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Impact of Investments on Productivity and Tourism Development in Bosnia and Herzegovina*

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Abstract

This paper examines the short- and long-run effects of investment on tourism value added and labour productivity in Bosnia and Herzegovina over the period 2000–2023. The analysis distinguishes between total investment in tourism and gross investment in long-term assets. Results indicate that long-term investments in fixed assets have a significant positive impact on both tourism value added and labour productivity: a 1% increase in gross investment in long-term assets raises tourism value added by 1.36% and labour productivity by 0.83%. In contrast, total investment in tourism exhibits a more complex pattern: while it positively affects tourism value added, it negatively affects labour productivity, highlighting a paradox whereby overall sector growth does not automatically translate into higher productivity per employee. This effect likely reflects structural constraints, including seasonality, spatial concentration of demand, prevalence of low-skilled or seasonal employment, and inefficient capital allocation. Short-run effects are limited, although the error-correction mechanism confirms stable adjustment

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toward long-run equilibrium, with approximately 60% of deviations corrected annually. The findings underscore the importance of sustained fixed-asset investment and capital deepening for enhancing sectoral output and labour productivity, while indicating that the quantity of investment alone is insufficient without addressing structural and institutional constraints.

Keywords: *tourism investment, productivity, cointegration, Bosnia and Herzegovina, fixed assets*

JEL classification*: O47, C32, Z32*

1. Introduction

Tourism is widely recognized as a catalyst of economic diversification and regional cohesion, accounting for 9.1% of global GDP and roughly one in eleven jobs worldwide (United Nations World Tourism Organization [UNWTO], 2024). In Bosnia and Herzegovina (BiH) the sector's direct contribution rose from 2.1% of GDP in 2000 to 5.4% in 2019, outpacing manufacturing and agriculture in relative terms (World Travel & Tourism Council [WTTC], 2024). Yet BiH continues to trail its Western-Balkan peers on value added per employee and on the share of gross fixed capital formation channelled into tourism. Although national strategies repeatedly emphasize investment as a policy lever, empirical evidence on how different categories of capital formation translate into productivity gains is still sparse.

In line with growth theory, capital deepening refers to an increase in the amount of capital available per worker, usually through investment in infrastructure, equipment and technology, which is expected to enhance labour productivity (Romer, 1990; Sharpley, 2020; Solow, 1956). However, in tourism, the productivity effects of investment depend not only on the volume of investment, but also on its structure and purpose. Ivanovic et al. (2011) emphasize that FDI is important for technological development and export capacity, but also note that a large share of foreign investment in Croatia was directed toward infrastructure, while stronger multiplier effects could be expected from investment in more technologically advanced and productive activities. This distinction is important because investment in tourism may increase capacity and output without necessarily improving labour productivity if it is not accompanied by technological upgrading, better business processes, higher service quality and greater value added per worker. In this context, the available literature has not sufficiently isolated the short- and long-run effects of total investment and fixed-asset investment on tourism value added and labour productivity, which defines the empirical contribution of the present study.

Unlike other CEE and Adriatic economies, Bosnia and Herzegovina represents a particularly specific case due to fragmented tourism governance, the absence of a harmonised state-level investment framework, and persistently low capital

intensity despite sustained growth in tourist arrivals and overnight stays. In contrast to Croatia, where tourism investment has been more strongly integrated with productivity-enhancing accommodation upgrading, or Montenegro, where tourism expansion has been more clearly linked to targeted destination development, BiH combines demand growth with weak capital deepening, spatial concentration, and institutional fragmentation. These structural features make Bosnia and Herzegovina a particularly suitable case for analysing whether different forms of investment generate distinct long-run effects on tourism value added and labour productivity.

Against this background, the causal relationship between investment flows and tourism-sector performance in BiH remains insufficiently measured. Accordingly, this study quantifies both the short- and long-run effects of total investment in tourism (TI) and gross investment in long-term assets (GI) on tourism value added (AVT) as an indicator of sectoral development, and on value added per employee (AVPE) as an indicator of labour productivity.

The aim of the research is to clarify whether investment-led growth in Bosnia and Herzegovina's tourism sector leads to measurable productivity improvements, as well as to distinguish the short- and long-term effects of total investment in tourism and gross investment in long-term assets on total value added in tourism and productivity measured as added value per employee.

Hypotheses:

> H1: *Total Investments in the tourism sector have a positive impact on its development, measured by the added value of this sector, as well as on worker productivity.*
>
> H2: *Gross investment in long-term assets have a positive impact on its development, measured by the added value of this sector, as well as on worker productivity.*

By integrating investment-led growth theory with the tourism-led growth hypothesis, the research advances the understanding of how different categories of capital formation affect productivity in a small post-transition economy—a topic that remains under-represented in the literature. Methodologically, the study contributes by simultaneously distinguishing between total tourism investment and gross investment in long-term assets within an Autoregressive Distributed Lag – Error Correction Model (ARDL–ECM) framework applied to a data-constrained transition economy characterised by structural breaks and limited time-series observations. Empirically, the main novelty of the paper lies in identifying a paradoxical negative long-run effect of total tourism investment on labour productivity, in contrast to the generally positive productivity effects reported in much of the CEE and Adriatic tourism-investment literature. This finding suggests that the volume of investment alone is insufficient to improve

productivity unless accompanied by institutional coordination, efficient capital allocation, and investment in productivity-enhancing fixed assets. The findings are intended to assist policymakers in designing incentive programmes, prioritising fixed-asset formation, public–private partnerships, and alternative financing instruments.

2. Literature review

The relationship between capital formation and tourism performance is usually framed within two complementary strands of theory. These two strands can be analytically distinguished as: (i) the investment–productivity nexus, which focuses on the role of capital deepening in enhancing labour productivity, and (ii) the tourism–growth nexus, which emphasises the contribution of tourism activity to overall economic performance. The first strand, referred to as the investment–productivity nexus, is grounded in the investment-led-growth paradigm rooted in Solow's (1956) neoclassical model and its endogenous extensions (Romer, 1990), which emphasise the role of capital deepening in enhancing labour productivity and output. The second strand, known as the tourism–growth nexus, is reflected in the tourism-led-growth (TLG) hypothesis, which posits that tourism receipts stimulate economic growth through export earnings, employment, and knowledge diffusion (Balaguer & Cantavella-Jordá, 2002). Recent empirical research (post-2010) integrates the two, suggesting that targeted tourism investment amplifies the TLG channel by lifting total-factor productivity (Dwyer et al., 2010).

Building on these two strands, this study integrates the investment–productivity and tourism–growth perspectives by examining total investment and gross investment in long-term assets as distinct drivers of tourism value added and labour productivity (AVPE). In this framework, AVT captures aggregate tourism performance in line with the tourism–growth literature, while AVPE reflects productivity dynamics associated with capital deepening.

Empirical evidence suggests that tourism-related investment can support broader economic and social outcomes, although its productivity effects depend on the structure, purpose and institutional embeddedness of investment. Castilho and Fuinhas (2025), using a panel of 24 EU countries for the period 2006–2019, find that tourism capital investment contributes to reducing income inequality and poverty, indicating that tourism investment may have developmental effects beyond sectoral output alone. This argument is consistent with Sharpley's (2020) broader critique of sustainable tourism development, which stresses that tourism does not automatically generate sustainable development outcomes unless it is embedded in wider development processes and supported by appropriate policy and institutional conditions. Therefore, investment volume alone is insufficient to

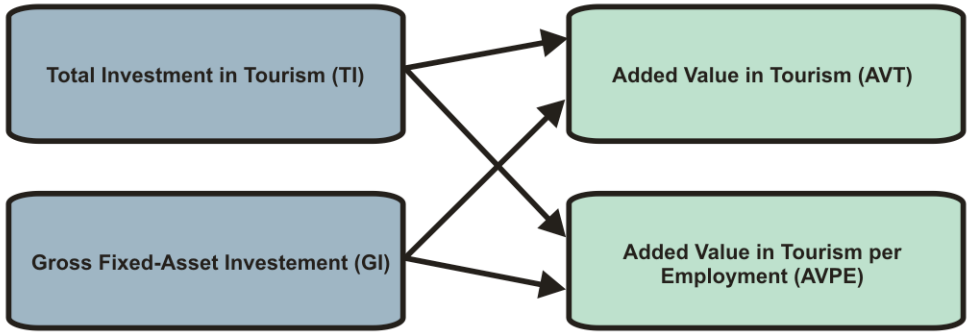
explain productivity effects in tourism; the structure, technological orientation and developmental quality of investment are equally important.

Regional evidence on tourism productivity remains limited and methodologically diverse. In Croatia, Perić and Nikšić Radić (2015) find that the stock of tourism FDI has a positive and statistically significant effect on tourism productivity, with education also making a positive contribution, while Bezić and Nikšić Radić (2017) show that tourism FDI is linked to tourism gross value added through cointegration and causality analysis. Ivanovic et al. (2011) further emphasize that FDI is important for technological development and export capacity, but warn that investment directed mainly toward infrastructure may produce weaker multiplier effects than investment in technologically advanced and higher value-added activities. In the Croatia–Slovenia context, Gričar et al. (2021) show that labour productivity and real gross wages in tourism are cointegrated, indicating that productivity dynamics represent an important factor in tourism labour-market outcomes. While these studies confirm the relevance of investment, FDI, value added and labour productivity in tourism, they do not directly examine whether total investment and gross investment in long-term assets contribute to changes in tourism value added and labour productivity, which defines the focus of the present study.

The European Bank for Reconstruction and Development (EBRD, 2022)'s Country Strategy flags fragmented project pipelines, while the World Bank (2022) warns that consumption-led recoveries lose momentum without complementary capital spending. The United Nations Development Programme (UNDP, 2025) reports a 32% year-on-year increase in arrivals following EU-funded upgrades in mountain resorts, yet offers no causal estimates. Macro-datasets reinforce these qualitative findings. Eurostat (2023) shows that BiH's capital stock per bed is 44% below the regional median. CEIC Data Company (2023) record a rebound to 96% of pre-pandemic receipts once gross fixed capital formation in accommodation returned to 2019 levels, while World Travel & Tourism Council (WTTC, 2024) emphasizes that tourism investment generates substantial multiplier effects throughout the economy, with the overall economic impact of tourism estimated to be approximately twice as large as its direct contribution once indirect and induced effects are included.

The literature suggests three stylised facts: (i) investment quality outweighs quantity, (ii) governance conditions the magnitude of spill-overs, and (iii) Western-Balkan evidence is fragmentary. No previous study has estimated short- and long-run effects of both total and fixed-asset investment on multiple productivity measures in BiH. Diagram 1 therefore proposes a conceptual model in which TI and GI affect AVT and AVPE through capital-deepening and spill-over channels moderated by institutional quality. This model serves as the analytical basis for the ARDL–ECM estimations presented in Section 5.

Diagram 1: Conceptual diagram of investment channels to tourism productivity in Bosnia and Herzegovina



Source: Authors' construction

By empirically testing this framework, the present paper contributes to closing a triple gap: a country gap (BiH), a variable gap (TI vs. GI), and a methodological gap (long-run cointegration with productivity proxies in a data-constrained transition economy). In addition, the paper contributes empirically by showing that total tourism investment does not necessarily translate into higher labour productivity, thereby refining the conventional assumption that tourism investment has uniformly positive productivity effects.

3. Investment context and empirical analysis of tourism productivity in BiH (2000-2023)

Since the Dayton Peace Agreement, Bosnia and Herzegovina's economy has undergone three phases of post-war transition. The initial phase (1995–1999) was marked by aid-driven recovery and double-digit GDP growth, but tourism contributed less than 2% to GDP (World Bank, 2015). During the second phase (2000–2007), the economy expanded at a steady annual rate of around 5%, yet capital formation in tourism remained below 4% of total investment (Central Bank of Bosnia and Herzegovina [CBBH], n.d.). The third phase (2008–2020) saw economic stagnation, with average growth rates below 1%, but also the fastest expansion of the tourism sector: foreign tourist nights increased by 87%, and direct employment reached 12% of the labour force by 2019 (WTTC, 2024).

Despite strong demand-side growth—total tourist arrivals rose from 0.69 million in 2010 to 1.64 million in 2019, and overnight stays nearly doubled—Bosnia and Herzegovina captured only 5.4% of international tourism receipts in the region encompassing the former Yugoslavia and Albania, compared to Croatia's 53.1% and Slovenia's 14.3% (Centre for Excellence for Evaluation and Policy Research,

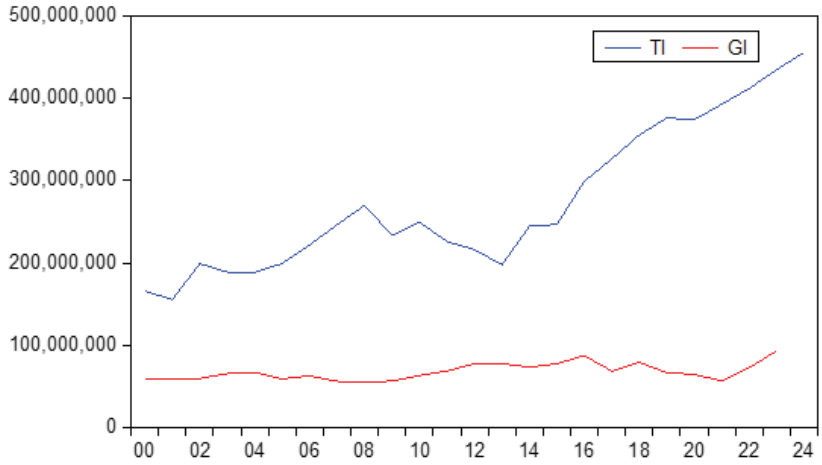
2022). The country offers a diverse but fragmented tourism product: Olympic ski resorts such as Jahorina and Bjelašnica, the coastal outlet of Neum, UNESCO sites in Mostar and Višegrad, and a growing cluster of eco- and wellness destinations. However, more than 70% of overnight stays remain concentrated in Sarajevo, Neum, and Mostar, while 40% of travel-export earnings are generated in the third quarter, illustrating persistent spatial and seasonal imbalances (CBBH, n.d.; International Finance Corporation [IFC], 2021).

While these trends are widely recognised by policy institutions, the practical implementation of strategic planning remains uneven. For instance, although the 2021–2027 Tourism Development Strategy of Republika Srpska explicitly prioritises investment in highland health and wellness tourism, there is limited evidence of project execution beyond a few infrastructure upgrades in Jahorina and Teslić. The absence of a harmonised investment roadmap at the state level further fragments the capital allocation process, limiting the country's ability to attract large-scale private investment and to access EU structural funds.

Recent policy analyses converge on the view that the core barriers to scalable tourism investment lie not in capital scarcity, but in institutional fragmentation, limited project pipelines, and regulatory bottlenecks (EBRD, 2022; World Bank, 2022). Evidence from Croatia suggests that tourism-related foreign direct investment may contribute to tourism development, although its effects depend on the structure and efficiency of investment allocation (Ivanovic et al. 2011; Perić & Nikšić Radić, 2015). In addition, recent research indicates that tourism capital investment can generate broader socio-economic effects, further supporting the relevance of long-term capital formation in tourism development (Castilho & Fuinhas, 2025). In this context, Bosnia and Herzegovina's challenge is one of allocation efficiency and institutional readiness. Streamlined permitting procedures and the deployment of bundled debt–equity instruments could unlock private-sector investment, particularly in health, adventure, and winter tourism, while also supporting geographic diversification and reducing outbound migration. Compared to Montenegro, where the share of tourism in gross fixed capital formation surpassed 10% in the post-2015 period, BiH has consistently remained below 4% despite similar terrain and comparable regional accessibility. Moreover, EU-27 countries allocate on average 6–9% of public infrastructure budgets to tourism-related capital, further underscoring BiH's structural lag in investment orientation.

Annual series in this section originate from WTTC (tourism employment and investment), the Central Bank of Bosnia and Herzegovina (CBBH, balance-of-payments travel receipts) and the Agency for Statistics of Bosnia and Herzegovina (BHAS, arrivals, overnight stays, value-added indicators) (CBBH, n.d.; BHAS, 2023). The empirical window is restricted to 2000 to 2023—the earliest year in which the four core variables are simultaneously available: total investment in tourism, gross investment in long-term tourism assets, tourism value added and value added per worker**.**

Figure 1: Tourism investment (TI) and gross investment in long-term tourism (GI) assets in Bosnia and Herzegovina, 2000 – 2023



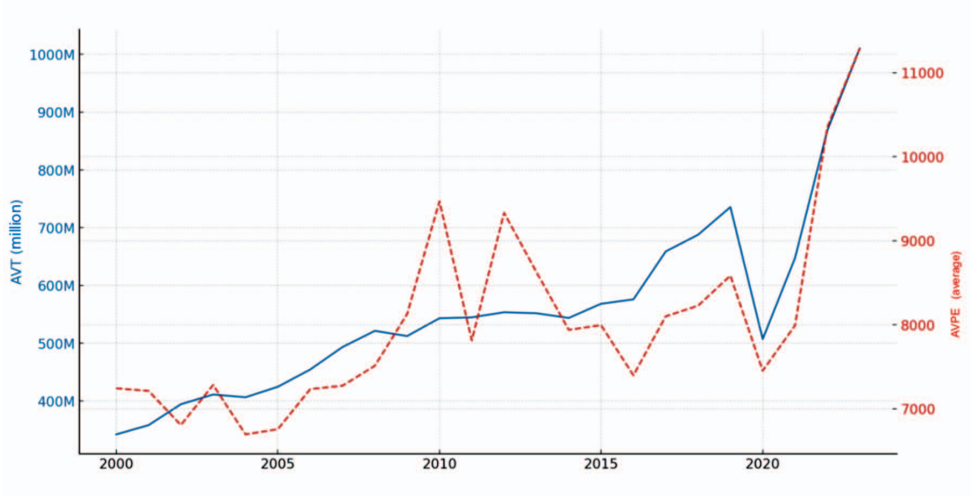
Source: Authors' calculations

Between 2000 and 2019 nominal TI rose from BAM 185 million to BAM 372 million, a compound annual growth rate of 3.7 percent (constant-2015 BAM unless stated otherwise). Yet GI remained shallow, seldom exceeding 4 percent of total national capital formation and, moreover, was heavily skewed toward accommodation facilities (see Figure 1).

Formal employment in tourism expanded from 57,000 in 2010 to 85,700 in 2019, before the Covid-19 contraction, and allowing for an estimated 30 percent shadow-economy share, total labour input is roughly one-third higher. The labour surge, however, did not translate into commensurate productivity growth: tourism's share of GDP slipped from 2.89 percent in 2000 to 2.08 percent in 2019, while AVPE has stagnated since 2011. Figure 2 depicts the divergent trajectories of AVT and AVPE.

International demand evolved in two waves: foreign arrivals grew 2.8-fold up to the 2008 crisis, paused briefly, and then tripled between 2010 and 2019, while overnight stays doubled in the latter surge (Centre for Excellence for Evaluation and Policy Research, 2022). Domestic arrivals increased more modestly—about 1.5-fold over 2010-2019—and were temporarily boosted by a pandemic voucher scheme in 2020. Despite rising volumes, average stays remain short (approximately two nights) and sharply seasonal: roughly 40 percent of travel-export revenue is earned in Q3, and more than 70 percent of registered overnights are concentrated in Sarajevo, Neum and Mostar (IFC, 2021). Such geographic and temporal concentration, coupled with limited GI, keeps annual bed utilisation below one-third and restrains productivity gains.

Figure 2: Tourism value added (AVT) and value added per worker (AVPE), 2000 – 2023



Source: Authors' calculations

Taken together, the descriptive evidence corroborates the study's premise: Bosnia and Herzegovina has achieved robust expansion in tourist volumes but only marginal improvements in value added and labour productivity, chiefly because capital deepening—captured by GI—has lagged behind demand. The cointegration and error-correction tests in Section 5 therefore examine whether stronger growth in TI, and above all in GI, can narrow this investment–productivity gap.

4. Methodology

This study examines the relationship between investment and the performance of the tourism sector in Bosnia and Herzegovina over the period 2000–2023, using annual data. This timeframe allows for the identification of long-term trends and the assessment of the effects of macroeconomic shocks and structural breaks in the sector.

Tourism development is measured by tourism value added, defined as the difference between the sector's total output and intermediate consumption, expressed in constant prices to remove the effects of inflation. AVT reflects the real value generated by tourism in the economy and is widely recognised in the literature as a key performance indicator, capturing tourism's direct, indirect, and induced contributions to gross domestic product (Stabler et al., 2010; UNWTO, 2014). In addition to AVT, the analysis employs labour productivity in tourism, measured as the ratio of value added to the number of employees. This approach provides

insight into the efficiency of labour utilisation and represents a standard metric of productivity in both economic and tourism literature (Baum, 2015; Organisation for Economic Co-operation and Development [OECD], 2001).

The independent variables comprise tourism investment, including both total investment in the sector—encompassing gross fixed capital formation aimed at expanding capacity, modernising facilities, and improving service quality—and gross investment in long-term assets, covering expenditures on tangible and intangible assets such as accommodation facilities, land, equipment, software solutions, and licences. Long-term asset investment is of particular importance as it enables sustained productivity growth and sectoral resilience (Dwyer et al., 2010; Twining-Ward et al., 2017).

In this study, total investment in tourism refers to the broader aggregate measure of investment activity directed toward the tourism sector. It includes overall capital flows associated with the expansion, modernisation, and maintenance of tourism-related capacity, including investment in accommodation, supporting infrastructure, service facilities, and other tourism-related business activities. By contrast, gross investment in long-term assets refers more narrowly to investment in fixed and durable assets that remain in use over several accounting periods, such as buildings, accommodation facilities, land improvements, equipment, machinery, vehicles, software, licences, and other tangible or intangible long-term assets. Therefore, while TI captures the overall volume of investment activity in tourism, GI captures the fixed-asset component of capital formation that is more directly related to capital deepening and productivity-enhancing capacity.

Due to data limitations, investment is operationalised through total tourism investment and gross investment in long-term assets, which jointly capture overall capital formation in the tourism sector. While this operationalisation does not allow a direct distinction between public, private, and foreign direct investment, it reflects the aggregate structure of capital inflows available in official datasets. Moreover, previous empirical research suggests that investment in long-term assets serves as a robust proxy for productivity-enhancing capital, particularly in tourism sectors characterised by infrastructure constraints and capital scarcity. This distinction is particularly relevant in the context of Bosnia and Herzegovina, where the efficiency of capital allocation may be more important than the overall volume of investment.

All variables were transformed into natural logarithms to stabilise variance and allow coefficients to be interpreted as elasticities (Wooldridge, 2016). This operationalisation makes it possible to analyse both short- and long-term effects of investment on sectoral performance, revealing the mechanisms through which capital shapes productivity and tourism's contribution to overall economic growth.

Table 1 gives an overview of the used variables and data sources. Or A summary of the variables used within this research and their sources are presented in Table 1.

Table 1: Definition of Variables and Data Source

Symbol	Definition	Unit	Source	Expected sign
TI	Total investment in tourism	BAM million (2015)	WTTC, 2024	+
GI	Gross investment in long-term tourism assets	BAM million (2015)	BHAS, n.d.	+
AVT	Added value in tourism value added	BAM million (2015)	BHAS, n.d.	n/a
AVPE	Added value in tourism divided by the number of employees.	BAM thousand (2015)	WTTC, 2024	n/a

Source: author's compilation

The following section presents the econometric framework of the study, including the model specification, data sources, and diagnostic procedures employed to examine the interdependencies between tourism value added, total investment in the tourism sector, and gross investment in long-term assets in Bosnia and Herzegovina.

The analysis applies the ARDL–ECM methodology, which allows for the simultaneous modelling of short-run dynamic adjustments and long-run equilibrium relationships among variables (Pesaran et al., 2001). This approach is particularly suitable for datasets comprising variables with mixed orders of integration, I(0) and I(1), without requiring them to be stationary at the same level. Another advantage of the ARDL–ECM framework lies in its efficiency when applied to shorter time series, which is highly relevant given that only 24 annual observations are available in this study. Moreover, the framework enables the inclusion of dummy variables representing structural breaks, thereby ensuring more consistent estimates under conditions of limited data (Kripfganz & Schneider, 2023).

The theoretical foundation of the research is grounded in models linking investment to economic growth in the tourism sector, assuming that tourism value added is a function of both aggregate and specific forms of investment, while accounting for the technological and structural parameters of the economy (Balaguer & Cantavella-Jordá, 2002). These models help to clarify how different categories of investment affect productivity and sectoral development over the long run. It is important to emphasise that the results are context-specific and pertain to the economy of Bosnia and Herzegovina, given its distinct institutional and macroeconomic characteristics.

The applied ARDL–ECM can be represented by the following equation:

$$\Delta \ln Y_i = \alpha_0 + \sum_{i=1}^{p} \beta_i \, \Delta \ln Y_{t-i} + \sum_{j=0}^{q_1} \gamma_j \, \Delta \ln \mathrm{TI}_{t-J} + \sum_{k=0}^{q_2} \delta_k \, \Delta \ln \mathrm{GI}_{t-k} + \varphi_1 \ln Y_{t-1} + \varphi_{21} \ln \mathrm{TI}_{t-1} + \varphi_{31} \ln \mathrm{gi}_{t-1} + \varepsilon_t \quad (1)$$

where Δ denotes the first-difference operator, and p, q_1 and q_2 represent the optimal lag lengths. Given that two models are being evaluated, the dependent variable Y in the first model represents value added in tourism (AVT), while in the second model it represents the productivity of workers in tourism (AVPE). The parameters β_i, γ_j and δ_k capture the short-run effects of past changes in the observed variables, while the long-run coefficients ϕ_i reflect the equilibrium relationships between their levels. The sign and magnitude of these coefficients indicate the existence and strength of a stable long-run equilibrium. Finally, ε_i denotes the stochastic error term, capturing the influence of factors not explicitly modelled in the specification.

Short-run adjustments were captured through an error-correction model (ECM):

$$\Delta Y_t = \beta_0 + \beta_1 \Delta \ln Y_{t-1} + \sum_{i=0}^{p} \beta_{2,i} \Delta \ln \mathrm{TI}_{t-1} + \sum_{i=0}^{q} \beta_{3,i} \Delta \ln \mathrm{GI}_{t-1} + \gamma \mathrm{ECM}_{t-1} + \varepsilon_t \quad (2)$$

where γ measures the speed of adjustment back to equilibrium.

Diagnostic checks included Breusch–Godfrey LM for serial correlation, Breusch–Godfrey- Pagan test for heteroscedasticity, Jarque Berra test for normality and CUSUM stability tests.

The Error Correction Model specification enables the estimation of short-run changes in tourism value added in response to investment, while simultaneously incorporating information on the long-run equilibrium among the variables. Through the coefficient associated with deviations from long-run equilibrium, the model quantifies the speed of adjustment, i.e. the rate at which tourism value added responds in order to return to a stable long-run relationship with total tourism investment and gross investment in long-term assets. This coefficient is commonly referred to as the error-correction term, and it is obtained as the coefficient on the residual from the long-run equilibrium relationship between tourism value added and investment. The coefficients of the short-run dynamics capture the immediate effect of changes in investment on tourism value added, while the long-run component ensures that these changes converge toward a stable long-term trend.

Prior to model estimation, the stationarity of the observed series was assessed. A graphical analysis suggested the presence of potential structural breaks, i.e. sudden

shifts in the level of the series. To formally identify such breaks, the Bai–Perron test (Bai & Perron, 2003) was applied, which allows for the detection of multiple breaks and the determination of their exact timing. The identified breaks were incorporated into the model as dummy variables, thereby controlling for structural changes and improving the reliability of the ARDL/ECM estimations. Traditional unit-root tests, such as the ADF test, may yield imprecise results in the presence of structural breaks; therefore, the Perron test with an additive outlier (AO) specification (Perron, 1989) was employed, enabling the detection of abrupt, one-time shifts in the level of the series, including both trend and intercept components (Gujarati & Porter, 2009).

Although the ARDL–ECM methodology offers flexible parameterisation, it assumes the absence of endogeneity among regressors, which may be restrictive in the case of macroeconomic series, as TI and GI may simultaneously exhibit causal interactions with AVT. In this study, a maximum of one lag was applied due to the limited sample size, reducing the risk of over-parameterisation but constraining the model's ability to capture more complex dynamic patterns (Gujarati & Porter, 2009; Kripfganz & Schneider, 2023; Narayan, 2005; Pesaran et al., 2001). The study does not incorporate nonlinear transformations of investment variables, which remains a recommendation for future research. In particular, the nonlinear ARDL (NARDL) approach could be employed to test for asymmetric effects of investment changes and economic shocks (Shin et al., 2014).

Considering the objective of this study—to establish the basic empirical interdependencies and ensure comparability with prior research—the ARDL–ECM framework proves adequate for analysing the relationships between investment and tourism sector performance in Bosnia and Herzegovina. Future research is encouraged to extend the model by incorporating nonlinear transformations and longer time series, thereby examining the marginal contributions of investment across different phases of the economic cycle or under structural breaks (Shin et al., 2014).

5. Empirical results and discussion

This section presents the empirical results obtained from the estimation of the ARDL model, starting with descriptive statistics, followed by stationarity and cointegration testing, and finally the estimation of long-run and short-run coefficients. The empirical analysis proceeds in three steps: (i) stationarity testing using Perron unit-root tests with structural breaks, (ii) cointegration testing using the ARDL bounds approach, and (iii) estimation of long-run and short-run coefficients within the ARDL–ECM framework.

Table 2 reports the descriptive statistics for all variables. The data indicate moderate variability, while the minimum and maximum values do not suggest the presence of significant outliers.

Table 2: Descriptive statistics

	Mean	Std.Dev	Max	Min
lnAV	20.09981	0.262569	20.73332	19.65074
lnAVPE	8.982171	0.131684	9.331327	8.809116
lnGI	18.38767	0.218331	18.70662	17.84519
lnTI	19.36034	0.300438	19.89086	18.86183

Source: Authors' calculations

Potential structural breaks in the observed series were first identified through a visual inspection of their trajectories (Figure 1 and Figure 2), taking into account abrupt changes in trend or level. To precisely determine the years in which structural shifts occurred, the Bai–Perron test (Bai & Perron, 2003) was applied, enabling the detection of multiple breaks within time series data. The test results are presented in Table 3, including the F-statistics, critical values, and the years of the identified breaks for each of the analysed series. For each series, the Perron unit-root test allowing for a single break was employed, with the break year determined according to the observed shifts in the series.

Table 3: Results of the Bai–Perron test for structural breaks

Series	F-statistic	Critical Value	Break Date
LNAVT	28.39 / 19.03	8.58 / 10.13	2007 / 2021
LNTI	18.96 / 10.35	8.58 / 10.13	2009 / 2021
LNGI	10.55 / 35.23	8.58 / 10.13	2007 / 2021
LNAVPE	28.38 / 19.03	8.58 / 10.13	2008 / 2021

Note: all reported F-statistics are statistically significant at the 5% level.
Source: Authors' calculations

Based on the test results, it was observed that all series share a common structural break in 2021, while additional breaks differ across series (lnAVT in 2007, lnTI in 2009, lnGI in 2007, and lnAVPE in 2008). These findings confirm the preliminary observations from the graphical analysis, where abrupt changes in trend had already been visually detected. Given the identified breaks, stationarity was tested using the Perron test with an additive specification, which allows for the simultaneous modelling of level and trend shifts. This variant more accurately accounts for the consequences of breaks and better reflects the actual dynamics of the series, thereby increasing the reliability of stationarity assessment and facilitating the subsequent application of the ARDL/ECM framework. The test results are reported in Table 4.

Table 4: Unit root test

Variable	Break year	t - statistika	Critical value at 1%	Critical value at 5%	Conclusion
lnAVT	2007	-3.92053	-4.373333	-3.74667	significant at the 5% level
lnAVT	2021	-3.517669	-3.918333	-3.336667	significant at the 5% level
lnAVPE	2008	-2.747000	-4.352500	-3.730000	no significant
ΔlnAVPE	2008	-5.927899	-4.366087	-3.740870	significant at the 1% level
lnAVPE	2021	-3.725333	-3.918333	-3.336667	significant at the 5% level
lnTI	2009	-3.033606	-4.336667	-3.72667	no significant
ΔlnTI	2009	-6.449524	-4.344348	-3.723478	significant at the 1% level
lnTI	2021	-2.123406	-3.918333	-3.336667	no significant
ΔlnTI	2021	-5.692365	-3.929585	-3.346087	significant at the 1% level
lnGI	2007	-2.981125	-4.373333	-3.746667	no significant
ΔlnGI	2007	-4.624584	-4.387826	-3.758261	significant at the 1% level
lnGI	2021	-1.945826	-3.918333	-3.336667	no significant
ΔlnGI	2021	-13.44210	-3.295665	-3.346087	significant at the 1% level

Source: Authors' calculations

Table 4 presents the results of the Perron stationarity test for the four analysed series, taking into account the identified structural breaks. The results show that lnAVT is stationary at level (I(0)) in the identified break years, while the series lnAVPE, lnTI, and lnGI are non-stationary at level but become stationary after first differencing, confirming that these variables are integrated of order one, I(1).

The results of the Perron stationarity test therefore confirm different levels of integration across the observed series: while the model with lnAVT as the dependent variable and lnTI and lnGI as independent variables contains a combination of I(0) and I(1) series, the model with lnAVPE as the dependent variable comprises only I(1) series. Given these characteristics, as well as the relatively short sample period, the application of the ARDL/ECM model remains methodologically justified, as this approach allows for the simultaneous modelling of short-run and long-run relationships among variables of mixed or identical integration orders, while controlling for potential structural breaks.

In view of the limited number of annual observations, the maximum lag length in the ARDL model was restricted to one. To control for the effects of the identified structural breaks on the dependent variables, four dummy variables (d1–d4) were included in the model, defined as follows:

- **d1** denotes the break in 2007 (lnAVT and lnGI), taking the value 0 up to 2006 and 1 from 2007 onwards.

- **d2** refers to the 2008 crisis (lnAVPE and lnTI), taking the value 0 up to 2007 and 1 from 2008 onwards.
- **d3** captures the additional break specific to the lnTI series in 2009, taking the value 0 up to 2008 and 1 from that year onwards.
- **d4** denotes the common break in 2021 for all series, taking the value 0 up to 2020 and 1 from 2021 onwards.

The inclusion of these dummy variables is particularly important because the observed period includes two major external shocks that affected both investment behaviour and tourism performance. The global financial crisis of 2008–2009 reduced investment capacity, constrained access to finance, and slowed capital formation in tourism-related activities. In the context of Bosnia and Herzegovina, where tourism investment was already characterised by low capital intensity and fragmented institutional coordination, the crisis likely reinforced delays in fixed-asset investment and weakened the transmission of capital formation into productivity gains. The COVID-19 pandemic represented an even more direct shock to the tourism sector, as restrictions on mobility, the collapse of international travel, and temporary closures of accommodation and hospitality facilities sharply reduced demand and disrupted the utilisation of existing tourism capacities. The common structural break identified in 2021 therefore captures not only the immediate pandemic shock but also the post-pandemic adjustment phase, in which tourism activity began to recover while investment and productivity dynamics remained affected by uncertainty and uneven capacity utilisation.

The initial stage of the ARDL approach tests for the existence of a long-term relationship among the observed variables. The null hypothesis states that no cointegration relationship exists between the examined variables, regardless of whether the explanatory variables are purely I(0) or I(1). If the calculated F-statistic exceeds both the lower and upper bounds of the critical values, the null hypothesis is rejected. The results confirm the presence of cointegration between the variables, as the F-statistic exceeds the upper bound at all conventional significance levels (10%, 5%, and 1%). The results of the bounds test are presented in Table 5.

Table 5: Bounds test for cointegration

Model	Test statistic	Value	I(0)	I(1) Bound	Conclusion
Model 1 - AVT	F statistics	17.732154	5.155	6.265	Cointegration exists at the 1% significance level
Model 2 - AVPE	F statistics	17.201656	5.155	6.265	Cointegration exists at the 1% significance level

Source: Authors' calculations

The long-term ARDL estimates are summarized in Table 6.

Table 6: Long-run estimates of the ARDL model

Variable	Coefficient	Std. Error	t-statistics	Significance
Model 1 – lnAVT				
lnAVT(-1)	-0.504207	0.236598	-2.131071	*
lnTI	0.232185	0.097901	2.371625	*
lnGI	1.355748	0.252934	5.360091	***
d1	-0.042610	0.055810	-0.763493	not significant
d3	0.058436	0.049794	1.173564	not significant
d4	0.952701	0.140891	6.761950	***
C	0.660562	2.257190	0.292648	not significant
Model 2 – lnAVPE				
lnAVPE(-1)	-0.289971	0.157447	-1.841712	*
lnTI	-0.319439	0.082393	-3.877036	***
lnGI	0.826245	0.148382	5.568355	***
lnGI(-1)	-0.136402	0.079954	-1.706011	not significant
d2	0.017546	0.054730	0.320592	not significant
d3	0.079761	0.050322	1.585012	not significant
d4	0.644778	0.119195	5.409458	***
C	4.932142	2.328447	2.118211	*

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, no significance $p > 0.1$

Source: Authors' calculations

As shown in Table 6, the long-run coefficients in both models follow different patterns. The results indicate that investment in long-term assets has a significant positive effect in the long run on both tourism value added and labour productivity in tourism. Specifically, a one-percent increase in GI leads to a 0.83% rise in AVPE and a 1.36% rise in AVT, suggesting that investment in long-term assets constitutes the main driver of growth and productivity in the tourism sector.

The results also show that total investment in the tourism sector exerts different effects across the two models. In the AVT model, TI positively influences tourism value added, whereas in the AVPE model, TI negatively affects labour productivity. The finding that total tourism investment has a negative long-run effect on labour productivity calls for deeper interpretation and points to structural weaknesses in the tourism sector in Bosnia and Herzegovina. One possible explanation is the "labour absorption" effect, whereby investment-driven expansion generates additional employment, primarily seasonal and low-skilled, which reduces value added per employee even though the sector's overall output increases. In addition, inefficient capital allocation—predominantly into small guesthouses, seasonal facilities, and low-productivity segments—expands the sector without substantially

improving efficiency. A similar effect arises from pronounced fragmentation and seasonality: more than 70% of overnight stays are concentrated in three destinations and in the summer quarter, meaning that investments are not evenly utilised throughout the year and do not promote diversification of supply. This interpretation is consistent with Niavis and Kallioras (2021), who show that seasonality and spatial concentration of tourist flows affect tourism-sector efficiency in a non-linear manner, implying that concentration of demand may reduce efficiency when it leads to uneven capacity utilisation and limits the diffusion of tourism benefits across regions. Finally, institutional factors, such as complex regulatory procedures and the lack of strategic guidance, may cause investments to assume a rent-seeking character, directed more toward short-term subsidies and opportunistic projects than toward long-term sustainable productivity. These results suggest that the quantity of investment alone is insufficient; rather, its quality, structure, and the institutional framework in which it is implemented are decisive.

The coefficients of the lagged dependent variables (lnAVT(–1) and lnAVPE(–1)) are statistically significant and negative, confirming a process of partial adjustment toward long-run equilibrium. Among the dummy variables representing structural breaks, only the variable associated with the COVID-19 crisis shows a statistically significant effect. This suggests that the pandemic shock had a stronger and more persistent effect on tourism value added and labour productivity than the earlier financial crisis, most likely because COVID-19 directly disrupted mobility, accommodation demand, and capacity utilisation in the tourism sector.

Finally, the constant term in the AVPE model is significant at the 10% level, whereas in the AVT model it is not, suggesting that unobserved factors may influence productivity more strongly than overall tourism value added. Overall, the results indicate that investment in long-term assets plays a crucial role in driving growth and productivity in the tourism sector, while the COVID-19 pandemic had a significant impact in both models.

All diagnostic tests confirm that the ARDL model is statistically well-specified. The results of these tests are presented in Table 7 and Table 8.

Table 7: Diagnostic tests for Model 1

Test	Statistic	*p*-value	Conclusion
Serial Correlation (LM)	0.751830	0.4898	No serial correlation
Heteroscedasticity (BP-G)	1.196852	0.3571	No heteroscedasticity
Normality (Jarque – Bera)	3.256743	0.19655	Residuals normal
Stability (CUSUM)	-	-	Stable model

Source: Authors' calculations

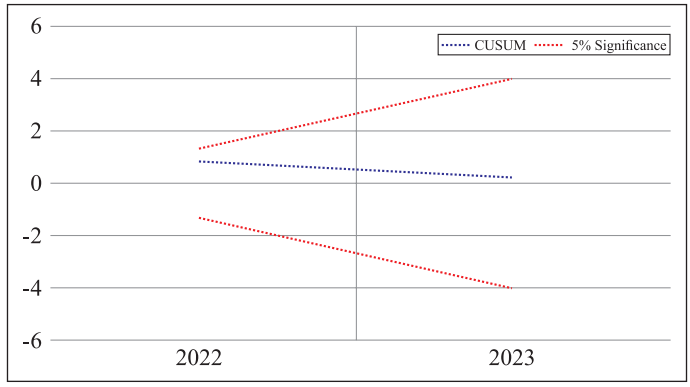
Table 8: Diagnostic tests for Model 2

Test	Statistic	p-value	Conclusion
Serial Correlation (LM)	0.567058	0.5806	No serial correlation
Heteroscedasticity (BP-G)	0.7775	0.0700	No heteroscedasticity
Normality (Jarque – Bera)	1.233873	0.539595	Residuals normal
Stability (CUSUM)	-	-	Stable model

Source: Authors' calculations

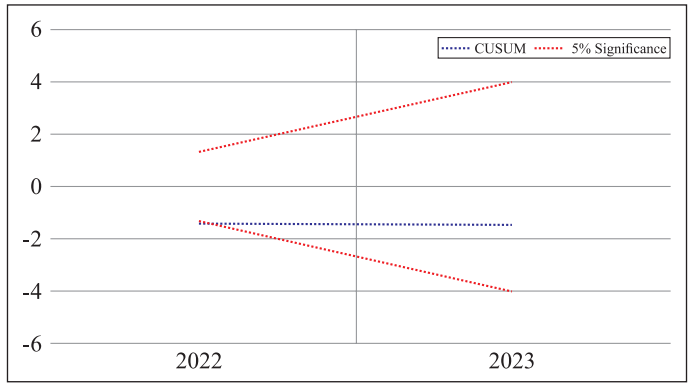
The diagnostic tests indicate that both ARDL models are statistically well-specified, with no evidence of serial correlation and with residuals following a normal distribution. The CUSUM plots further confirm the stability of the models over the observed period, as presented in Figures 3 and 4.

Figure 3: Coefficient stability (CUSUM) – Model 1



Source: Authors' calculations

Figure 4: Coefficient stability (CUSUM) – Model 2



Source: Authors' calculations

The results of the ECM model presented in Table 9 for short-run dynamics show that changes in current tourism investment (ΔlnTI) and investment in long-term assets (ΔlnGI) generally do not exert statistically significant effects on tourism value added or labour productivity in the sector. However, in the labour productivity (AVPE) model, a positive effect of long-term investment is observed at the 10% significance level, suggesting that even in the short run certain investment changes may contribute modestly to improvements in workforce efficiency. This indicates that the sector possesses mechanisms for partial transmission of investment effects onto productivity, although overall short-run impacts remain limited.

Table 9: Short-term coefficients and ECM

Variable	Coefficient	Std. Error	t - statistics	Significance
Model 1 – AVT				
ΔlnTI	0.353797	0.245996	1.438277	not significant
ΔlnGI	0.229620	0.163230	1.406731	not significant
ECM(-1)	-0.607776	0.2759880	-2.202182	**
c	0.022820	0.026226	1.438227	not significant
Model 2 –AVPE				
ΔlnTI	-0.110257	0.199423	-0.552879	not significant
ΔlnGI	0.217088	0.110664	1.961683	*
ECM(-1)	-0.593935	0.210606	-2.820120	***
c				

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, no significance $p > 0.1$
Source: Authors' calculations

The error-correction coefficient (ECT) is –0.61 and statistically significant, indicating that the sector tends to return to its long-run equilibrium after deviations. Approximately 61% of the divergence from the long-run relationship between investment and tourism value added in the previous year is corrected in the current year. The economic implication of this finding is that, although short-run investment effects are weak, an automatic adjustment mechanism enables a gradual return to a stable long-term path, contributing to the resilience of tourism against external and internal shocks. In the second model, the speed of adjustment is similar, at around 60%.

Given the relatively short time series (2000–2023) and the presence of several structural breaks, the econometric results should be interpreted with caution. The limited length of the dataset reduces the statistical power of asymptotic tests, which is explicitly acknowledged as a methodological limitation.

Although alternative proxies for tourism development, such as tourism receipts, could provide additional insights into the investment–performance relationship, the availability of consistent and sufficiently long time-series data for Bosnia and Herzegovina remains limited. In this context, tourism value added represents a more comprehensive and methodologically consistent measure, as it captures both direct and indirect contributions of the sector. Future research could extend the present analysis by testing the robustness of the results using alternative indicators of tourism performance, including disaggregated revenue-based measures. Moreover, AVT is less sensitive to short-term demand fluctuations and therefore better captures long-run structural effects of investment.

The findings confirm that both total tourism investment and investment in long-term assets have a significant positive effect on tourism value added in the long run, while short-run effects are statistically insignificant. This result is consistent with theoretical assumptions about capital deepening and demonstrates that the impacts of investment materialise only after a certain time horizon, once new capacities and infrastructure become operational. At the same time, the functionality of the error-correction mechanism (ECM) confirms that deviations from the equilibrium path are corrected, underscoring the stability of long-run relationships between investment and sectoral performance.

The most interesting and unexpected result is that total tourism investment has a negative long-run effect on labour productivity. This paradoxical outcome suggests that while overall investment contributes to sectoral value added, it simultaneously reduces value added per worker, likely reflecting labour market weaknesses and inefficient capital allocation in Bosnia and Herzegovina. Possible explanations include pronounced seasonality and spatial concentration of demand, the expansion of low-skilled and seasonal employment that dilutes per-worker productivity, and investments directed towards facilities and segments with lower efficiency. These findings suggest that the quantity of investment is not sufficient; rather, the quality and structure of investment are decisive.

This result can be related to the available regional literature. Ivanovic et al. (2011) show that foreign direct investment has contributed to tourism development in Croatia, while Perić and Nikšić Radić (2015) find a positive relationship between tourism FDI and tourism productivity. In addition, Gričar et al. (2021) emphasise the importance of labour productivity dynamics in the tourism sectors of Croatia and Slovenia. Against this background, the findings for Bosnia and Herzegovina refine the regional evidence by showing that not all forms of investment generate the same productivity effects. While gross investment in long-term assets has a positive long-run effect on both tourism value added and labour productivity, total tourism investment has a negative long-run effect on AVPE. This suggests that productivity gains depend less on the aggregate volume of investment and more on its structure, quality and allocation.

This finding also represents the main point of departure from much of the existing tourism-investment literature. While previous studies generally associate tourism investment with productivity improvements, the results for Bosnia and Herzegovina show that the aggregate volume of investment does not automatically translate into higher labour productivity. The negative long-run effect of total tourism investment on AVPE suggests that investment may expand sectoral output and employment while simultaneously diluting productivity if it is directed toward low-efficiency activities, seasonal facilities, or fragmented small-scale projects. In contrast, the positive effect of GI confirms that fixed-asset investment and capital deepening are more closely linked to productivity-enhancing capacity. The contribution of this paper therefore lies in showing that the type and structure of investment matter more than investment volume alone in a data-constrained post-transition tourism economy.

This study is subject to several limitations that should be considered when interpreting the empirical findings. First, the analysis is based on a relatively short annual time series (2000–2023), which limits the statistical power of econometric tests and constrains the complexity of model specification. Second, the presence of multiple structural breaks, particularly those associated with the global financial crisis and the COVID-19 pandemic, introduces additional instability that cannot be fully captured despite the use of dummy variables. Third, due to data limitations, the analysis does not distinguish between different sources of investment, such as public, private, or foreign direct investment, which may have heterogeneous effects on productivity. Fourth, potential endogeneity between investment and tourism performance cannot be entirely ruled out within the applied ARDL–ECM framework. Finally, the model does not incorporate nonlinear or asymmetric effects of investment, which may be relevant in the context of economic shocks and structural transitions. Despite these limitations, the model provides consistent and interpretable estimates that contribute to understanding the investment–productivity relationship in a data-constrained transition economy.

6. Conclusions

This study provides a detailed analysis of the effects of investment on tourism performance in Bosnia and Herzegovina, focusing on total tourism investment and gross investment in long-term assets. The empirical results, obtained using the ARDL–ECM model, show that investment in long-term assets plays a crucial role in increasing overall tourism value added and labour productivity. Specifically, a 1% increase in gross investment in long-term assets leads to a 1.36% rise in tourism value added and a 0.83% rise in labour productivity, confirming the importance of capital deepening for the sector's sustainable growth.

In contrast, total tourism investment exhibits a paradoxical effect: while it contributes to overall sectoral expansion, it negatively affects labour productivity, pointing

to structural constraints such as pronounced seasonality, spatial concentration of demand, the prevalence of low-skilled and seasonal workers, and inefficient capital allocation. Short-run investment effects are limited, yet the error-correction mechanism demonstrates that deviations from long-run equilibrium adjust at a rate of approximately 60% annually, indicating sectoral resilience.

The empirical results confirm the hypothesis regarding the positive long-run effect of long-term asset investment on both tourism value added and productivity, while total investment in tourism exerts a paradoxical negative effect on labour productivity. These findings highlight that the quantity of investment is not sufficient; rather, the quality, structure, and institutional framework within which investment is realised are decisive.

The findings carry practical implications for policy design. First, investment strategies should prioritise the quality and structure of capital formation rather than the aggregate volume of investment alone. This implies a stronger focus on fixed-asset investment, infrastructure upgrading, digitalisation, and capacity modernisation that directly enhance productivity. Second, public incentive schemes should be designed to favour projects with clear productivity-enhancing effects, such as year-round accommodation capacity, higher value-added tourism products, workforce training, and destination-level infrastructure. Third, policymakers should address seasonality and spatial concentration by supporting investment in underutilised destinations, thematic tourism products, and integrated destination management systems that extend demand beyond peak periods and dominant urban or coastal centres. Finally, public–private partnerships and targeted financing instruments could help overcome fragmented project pipelines and improve the allocation of capital toward long-term tourism competitiveness.

Future research should pursue more detailed micro-level analyses, including the effects of investment on firm-level productivity, differentiating between types of tourism businesses (e.g., hotels, rural tourism) and categories of employees. Comparative studies with other post-transition economies in the region may further clarify the role of structural and institutional factors in shaping investment efficiency. Incorporating qualitative assessments of governance, regulatory frameworks, and strategic planning could also explain discrepancies between investment volume and productivity outcomes.

Overall, the study demonstrates that investment-driven tourism growth can improve sectoral performance and productivity, but only when accompanied by structural improvements, strategic planning, and targeted capital allocation. Notwithstanding these limitations, the results provide consistent and policy-relevant evidence on the role of investment in shaping tourism productivity in Bosnia and Herzegovina. Future research should extend the sample, apply alternative specifications such as nonlinear or panel ARDL models, and test for asymmetric effects of investment shocks.

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Utjecaj investicija na produktivnost i razvoj turizma u Bosni i Hercegovini

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Sažetak

Rad analizira kratkoročne i dugoročne učinke ulaganja na dodanu vrijednost turizma i produktivnost rada u Bosni i Hercegovini u razdoblju 2000. – 2023. Ulaganja se promatraju kroz dvije kategorije: ukupna ulaganja u turizam i bruto ulaganja u dugotrajnu materijalnu imovinu. Rezultati pokazuju da dugoročna ulaganja u fiksnu imovinu imaju statistički značajan pozitivan učinak na dodanu vrijednost turizma i produktivnost rada. Naime, povećanje bruto ulaganja u dugotrajnu imovinu za 1 % povećava dodanu vrijednost turizma za 1,36 %, a produktivnost rada za 0,83 %. Nasuprot tome, ukupna ulaganja u turizam imaju dvojak učinak: iako pozitivno djeluju na dodanu vrijednost turizma, istodobno negativno utječu na produktivnost rada, što upućuje na paradoks prema kojem rast sektora ne rezultira nužno većom produktivnošću po zaposlenom. Uzrok ovakvog učinka može biti u strukturnim ograničenjima, odnosno u sezonalnosti, prostornoj koncentraciji potražnje, prevladavanju niskokvalificiranog i sezonskog rada te neučinkovitoj alokaciji kapitala. Kratkoročni učinci su ograničeni, no mehanizmi korekcije pogreške potvrđuju stabilno prilagođavanje dugoročnoj ravnoteži, a godišnje usklađivanje korigira oko 60 % odstupanja. Rezultati analize naglašavaju važnost kontinuiranih ulaganja u dugotrajnu imovinu i kapitalnog produbljivanja, kako bi doprinijeli rastu ukupnog outputa turizma i produktivnosti rada, dok istodobno upućuju na to da samo ulaganje nije dostatno bez rješavanja strukturnih i institucionalnih ograničenja.

Ključne riječi*: ulaganja u turizam, produktivnost, kointegracija, Bosna i Hercegovina, dugotrajna imovina*

JEL klasifikacija*: O47, C32, Z32*

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