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THE EFFECTS OF TOURİSM COMPONENTS ON MACROECONOMİC GROWTH: A COMPARATİVE ANALYSIS ON BLACK SEA COUNTRIES AND AZERBAIJAN

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Abstract: This study aims to analyze the long-term effects of key tourism variables on macroeconomic growth in Bulgaria, Georgia, Romania, the Russian Federation, Turkey, Ukraine, and Azerbaijan over the period 1995–2024. Conducted within the framework of the extended Solow growth hypothesis, the study applies long-run DOLS and MG-DOLS panel cointegration methods to examine dynamics at both the panel and country levels, taking into account common long-term trends as well as structural heterogeneity across countries to ensure robust results. Panel-level MG-DOLS cointegration analysis indicates that tourism capital investments, gross fixed capital formation, and international tourist arrivals have significant and positive effects on economic growth, thereby supporting the extended Solow hypothesis. Country-level DOLS analyses reveal heterogeneity in these effects; while tourism and capital indicators exhibit positive and significant relationships with economic growth in Azerbaijan and Turkey, structural differences in the other countries prevent full confirmation of the hypothesis. The findings highlight tourism's strategic importance for economic growth and the necessity of integrating it into the economic structure. Policy reforms, investment strategies, sectoral prioritization, revenue diversification, infrastructure improvements, and enhanced investment efficiency are essential to maximize growth potential. Overall, the study demonstrates that tourism plays a positive and strategic role in supporting macroeconomic growth and emphasizes coordinated policies and targeted investments to fully realize its economic contribution across the analyzed countries.

Keywords: tourism, solow, growth, Azerbaijan, Black Sea, Pedroni, DOLS, DOLSMG, cointegration

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INTRODUCTION

With the acceleration of globalization, the tourism sector has risen to a strategic position in the economic development of countries, especially developing countries, due to its multifaceted economic functions such as earning foreign currency, creating employment and contributing to foreign trade balance (Huseynli & Huseynli, 2023).

In addition to its economic contributions, the increase in international tourism flows transforms social structures with its social, cultural and environmental dimensions; tourism is recognized as a dynamic and complementary sector that supports regional development (Zhensikbayeva, et al., 2024). However, for a sustainable and balanced growth, social and environmental impacts should also be taken into account (Crouch & Ritchie, 1999).

The Black Sea and Caspian Sea coasts are of particular importance for tourism and this study analyzes the relationship between tourism indicators and economic growth in the Black Sea littoral countries and Azerbaijan. The contribution of the sector to macroeconomic growth is examined through key indicators such as ratio of tourism receipts to GDP, tourist arrivals, tourism investment and GFCF, while emphasizing the role of sustainable and competitive tourism policies in enhancing economic benefits (Seferov & Hesenov, 2006). A country's tourism capital stock is a combination of tourism capital stock based on natural resources and artificial tourism capital stock developed through factors such as innovation, human capital and knowledge. While the capital stock is explained by exogenous factors within the framework of the Solow model, one of the neoclassical growth approaches (Sezgin & Budak, 2022), the artificial tourism capital stock is explained by endogenous factors based on innovation and human/physical capital with the Romer approach (Romer, 1986). Economic growth is influenced not only by internal factors but also by external elements like bureaucratic obstacles, inflation, and levels of security and politics (Acemoglu, 2009, pp. 781, 831, 861–872).

The tourism sector has become a strategic tool for development at the global level due to its multifaceted contribution to economic growth, employment and foreign exchange earnings. For countries in the Black Sea region and transition economies such as Azerbaijan, tourism offers important opportunities for economic diversification and resilience to external shocks. Nevertheless, there are significant differences between these countries in terms of the extent of tourism

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development and their dependence on the sector. Figure 2 - 5 i is based on statistical data sets for The countries considered within the scope of the research between 1995-2024, Georgia has positioned itself as a regional leader by significantly increasing the ratio of tourism receipts to contrast, despite its huge tourism potential, Turkey lags behind Georgia and Bulgaria in terms of tourism's contribution to GDP. Azerbaijan has made some progress in tourism, but its economy is strongly dependent on the energy industry, limiting the total ratio to GDP. In other words, there has been a considerable reduction in tourism receipts over the last years due to the ongoing war and security-related crises in Ukraine and Russia.

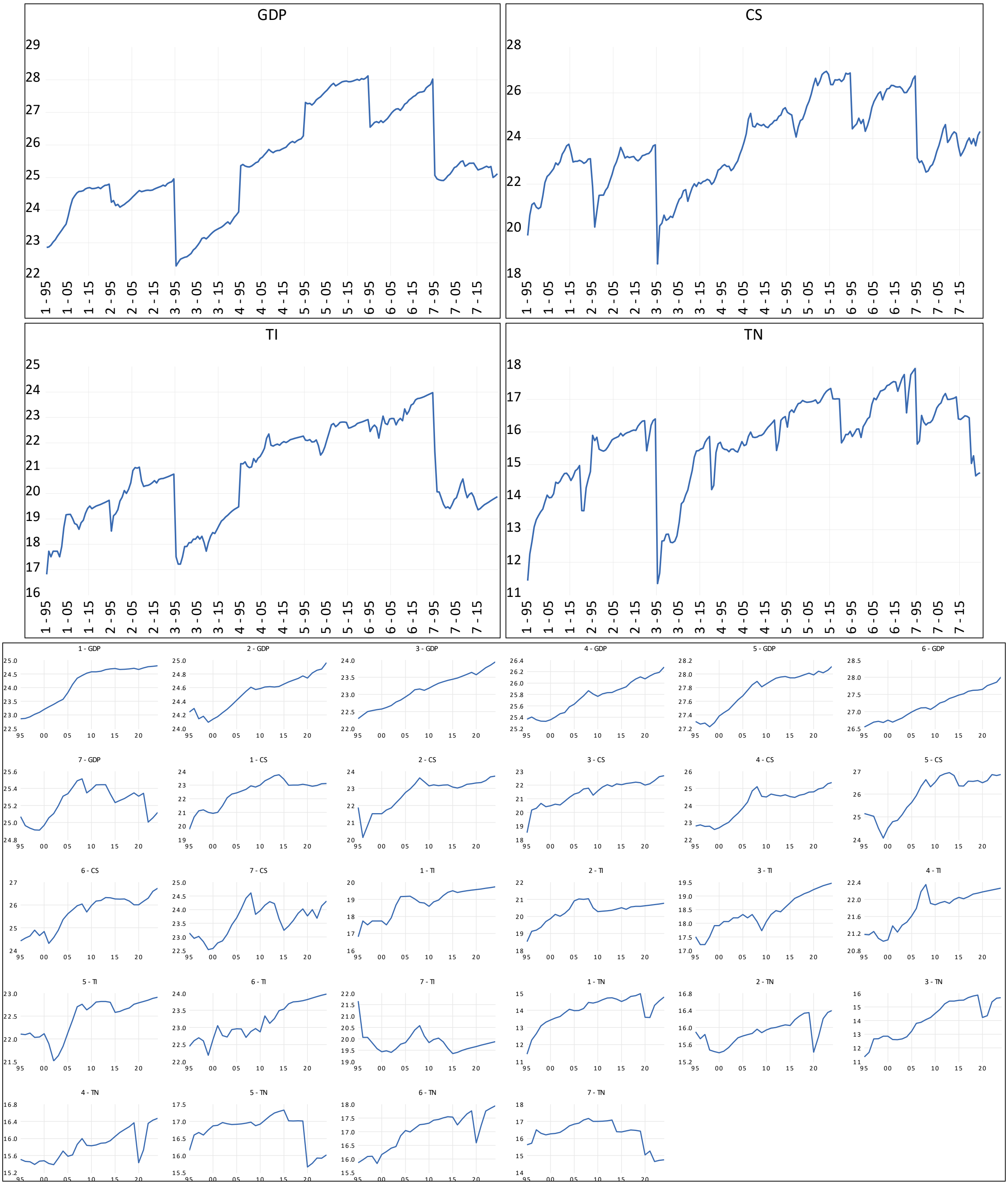

Figure 1. Logarithmic Structure Analysis of Variables by Country and Group

The share of tourism receipts in the overall exports is also an important indicator of economic resilience and strengthening of foreign exchange reserves. By 2024, Georgia has the highest level of dependency in the region, with 66% of export revenues coming from tourism. However, this dependency also increases vulnerability to external shocks.

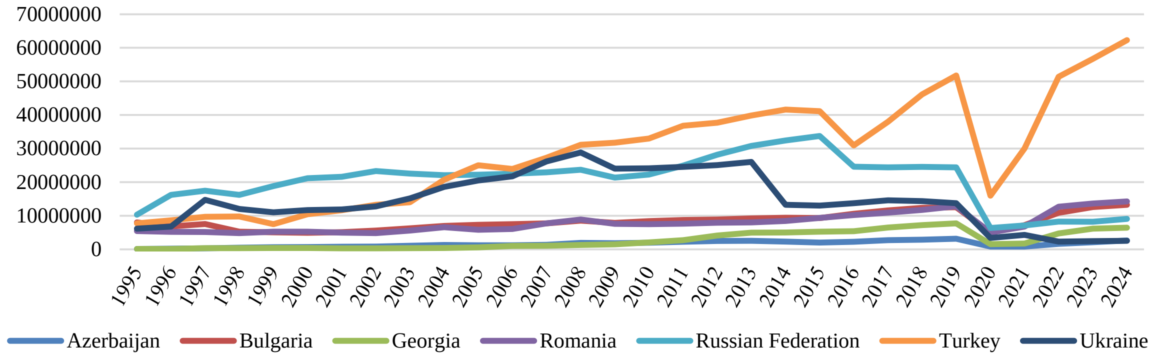

Figure 2. International Tourist Arrivals

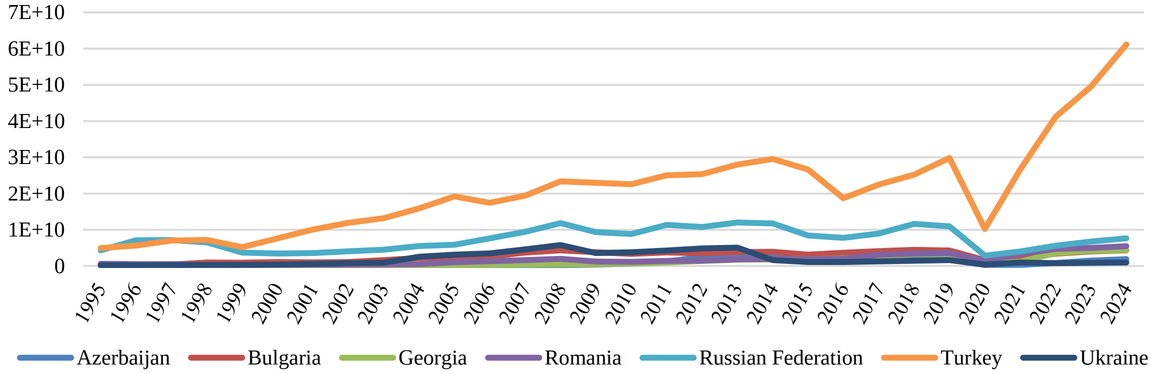

Figure 3. International Tourism, Receipts for Travel Items (Current US$)

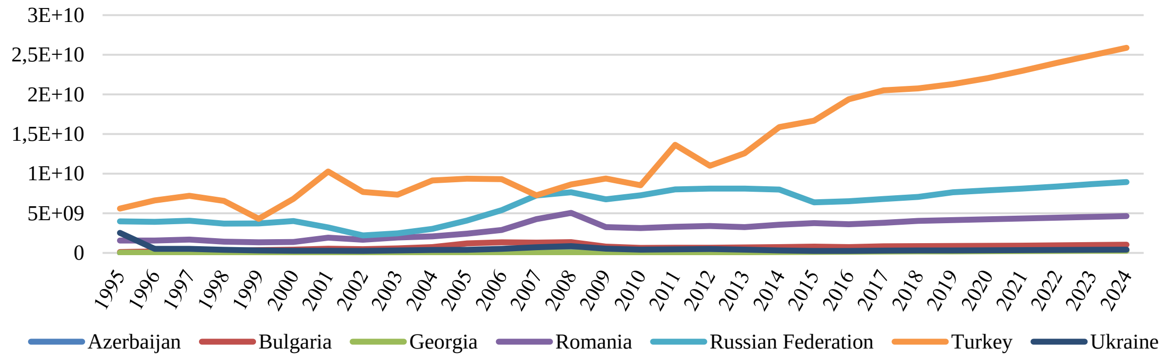

Figure 4. Tourism Capital Investment

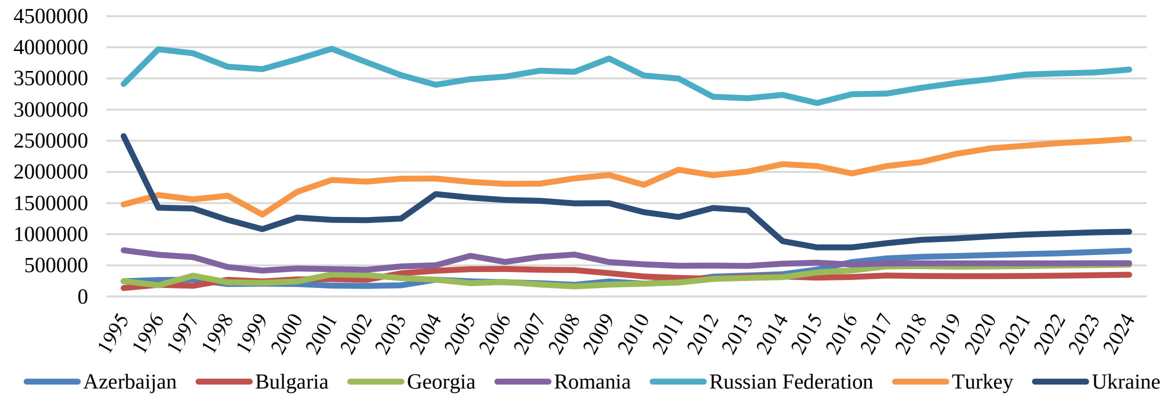

Figure 5. Share of Employment in the Tourism Sector in Total Employment (%)

Indeed, the COVID-19 pandemic has further increased economic vulnerability in tourism-dependent countries such as Georgia, and recovery has varied significantly across countries. Between 1995 and 2024, international tourist arrivals (ITA) in the countries showed a general upward trend, albeit occasionally interrupted by crises. Turkey, Bulgaria and Romania showed a rapid recovery thanks to their diversified tourism structures, while Azerbaijan experienced steady growth. In contrast, Ukraine and Russia experienced serious setbacks due to geopolitical instability.

For sustainable economic contribution, attracting high-spending tourists is more strategically important than simply increasing the number of tourists. In this context, Turkey and Azerbaijan have achieved higher quality growth by attracting visitors with higher per capita spending. Tourism investment patterns also vary across the region. Turkey has consolidated its leading position in the sector, recording by far the highest volume of tourism investment in the 1995-2024 period. Romania and Russia have also been characterized by steady increases in investment. In contrast, Georgia and Azerbaijan attracted relatively low investment, while Ukraine experienced a decline in investment activity due to political instability and war. These dynamics were also reflected in the labor market: Georgia and Azerbaijan recorded the largest increases in tourism-related employment as a share of total employment, while Turkey and Bulgaria experienced more moderate but steady growth.

In contrast, tourism employment remained limited or declined in Russia, Romania and Ukraine, which was particularly affected by the war. The analysis focuses on understanding the macroeconomic effects of tourism in the Black Sea coast and Azerbaijan from a comparative perspective. Analyzing indicators such as the share of tourism receipts to GDP and exports, income per tourist, investment volumes and contribution to employment, the study reveals both the structural characteristics of the countries and their different responses to external shocks. Within this framework, the study highlights the necessity of enhancing tourism infrastructure and regional cooperation mechanisms to ensure sustainable growth.

LİTERATURE REVİEW

The main aim of the research is to evaluate the long-term influence of crucial tourism variables such as tourism capital investment, GFCF and ITA on economic growth. By applying the extended Solow hypothesis in logarithmic form, long-run cointegration relationships between these variables are evaluated for the Black Sea littoral countries and Azerbaijan on the Caspian Sea coast for the period 1995-2024. Using advanced dynamic panel data analysis techniques such as Pedroni DOLSMG and DOLS, both panel-level and country-level relationships are revealed. Moreover, in line with the country-level results, a comparative analysis between Azerbaijan and the Black Sea countries, which have similar coastal geography, will be conducted. Ultimately, this investigation strives to contribute empirical findings and policy recommendations that demonstrate that tourism is a strategic driver of macroeconomic growth. Therefore, the literature review, aligned with the variables included in the analysis and the methodology employed in this study, is presented in Table 1 below, summarizing the findings of previous studies on the relationship between tourism and economic growth and supporting the theoretical framework of the research.

Tablo 1. Literature Review of Studies on Tourism and Economic Growth Variables

Author(s)	Period & Method	Findings	Variable Group
Baghirov & Sarkhanov (2023)	1995–2019; DOLS, DOLSMG	A 1% increase in ITR raises per capita GDP by 0.22% in Georgia, 0.08% in Moldova, 0.074% in Azerbaijan, and 0.034% in Ukraine, with a panel-wide effect of 0.1029%.	Per capita GDP, (ITR), Consumer Price Index (CPI)
Kum et al. (2015)	1995–2013; DOLS, FMOLS	A 1% increase in the number of ITA leads to a 0.06% increase in GDP according to FMOLS, and 0.08% according to DOLS	GDP and (ITA)
Lee & Chang (2008)	1990–2002; FMOLS, Cointegration	There is a strong long-run cointegration relationship between tourism development and GDP in both OECD and non-OECD countries.	Real GDP per capita, ITR per capita, ITA
Mishra et al. (2021)	1995–2019; Panel ARDL	For the BRICS countries, ITA was found to have a positive and statistically significant long-term effect on economic growth.	GDP, ITA, GFCF
Trisetia (2021)	1995–2018; FMOLS, DOLS	a consistent and significant long-run relationship exists between tourism expenditure, ITR, and per capita real GDP in Southeast Asia.	Real GDP per capita, tourism expenditure, ITR
Guellil et al. (2015)	1988-2012; DOLSMG, FMOLS	A 1% increase in tourism expenditure leads to a 4.53% rise in GDP per capita according to FMOLS, and a 635.11% rise according to DOLS, indicating a strong influence	GDP per capita, tourism expenditure
Rasool & Maqbool (2021)	1995–2015; Panel ARDL	There is a stable and significant long-run cointegration relationship among ITR, and GDP per capita. A 1% increase in ITR per capita raises GDP per capita by 0.31%.	GDP per capita, ITR per capita,
Dhungel (2015)	1974–2012; Johansen Cointegration	A significant long-term relationship exists between ITR and GDP per capita in Nepal. A 1% rise in ITR results in a 0.2% growth in GDP per capita	GDP per capita, ITR per capita
Anis et al. (2023)	1995–2021; FMOLS, DOLS	ITR, trade openness, and investment positively influence economic growth in selected Asian countries	GDP, ITR investment, population
Proença & Soukiazis (2008)	1990–2004; Panel Data	A 1% increase in ITA leads to a 0.026-point rise in GDP per capita in Southern European countries	GDP per capita, ITA
Özcan, Ș. S. (2021)	1995–2018 PDOLS	A 1% rise in per capita ITR and per capita ITA results in an approximate increase of 0.55% and 0.70% in real GDP, respectively. Bidirectional causality is observed in most countries.	Real GDP, ITR per capita, ITA per capita
Gökovalı & Bahar(2006)	1987–2002; Panel Data Analysis	a 1% increase in investment ratio and ITR's share in exports boosts GDP growth by approximately 13% and 8%, respectively.	GDP growth, capital formation, ITR/export ratio
Fayissa et al. (2011)	1990–2005; Dynamic Panel (GMM)	In Latin America, both physical capital investment and ITR significantly and positively impact GDP per capita. ITR have a comparable effect to capital investment.	GDP per capita, ITR, physical capital investment
Seetanah (2011)	1990–2007; Dynamic Panel (GMM)	Tourism drives growth in 19 island economies, with output elasticity of 0.12–0.14, and capital investment is the strongest determinant.	GDP, tourism arrivals, physical capital investment

Apergis & Payne(2012)	1995–2007; DOLSMG, Cointegration, FMOLS	A long-run equilibrium relationship is found between real GDP per capita, real effective exchange rate, ITA per capita in Caribbean countries	Real GDP per capita, real exchange rate, ITA per capita
Ekanayake & Long (2012)	1995–2009; FMOLS, Causality	Tourism receipts positively affect economic growth in 140 developing countries, although elasticity is not statistically significant in all regions.	GDP, ITR, GFCF, labor force
Işık (2019)	2000–2015; Panel DOLS, PDOLS	ITA and ITR both positively impact economic growth: a 1% increase in tourists raises growth by 1.1%, and revenue by 0.9%.	GDP, sustainable development, ITR, ITA
Hardi, et al. (2023)	1965–2021; DOLS, FMOLS	In Indonesia, a 1% rise in GFCF increases GDP by 0.19%, while a 1% rise in GDP boosts GFCF by 3.66%, indicating a strong bidirectional long-run relationship.	GDP, GFCF
Fauzel et al. (2016)	1984–2014; VECM	In Mauritius, a 1% rise in tourism FDI leads to a 0.06% increase in output after one year, indicating positive short- and long-term impacts on growth.	GDP, tourism FDI, non-tourism FDI
Seraj et al. (2025)	1999–2020; Quantile Regression	In six African countries, FDI boosts GDP by 0.58 units per increase, while ITR raise it by 0.0016 units.	GDP, ITR, FDI, exchange rate

The literature widely acknowledges that tourism positively contributes to long-term economic growth. However, studies specifically examining tourism investments are relatively scarce, indicating a need for more detailed research on the relationship between tourism investments and economic growth.

DATA

This study primarily focuses on examining the extended impacts of key tourism-related variables —namely tourism capital investment, GFCF, and ITA—on economic growth. Moreover, consistent with the country-level results, a comparative analysis between Azerbaijan and the Black Sea countries, which share similar coastal geographies, is performed. Ultimately, this investigation focuses on delivering analytical findings and policy recommendations highlighting the strategic role of tourism as a driver of macroeconomic growth in these regions. To achieve this, the extended Solow hypothesis in logarithmic form is employed to assess long-run cointegration relationships among these variables for the Black Sea littoral countries (Bulgaria, Georgia, Romania, Russian Federation, Turkey, Ukraine) and Azerbaijan on the Caspian Sea coast, over the period 1995–2024. In line with this hypothesis, the mentioned variables are expected to have significant and positive effects on economic growth. The study utilizes a balanced panel dataset of 210 observations spanning 30 years across seven countries. GDP in current US dollars is also used as the dependent variable, while tourism capital investment, GFCF, and ITA serve as independent variables. Data are sourced from reputable international and national institutions including the World Bank, CEIC Data, the WTTC, and the respective national statistical agencies. To harmonize scale differences and better capture proportional relationships, all variables are log-transformed. Advanced dynamic panel data analysis techniques are then applied: Pedroni DOLSMG estimators are employed for panel-level dynamic estimations, while DOLS estimators are used for country-level long-run cointegration analysis. These analyses are conducted using STATA 18, GAUSS 16, and EViews 12 software.

MODEL

The mathematical expression of this model, based on the extended Solow hypothesis and transformed into logarithmic form, is presented below (Wooldridge, 2010, pp. 8-10):

$$lnGDP_{it} = b_0 + \mathrm{b}_1 lngTI_{it} + \mathrm{b}_2 lnCS_{it} + \mathrm{b}_3 lnTN_{it} + u_{it} \quad (1)$$

Here, b_0 is the intercept term, ve b_1, b_2, and $\mathrm{b}_3$are the coefficients of tourism capital investment, GFCF, and ITA, respectively, and u_{it}represents the error term. Establishing the validity of the extended Solow hypothesis requires confirming the establishment of a long-run cointegration link both within the model framework and across countries.

METHODOLOGY

In this study, appropriate methods and tests are systematically applied to accurately model the long-run relationship in panel data analysis. First, Pesaran CD, Pesaran Scaled LM, and Breusch-Pagan LM tests are conducted to identify the cross- sectional dependence between the model and the variables. Furthermore, Pesaran-Yamagata Slope Homogeneity Test (Delta Test) is used to detect homogeneity or heterogeneity in the model. Based on these results, the CIPS test was selected as the appropriate unit root test and the stationarity of the variables was comprehensively analyzed.

Long-run dynamic associations are examined through the application of the Durbin-Hausman cointegration test at the panel level. In the estimation phase, to account for cross-sectional dependence and heterogeneity, second-generation heterogeneous panel techniques are employed. Specifically, the DOLSMG estimator is utilized for panel-level analysis, while country-level estimations are conducted using the DOLS approach (Gormus & Aydin, 2020).

Cross-Sectional Dependence Tests

In empirical studies testing long-run relationships using panel data analysis, it is essential to detect cross-sectional dependence between units. Therefore, in the analysis process, Pesaran CD, Pesaran Scaled LM, and Breusch-Pagan LM tests are applied both at the variable level and within the framework of a model based on the extended Solow hypothesis to determine whether cross-sectional dependence exists among panel units.

The mathematical formula of the test statistics proposed by Breusch & Pagan (1980) to test for cross-sectional dependence for the variables used in the analysis and the model in Equation 1 is shown below.

$$\mathrm{CD_{LM}} = T\sum_{i=1}^{N-1}\sum_{J=i+1}^{N}\hat{p}_{ij}^{2} \tag{2}$$

Here, $\hat{p}_{ij}^{2}$ denotes the correlation coefficient between the error terms of units i and j. The test statistic is asymptotically distributed as a chi-square x^2 variable with $N(N-1)/2$ degrees of freedom (Breusch & Pagan, 1980). "Pesaran (2004) introduced an alternative test statistic because the one computed in Equation 2 may produce misleading outcomes in large samples**:**

$$\mathrm{CD_{LM1}} = \sqrt{\frac{1}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{J=i+1}^{N}(T\,\hat{p}_{ij}^{2}-1) \tag{3}$$

Pesaran (2004) improved the test statistic in Equation 2 and proposed a new test statistic that allows the analysis of cross-sectional dependence in large samples (Pesaran, 2004). In addition, Equation 4 is restructured by considering the cases where the number of units (N) is larger than the time dimension (T) and an alternative test statistic is developed in this framework.

$$\mathrm{CD_{LM2}} = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{J=i+1}^{N}\hat{p}_{ij}\right) \tag{4}$$

For all variables and panel test statisticsThe null hypothesis indicates absence of cross-sectional dependence between units, in contrast to the alternative hypothesis which suggests its existence (Yerdelen Tatoğlu, 2020).

Slope Homogeneity Tests

In this study, delta tests proposed by Pesaran & Yamagata (2008) are used to test the homogeneity of slope coefficients in panel data models. These tests are improved versions of the classical Swamy (1970) method and provide appropriate results for both large and small sample sizes. Delta tests test the alternative hypothesis of heterogeneity against the null hypothesis that slopes are homogeneous. The test statistics allow us to reliably determine whether the slope coefficients are homogeneous. he first delta test statistic, formulated as an extension of Swamy's (1970) methodology, is computed as follows (Swamy, 1970):

$$\hat{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{s}-k}{\sqrt{2k}}\right) \tag{5}$$

In this context, S represents the modified Swamy statistic, and assuming normally distributed errors, the delta test statistics are adjusted to correct mean and variance biases.

$$\hat{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{s}-E(\tilde{z}_{\hat{it}})}{\sqrt{var(\tilde{z}_{\hat{it}})}}\right) \tag{6}$$

Hera, $E(\tilde{z}_{\hat{it}}) = k,\ var(\tilde{z}_{\hat{it}}) = 2k(T-k-1)/(T+1)$ For both test statistics, the null hypothesis suggests that the slopes are homogeneous, while the alternative hypothesis indicates that they are heterogeneous (Pesaran & Yamagata, 2008).

Cips Panel Unit Root Test

Pesaran's (2007) CIPS test is a second-generation panel unit root test that considers unit heterogeneity and cross-sectional dependence. It is based on the CADF statistics computed separately for each cross-sectional unit. The CIPS statistic is calculated as the simple average of individual CADF statistics and is applicable in both large - N and large -T panels. The formulation of the CIPS test is as follows (Pesaran, 2007):

$$\mathrm{CIPS\ (N,T)} = \mathrm{t-bar} = \frac{1}{\mathrm{N}}\sum_{\mathrm{i=1}}^{\mathrm{N}}\mathrm{t_i\ (N,T)} \quad or \quad \mathrm{CIPS} = \frac{1}{\mathrm{N}}\sum_{\mathrm{i=1}}^{\mathrm{N}}\mathrm{CADF}_i \tag{7}$$

Thus, $\mathrm{t_i}$ $\mathrm{(N,T)}$is the CADF test statistic derived for each unit in the panel. The calculated CIPS value is compared with the critical values provided by Pesaran based on Monte Carlo simulations. When the test statistic surpasses the critical threshold, it leads to rejecting the null hypothesis of a unit root, which implies that the series is stationary (Yerdelen Tatoğlu, 2020).

Panel Cointegration Tests

The Durbin-Hausman (DH) panel cointegration test is conducted after confirming that the variables are stationary at their first differences based on unit root test results. The DH test developed by Westerlund (2008) tests long-run cointegration relationships in panel data sets with different degrees of integration and cross-sectional dependence at both group and panel levels. The group test assesses the presence of cointegration in some cross-sections, while the panel test assesses cointegration in the whole panel. The Westerlund cointegration test is expressed by the following formulas at both group and panel level (Westerlund, 2008).

$\mathrm{DH_g}$ At the panel level: $$DH_g = \sum_{i=1}^{n}\hat{S}_i\,(\tilde{\phi}_i - \hat{\phi})^2\,\sum_{t=2}^{T}\hat{e}_{it-1}^{2} \tag{8}$$

$\mathrm{DH_g}$ At the group level: $$DH_p = \hat{S}_i(\tilde{\phi} - \hat{\phi})^2\,\sum_{i=1}^{T}\sum_{t=2}^{T}\hat{e}_{it-1}^{2} \tag{9}$$

The $\mathrm{DH_g}$ panel statistic is calculated by summing the individual terms, while $\mathrm{DH_p}$ is the average statistic generated by multiplying and summing the various terms. Both tests assume no cointegration under the null hypothesis, whereas the alternative hypothesis suggests the presence of cointegration (Gövdeli, 2019).

Long Run Cointegration Estimators in Dynamic Models

In order to validly estimate long-run relationships in panel data analysis, the stationarity of variables should be examined with the CIPS test and cointegration relationships should be tested with the Durbin-Hausman test, taking into account panel data characteristics such as cross-section dependence and structural heterogeneity. Following these steps, the Dynamic DOLS long-run cointegration estimator, which takes into account the dynamic structure of the units in the panel, and the DOLSMG long-run cointegration estimator developed by Pedroni for the whole panel stand out as a methodological approach that is frequently recommended in the empirical literature for estimating long-run relationships (Yerdelen Tatoğlu, 2020).

Dynamic DOLS Cointegration Estimator

The DOLS method, developed by Stock and Watson (1993) by adding dynamic a priori components to the classical Least Squares method, eliminates endogeneity and autocorrelation problems in time series with different stationarity levels and provides reliable estimation of long-run relationships in small samples. The mathematical formulation of the DOLS approach is implemented within the framework of the following model (Stock & Watson, 1993):

$$\mathrm{Z} = \mathrm{a} + \mathrm{X}'\beta + \sum_{i=-p}^{p} \gamma \Delta X_{t+1} + \mathrm{u_t} \qquad (10)$$

The DOLS approach addresses the unit root issue by incorporating the first differences of independent variables with lag length p selected via the AIC, enabling a reliable estimation of the long-run relationship between variables (Özer, 2020).

Dynamic DOLSMG Cointegration Estimator

In panel data analysis, the DOLSMG approach proposed by Pedroni (2001), which accounts for cross-sectional dependence and heterogeneity in long-run coefficients, is employed. This method obtains individual long-run coefficients by performing Dynamic DOLS estimations for each unit separately and presents a common and reliable cointegration coefficient across the panel by calculating the arithmetic mean of these estimates. Thus, both heterogeneity across units is preserved and the long-run relationships of the panel are robustly captured. The DOLSMG estimator model equation by Pedroni is given below (Pedroni, 2001):

$$t_{\hat{\beta}_{\mathrm{DOLSMG}}} = \mathrm{N}^{-1} \sum_{i=1}^{N} t_{\hat{\beta}_{\mathrm{DOLS,i}}} \qquad (11)$$

The Panel DOLS and DOLSMG approaches assess whether a long-term relationship exists between dependent and independent variables. When the t-statistic surpasses the critical value, the null hypothesis is rejected, indicating a statistically significant long-run link, otherwise, the relationship is considered insignificant (Yerdelen Tatoğlu, 2020).

FINDINGS

In order to reach reliable and valid results in this study, the structural properties of the panel data set need to be analyzed in detail in several stages. First, cross-section dependence and slope heterogeneity tests are applied and it is determined that the panel data set has both a dependent and heterogeneous structure. Accordingly, the CIPS panel unit root test, a second-generation method that accounts for heterogeneity in panel data, was applied, and the results revealed that the dependent variable is stationary in first differences while the independent variables have a mixed stationarity structure. In line with the aforementioned stationarity structure, the Durbin-Hausman panel cointegration test, which has the capacity to test the long-run relationships between variables, was applied and the existence of long-run cointegration relationships was determined both at the model level and country level. The impact of tourism components on economic growth is analyzed in the context of dynamic models using the panel-level Pedroni DOLSMG and country-level DOLS long-run cointegration estimators.

In Table 2 below, the cross-sectional dependence in the variables and the extended Solow hypothesis are analyzed using the Breusch-Pagan (1980) LM test, the Pesaran (2004) scaled LM test and the Pesaran (2004) CD test, as well as the homogeneity of the model using the Delta and adjusted Delta homogeneity tests and the results are presented.

The results show that there is cross-sectional dependence in both the variables and the extended Solow hypothesis and that the model has heterogeneous slopes. Therefore, in the rest of the paper, unit root and cointegration tests are applied taking into account cross-sectional dependence and heterogeneity. In this study, a graphical evaluation is presented in Appendix 1 to determine whether the dependent and independent variables should be analyzed with a constant or with a trend, taking into account cross-sectional dependence and heterogeneity. As a result of this evaluation, CIPS panel unit root test with constant term is applied and the related results are presented in Table 3.

Table 2. Cross-Section Dependence and Homogeneity Test Results

Variables	Breusch-Pagan LM	Pesaran scaled LM	Pesaran CD
LnGDP	464.0429*	68.36300*	20.87600*
LnCS	486.5458*	71.83528*	22.00031*
LnTI	281.6274*	40.21568*	11.94741*
LnTN	242.0970*	34.11601*	11.37814*
MODEL	218.5294*	30.47945*	13.07769*
Slope Homogeneity Test Results		$\hat{\Delta}$	$\hat{\Delta}_{adj}$
		10.989*	12.038*

*, **, and *** indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively

Table 3. CIPS Panel Unit Root Test Results

Variables	Level I(0)	I Differences I(1)
LnGDP	-1.464	-4.359*

LnCS	-3.374*		-4.778*
LnTI	-0.589		-5.085*
LnTN	-2.750*		-4.663*
Critical values	10%	5%	1%
	-2.21	-2.33	-2.57

*, **, and *** indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively

The results of the CIPS panel unit root test reveal that LnGDP and LnTI variables are non-stationary at level but become stationary at first difference, while LnCS and LnTN variables are stationary both at level and at first difference. The fact that the variables have different degrees of integration indicates that there is a mixed stationarity structure in the model, and in this direction, it would be appropriate to apply the Durbin-Hausman panel cointegration test to analyze the long-run relationship between the variables. The Durbin-Hausman Panel Cointegration Test, which suggests that error correction and cointegration-based panel data analyses should be applied in case cointegration is detected, presents results at both panel and group levels. The Durbin-Hausman test confirms significant long-run cointegration at both panel and group levels. The DOLSMG estimator by Pedroni, accounting for cross-sectional dependence and heterogeneity, was used for estimation. This method performs individual Dynamic DOLS estimations and averages the long-run coefficients to obtain a common panel cointegration coefficient. The Durbin-Hausman Panel Cointegration Test, which suggests that error correction and cointegration-based panel data analyses should be applied when cointegration is detected, presents the results at both the panel and group levels in Table 4.

Table 4. Panel Cointegration Tests Results

Tests	**Group**	**Panel**
Durbin-Hausman Test Statistic Value	2.824*	011.343*

*, **, and *** indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively

Table 5. Dynamic DOLS and DOLSMG Panel Cointegration Estimation Results

COUNTRIES		**LNTI**	**LNCS**	**LNTS**
1	Azerbaijan	0.818*	0.5447*	0.9286*
2	Bulgaria	0.1721**	-0.2679	0.244*
3	Georgia	0.484*	-0.231**	0.0418*
4	Romania	0.4917*	-0.1163*	0.3817*
5	Russian Federation	0.2217**	-0.5166*	-0.0278
6	Turkey	0.2462*	0.5896*	0.3819*
7	Ukraine	-0.7934*	0.9111*	0.4719*
MODEL		0.2343*	0.1305*	0 .346*
Critical Values		%10	%5	%1
		1.645	1.960	2.326

*, **, and *** indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectivey

The Dynamic DOLS long-run panel cointegration results presented in Table 5 reveal the effects of tourism capital investments, GFCF, and ITA on economic growth across countries. According to the analysis, tourism capital investments have a positive and statistically significant impact on GDP at the 1% significance level in Azerbaijan, Georgia, Romania, and Turkey, and at the 5% significance level in Bulgaria and the Russian Federation. However, the negative relationship observed in Ukraine reflects the influence of country-specific structural and political factors. GFCF is significant in all countries except Bulgaria, exhibiting positive effects in Azerbaijan, Turkey, and Ukraine, and negative effects in Georgia, Romania, and the Russian Federation. ITA exert a strong and positive effect on economic growth in all countries except the Russian Federation. Overall, all independent variables positively affect GDP in Azerbaijan and Turkey, whereas in Georgia, Romania, and Ukraine, some variables show negative or varying effects. In Bulgaria and the Russian Federation, some independent variables either lack statistical significance or have negative impacts on economic growth. In conclusion, tourism capital investments and ITA generally contribute positively to economic growth, while the contribution of GFCF varies across countries.

In Azerbaijan, tourism capital investments, GFCF and the ITA strongly and positively support economic growth. In Bulgaria, tourism investments and ITA have a positive effect, while GFCF is ineffective. In Georgia, tourism investments and ITA exert a positive impact, whereas GFCF has a negative effect. In Romania, all variables are significant, with tourism investments and ITA having positive effects, and GFCF being negative. In Russia, tourism investments positively affect growth, GFCF has a negative impact, and the effect of ITA is not significant. In Turkey, all variables significantly and positively contribute to economic growth. In Ukraine, tourism investments have a negative effect, while GFCF and ITA provide positive contributions. In Azerbaijan, tourism capital investments, GFCF, and the ITA have positive and strong effects on economic growth at the 1% significance level. In terms of effect size, a 1% increase in tourism capital investments, GFCF, and the ITA is estimated to increase GDP by approximately 0.82%, 0.54%, and 0.93%, respectively. In general, Azerbaijan stands out as one of the countries where tourism and capital investments contribute most balanced and strongly to economic growth. In other countries, however, these relationships tend to be more complex and can sometimes yield negative outcomes. This situation necessitates that policymakers undertake more careful and strategic planning regarding investment efficiency, resource utilization, and sectoral support mechanisms. To enhance the positive impact of the tourism sector on economic growth, the development of sustainable and efficient investment strategies is a critical priority for all countries. The results presented in Table 5 are based on dynamic DOLSMG panel cointegration estimations based on the extended Solow hypothesis and reveal that each of these variables has positive and significant effects on GDP. According to the findings, a 1% increase in tourism capital investments, GFCF and ITA is estimated to increase GDP by 0.2343%, 0.1305% and 0.3460%, respectively. Thus, based on the obtained results, the extended Solow hypothesis model is formulated as follows:

$$\text{GSYİH}_{it} = \alpha_{it} + 0.2343\ \text{LNTY}_{it} + 0.1305\ \text{LNSS}_{it} + 0.3460\ \text{LNTS}_{it} + \varepsilon_{it} \qquad (12)$$

Here, the coefficients $\beta_1 = 0.2343$, $\beta_2 = 0.1305$, and $\beta_3 = 0.3460$ represent the long-term effects of tourism capital investments, GFCF. and the ITA on GDP, respectively. The term α_{it} denotes country-specific fixed effects, while ε_{it} represents the error term.

CONCLUSION

This study examines the effects of tourism capital investments, GFCF, and the ITA on economic growth using dynamic panel data analysis techniques. Long-run relationships among the variables were reliably analyzed employing Pedroni's (2001) DOLSMG and DOLS panel cointegration estimators. The findings indicate that, overall, these three variables have positive and statistically significant effects on GDP, with the contribution of ITA to growth being stronger and more decisive compared to the other two variables. Country-level analyses reveal some differences. While all variables exert positive effects in Azerbaijan and Turkey, GFCF has a negative impact in Georgia, Romania, and Ukraine.

Notably, tourism investments also show a negative effect in Ukraine. In Bulgaria and Russia, the contributions of tourism and capital variables to growth are limited or statistically insignificant. These results highlight the influence of structural differences in national economies and investment efficiency. Compared to regional countries, Azerbaijan exhibits the strongest economic growth response in terms of tourism investments and ITA. In Turkey, this relationship is positive but weaker. The impact of investments remains limited in Bulgaria, while tourism and investment effects are generally low in countries such as Georgia, Romania, and Russia. According to the DOLSMG test, tourism capital investments, gross fixed capital formation, and international tourist arrivals have a significant and positive impact on economic growth, supporting the extended Solow hypothesis at the panel level, while country-level DOLS tests show that the hypothesis is not fully confirmed in countries other than Azerbaijan and Turkey due to heterogeneous effects. Studies such as Fauzel et al. (2016), Gökovalı & Bahar (2006), Fayissa et al. (2011), and Hardi et al. (2023) demonstrate that foreign direct investment and fixed capital formation in the tourism sector significantly and sustainably support economic growth in the long term. Additionally, Seraj et al. (2025) emphasize that tourism contributes positively to sustainable growth and GDP increases in African countries. The positive impact of GFCF on economic growth, which varies across countries and is strong in Azerbaijan, Turkey, and Ukraine but insignificant in Bulgaria, aligns with the findings of Seraj et al. (2025) and Fauzel et al. (2016), who emphasize the beneficial role of capital accumulation in economic development. The stronger positive impact of ITA on GDP compared to other variables, supported by analyses conducted in Azerbaijan, Georgia, Turkey, Romania, Bulgaria, Ukraine, and the Russian Federation, aligns with the findings of Baghirov & Sarkhanov (2023), Kum et al. (2015), Rasool & Maqbool (2021), Özcan (2021), Seetanah (2011), and Işık (2019), which emphasize the positive effects of tourism on economic growth.

This study confirms that tourism and capital investments have a significant and lasting impact on long-term economic growth, with international tourist arrivals (ITA) emerging as the strongest contributor. It recommends enhancing tourism capital through incentives, infrastructure development, and promotional efforts to attract more ITA. Due to structural and economic differences among countries, tailored policies should be implemented to increase investment efficiency. Improving investment quality and management is also essential for sustainable growth. The study offers valuable insights for policymakers and provides a solid foundation for future research on the economic role of tourism and investment.

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