 2023 fluctuates around 7.3% of GDP. While the Western Balkan countries at the end of the period fluctuated respectively in the figures: Albania 3.5% of GDP, Bosnia and Herzegovina 6% of GDP, Macedonia 4.3% of GDP, Montenegro 5.8% of GDP and Serbia 6.7% of GDP at the end of the period under study. Comparing the above table with Table 1,

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it is not difficult to conclude that countries that have higher expenditure on education and health also have better GDP per capita indicators. Therefore, it is recommended for the Western Balkan countries to increase expenditure on education and health to at least around the European Union average. The results of the study analysis, which examined the relationship between variables (GDP per capita, employment, unemployment) and the HDI, more clearly evidence this recommendation.

Conclusions

The study analyzed and explicitly examined the relationships between the Human Development Index (HDI), GDP per capita, employment, and unemployment over the period 2006-2023. The analysis was supported by regression models and the necessary statistical tests. The study showed that upward trends in GDP have a significant influence on the upward trends in HDI, but they do not constitute a sufficient or complete condition for changes in HDI growth. The impact of GDP on HDI for the countries studied over the period ranges from 71.38% to 88.02%. In the rank correlation between GDP and HDI, there is a very strong long-term relationship and GDP and HDI move together in the same direction. Similarly, the effect of employment on HDI exhibits considerable variation among countries, ranging from 27.67% to 72.7%. The negative impact of unemployment on HDI also shows notable differences among the Western Balkan countries. This analysis can provide deeper insights for future studies on economic and social development in the Western Balkan countries. As highlighted based on the analysis of the results, each country must necessarily address the need to increase expenditure, especially on education and health (% GDP), since even in the Western Balkan region, countries that have higher GDP per capita than other countries also have expenditure on education and health closer to the average value of this indicator in the European Union.

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