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Research Article

Tourism as a Driver of Economic Development of the Greek Regions

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Abstract

It has been recognized that the effects of tourism have a huge positive impact on local economies. With the global growth of the tourism industry, an increasing number of regions in many countries have recognized the importance of tourism as a driver of local economic growth. Tourism contributes to economic growth through multiple channels: it provides income and employment opportunities, encourages investment in infrastructure and improves the national balance of payments. Given the importance of tourism in economic growth, this paper empirically investigates the impact of tourism activity on the economic growth of Greek regions. The empirical analysis consists of 8 years of panel data for the 13 regions of Greece for the period 2013-2019. Using econometric panel regression techniques, several subsamples are estimated and analyzed. In particular, three categories of linear models of panel data are estimated: the Common Constant Model-CCM, the Fixed Effects Model-FEM and the Random Effects Models-REM. By estimating these models, the study investigates the random and fixed effects, as well as the individual heterogeneity among these regions. In addition, Hausman test was used to select the most appropriate model. The results of the estimation in all types of models show that tourism has a positive and significant impact on the economic development of Greek regions. The findings underline the necessity of policy implementation at the regional level.

Keywords: tourism; regional development; Greek regions; data panel models

Introduction

Understanding the drivers of regional development is an important task in the pursuit of development policies at the local level. One of the drivers of regional development is tourism. With the global boom in the tourism industry, an increasing number of regions in many countries have realized the importance of tourism as a driver of local economic growth. It is well known that the effects of tourism have huge positive impacts at the local and national level. Contributing to economic growth through multiple channels: a) tourism stimulates investment in new infrastructure and increases competition thus improving the efficiency of local firms [1]; b) tourism creates employment and enhances human capital accumulation by acting as a catalyst in the diffusion of technical knowledge; c) tourism can create economies of scale and scope thus reducing production costs for local firms [2]; d) tourism generates additional tax [3].

Taking into account the importance of tourism in economic development, this paper empirically investigates the impact of tourism activity on the economic development of Greek regions. Specifically, in this paper we examine the question of which Greek regions benefit most from tourism and ultimately whether tourism has contributed to economic growth at the regional level. To the extent that the marginal tourism product for any given region is larger than the region's share of the private sector variables - output, employment and investment - we can conclude that tourism contributes to the economic growth of that region [4]. This issue is important as it has direct policy implications for future tourism promotion decisions and highlights whether tourism policy decisions towards promoting overall growth can simultaneously promote regional convergence or, on the contrary, whether overall growth is achieved at the cost of increasing regional asymmetries.

The empirical analysis consists of 7 years of panel data for the 13 regions of Greece over the period 2013-2019. Using econometric panel regression techniques, various subsamples are estimated and analyzed. In particular, three categories of linear models of panel data are estimated: the Common Constant Model-CCM, the Fixed Effects Model-FEM and the Random Effects Models-REM. By estimating these models, the study investigates the random and fixed effects, as well as the individual heterogeneity among these regions. In addition, the Hausman Check test was used to select the most appropriate model. The estimation results in all types of models show that tourism has a positive and significant impact on the economic growth of Greek regions.

The structure of the study is as follows. Section 2 presents a brief review of the literature. Section 3 describes the methodology and data of the empirical analysis and presents the results. Finally, Section 4 presents the main conclusions and policy recommendations.

Review of the Empirical Literature

Despite the importance of tourism in promoting economic growth, the literature of empirical studies that have investigated the impact of tourism on economic growth at the regional level is quite limited.

At the international level, several studies have examined the relationship between tourism and economic growth at the national level. Examples of empirical studies that have been published in leading journals in recent years include Tugcu [5], Cárdenas-García et al. [6], Inchausti-Sintes [7], Tang & Tan [8], Antonakakis et al. [9, 10], Chiu & Yeh [11], De Vita & Kyaw [12, 13], Du et al. [14], Liu & Song [15], Lin et al. [16], Wu & Wu [17] and Zuo & Huang [18], Azam, M., Mahdiat, M., Hafeez, M.H. et al. [19]. Reviews of much of the literature, dating back to the pioneering study by Balaguer & Cantavella-Jorda [1], are contained in Brida et al. [20] and Castro-Nuño et al. [21]. With few exceptions, the literature suggests broad support that tourism contributes to economic growth at the national level.

In the case of Greece, several empirical studies have investigated the relationship between international tourism and the country's economic growth. In particular, Dritsakis [22] analyzed the relationship between tourism revenues, GDP and exchange rate (1960Q1-2000QIV) using VECM (Johansen) - Granger causality tests and found that Granger tourism causes economic growth with a strong causal relationship, while economic growth causes tourism with a simple causal relationship.

Kasimati [23] analyzed the relationship between tourist arrivals, GDP and real exchange rate for Greece over the period 1960-2010 using the VECM (Johansen) - Granger causality method and found that there is no causality between the variables.

Dritsakis [24] examined the relationship between tourist arrivals, the real exchange rate and GDP for seven Mediterranean countries including Greece (1980-2007) and found a one-way long-run causality driven by tourism to economic growth. Othman et al. [25] investigated 18 major tourism destinations worldwide, including Greece, using the ARDL methodology and also found mixed results. In the case of Greece, they found no causal relationship between tourism and growth.

Eeckels et al. [26] using VAR analysis showed that the cyclical component of tourism income significantly affects the cyclical component of GDP and validated the hypothesis of tourism-led economic growth for the case of Greece in the period 1976-2004.

Aslan [27] examined the relationship between tourism receipts, exchange rate and GDP using the Granger causality methodology for twelve Mediterranean countries (1995-2010). He obtained mixed results and for the case of Greece he found a one-way causality starting from economic growth in tourism.

Antonakakis et al. [28] examined the dynamic relationship between tourism growth and economic growth for 10 European countries for the period 1995-2012. They concluded that the tourism-economic growth relationship is not stable over time in terms of magnitude and direction. They show that this relationship is event-dependent, especially in countries that have experienced severe economic recessions since 2009, such as Cyprus, Greece, Portugal and Spain.

Recently, Lolos et al. [29] investigated the relationship between tourism and growth in the Greek economy. Using quarterly data for the period 1977-2020 they verified the hypothesis of tourism-led growth. They also showed that tourism growth has an asymmetric effect on output growth and that the effect of tourism on output is related to the state of the economy.

In terms of investigating the impact of tourism activity on economic growth at the regional level, empirical studies are limited. As an example, Yang and Wong [30] analyze the effects of tourism flows in different Chinese cities through a spatial panel data model. In the same vein, Klytchnikova and Dorosh [31] study the impacts of tourism in regions of Panama.

Zhang, et al. [32] analyze data for Denmark while Aguayo [33] studies the economic impact of tourism on the economy of Central and Eastern European countries at the regional level. Proença and Soukiazis [34] argue that tourism can be used as a means to reduce regional asymmetries.

Paci and Marrocu [35] analysed the impact of domestic and international tourism on economic growth for 179 regions in ten European countries, which are highly representative of total tourism flows. The econometric analysis is carried out for the period 1999-2009 and based on a spatial development model, The results, demonstrate that regional growth is positively affected by domestic and international tourism flows.

Andraz, J. et al, [4] use a VAR model to estimate the regional impact of tourism in Portugal with the ultimate goal of assessing the role of tourism in reducing regional asymmetries.

They identify the locations where tourism produces the highest impacts, as well as the regions where tourism produces the strongest effects on the country's economic performance.

Santos, and Vieira, [36] examine the importance of tourism as a factor of regional economic development in mainland Portugal, with an emphasis on interregional spatial effects. Their work used spatial econometric models to estimate the importance of tourism in regional economic development at the municipal level. The results showed that tourism is an important driver of regional economic development.

Theoretical Model

The role of tourism and its contribution to regional economic development is analysed through the use of Robert Solow's economic growth model, which is derived from the Cobb-Douglas aggregate production function.

Robert Solow's Neoclassical Model of Economic Growth

We start our analysis by assuming a typical neoclassical growth model, where the underlying basic aggregate production function can be written as:

$$Y = f\left(L, K\right) \qquad (1)$$

Y is the produced product, L, is the labour force of the population and K is the physical capital. The above function states that the total output of an economy depends on the quality and quantity of physical capital and on the total number of workers in an economy.

The Augmented Economic Growth Model

In addition, by being consistent with the extensive empirical literature in this area, the above model can be extended to incorporate other macroeconomic explanatory variables (Robert Solow's Augmented Economic Growth Model) which have been shown to be consistently associated with the economic growth of an economy. In our case, we will incorporate tourism as a determinant of total factor productivity or as another factor of production similar to capital and labour. Therefore, the estimation equation to be used in our study is based on the simple standard economic growth model that relates real GDP to the labor force of the population, physical capital. Consequently, for our empirical research, we formulate the following economic growth correlation:

$$rgdp_{i.t} = f\left(lf_{i,t}, gfcf_{i,t}, tour_{i,t},\right) \qquad i = 1,\ldots,N,\ t = 1,\ldots,T \qquad (2)$$

where $rgdp_{i.t}$ is real GDP, $lf_{i,t}$ is total labor force, $gfcf_{i,t}$ represents physical capital and the variable $tour_{i,t}$, represents tourism activity in each region.

Empirical Analysis - Methodology

The methodology, data and econometric analysis are presented below.

The Econometric Model of Economic Growth

Robert Solow's Model of Economic Growth can be expressed econometrically as follows:

$$lrgdp_{it} = \alpha + \beta_{1t} llf_{i,t} + \beta_{2t} lgfcf_{i,t} + \beta_{3t} ltour_{i,t} + u_{it} \qquad i = 1,\ldots,13\ \kappa\alpha\iota\ t = 2013,\ldots,2019 \quad (3)$$

where α incorporates all time-invariant and unobserved factors affecting $lrgdp_{it}$ while β represents $k-1$ vector of regression coefficients. The disturbance term u_{it} asymptotically follows the normal distribution $u_{it} \rightarrow N\left(0, \sigma_{it}^2\right)$.

The dependent variable is $lrgdp_{it}$ and the independent variables are ⟦ $llf_{i,t}, lgfcf_{i,t}, lhc_{i,t}, and\ ltour_{i,t}$. According to the theory, the key variables of the Economic Growth model are Labor Force $\left(llf_{i,t}\right)$ and Physical Capital $\left(lgfcf_{i,t}\right)$. In the economic growth literature, the labor force used in the production process and the accumulation of physical capital are the key determinants of growth [37]. Therefore, they will have a positive influence on economic growth. The tourism variable $ltour_{i,t}$, represents the activity in each region.

The estimation of the model (3) depends on the assumptions made regarding the intercept of the model, the slope coefficients or regression coefficients, as well as the error term. According to Judge et al., [38] and Hsiao, [39], there are many cases of assumptions that can be encountered in an empirical analysis, the main ones can be summarized as:

- The line constant and slopes are constant in time and space, while the error term varies over time and between entities.
- The regression coefficients are invariant, while the constant varies across entities.
- The regression coefficients are invariant, while the constant varies across entities and over time
- All coefficients vary between entities
- The regression constant and coefficients vary over time and between entities.

In empirical analysis, the focus is on selecting the most appropriate model. In general, there are three categories of linear panel data models: the Common Constant Model-CCM, the Fixed Effects model-FEM and the Random Effects Models-REM. The choice between the models is based on the assumptions made on the constant, the slope coefficients and the error term.

Common Constant or Pooled OLS

The simplest form of linear panel model is that of the Common Constant Model. In common constant models the intercept and slope coefficients are common for all stratified units $\left(i\right)$ and all periods $\left(t\right)$. In essence, this means that the individual effects are the same for all stratified units and that our sample is a priori homogeneous. The classical linear common constant model has the form:

$$y_{it} = \alpha + X_{it}^{'}\beta + u_{it}, i = 1,\ldots,N \ \kappa\alpha\iota\ t = 1,\ldots T \quad (4)$$

where y_{it} is the dependent variable and $X_{it}^{'}$ is $k-1$ vector of independent or explanatory variables affecting the dependent variable y_{it}. α is the constant and β represents $k-1$ vector of regression coefficients. The index $i = 1,\ldots,N$ represents the dimension of the stratified data, with i denoting the i - th stratified unit or entity (for example: individuals, firms, countries, regions, etc.), while $t = 1,\ldots T$ is the dimension of time series, with t denoting the i - th period. u_{it} it is the perturbation term or error term, which is independently and uniformly distributed over i and t.

In the common constant model we assume that there is unobserved heterogeneity, which is captured by the constant term α. If the model is correctly specified, then under the assumption of strict exogeneity (i.e. X_it^'. $X_{it}^{'}$ is not correlated with the random factor values) it can be reliably estimated using the single-sample least squares (pooled OLS) method.

Fixed Effects Model- FEM

One way to capture the uniqueness or specificity of each stratum is to assume that the constant varies for each stratum while the regression coefficients are fixed. The model that takes into account the uniqueness of each stratified unit while the regression coefficients are constant is the Fixed Effects Model (FEM). The Fixed Effects Model (FEM) is expressed as:

$$y_{it} = \alpha + X_{it}^{'}\beta + u_{it}, \quad i = 1,\ldots,N \ \kappa\alpha\iota\ t = 1,\ldots T \quad (5)$$

where α_ι incorporates all time-invariant and unobserved factors affecting y_{it} while β represents $k-1$ vector of regression coefficients. The disturbance term u_{it} asymptotically follows the normal distribution $u_{it} \to N\left(0,\sigma_{it}^2\right)$. The linear model (5) can be estimated by the pseudo-variable technique, assuming that the covariance of the stochastic term $E\left(u_{it},u_{jt}\right)$,, for $i \neq j$ can vary between the stratified units i. The fixed effects model (FEM) has the characteristic that the constant term varies between the stratified units, but does not change over time. Thus, the constant α_ι may vary between stratified units but the value of this constant attributable to each stratified unit remains unchanged over time.

Random Effects Model - REM

Several argue that some shortcomings of FEM models can be eliminated or circumvented by using χ

$$y_{it} = \alpha + X_{it}^{'}\beta + \left(\alpha + u_{it}\right), \quad i = 1,\ldots,N \ \kappa\alpha\iota\ t = 1,\ldots T \quad (6)$$

In the above model, the main feature is the random nature of the individual effects. The parameter a in relation (7) is considered as a random variable and is expressed as:

$$\alpha_{it} = \alpha + \varepsilon_{it}, \quad (7)$$

In relation (7) the factor ε_{it} is the stochastic term, while the α is unknown and represents the average value of the random constant α_i. For the disturbance term ε_{it}, the following assumptions are made::

$$E\left(\varepsilon_{it}\right) = 0,$$

and

$$var\left(\varepsilon_{it}\right) = \sigma_\varepsilon^2,$$

We also have

$$E\left(\alpha\right) = 0,$$

And

$$var\left(\alpha\right) = \sigma_\alpha^2.$$

H α_i is not correlated with the observed explanatory variables and each entity has the same estimation parameter β. The constant term α is incorporated into the disturbance term u_{it}, so that the disturbance term u_{it} plays a buffering role in the model estimation process. Thus, a complex disturbance term v_{it} of the form:

$$v_{it} = \varepsilon_{it} + u_{it} \quad (8)$$

The result is to have a two-error component model, where the random errors ε_{it} and u_{it} are independently distributed with zero mean and constant variance. The stochastic term u_{it} reflects the individual variations of the individual strata, and may vary between individual strata, but remains constant over time within individual strata. The assumptions made regarding the above model are:

$$\alpha_i \to N\left(0,\sigma_\alpha^2\right)$$

$$u_i \to N\left(0,\sigma_u^2\right)$$

$$\varepsilon_{it} \to N\left(0,\sigma_\varepsilon^2\right)$$

$$E\left(u_i u_j\right) = 0 \ \gamma\iota\alpha\ i \neq j$$

$$E\left(u_{it}\varepsilon_{it}\right) = 0$$

$$v_{it} \to N\left(0,\sigma_v^2\right)$$

$$cov\left(v_{it}v_{is}\right) = \sigma_\alpha^2 + \sigma_\varepsilon^2, \ \gamma\iota\alpha\ t = s$$

$$cov\left(v_{it}v_{is}\right) = \sigma_\alpha^2, \ \gamma\iota\alpha\ t \neq s$$

$$cov\left(v_{it}v_{is}\right) = 0, \ \gamma\iota\alpha\ i \neq j$$

The estimation of β requires the calculation of the variances σ_ε^2 and σ_u^2, in order to determine the estimates of the variance-covariance matrices. If the values of the variances σ_ε^2 and σ_u^2, areknown, the values of the coefficients of the random effects model can be estimated by the GLS method. The estimated coefficients by the GLS method will be BLUE.

Selection Between Fixed and Random Effects Models

Considering both FEM and REM models, the following question arises: Which of the models is deemed more suitable for better subsampling of the data panels? Which of the best models is the most appropriate to use for the best modeling model?

Hausman Test

Based on Hausman's [40] test, the choice between the fixed effects (FE) and random effects (RE) model depends on the assumption of the correlation between the explanatory variables X_{it} and the effectes α_i of the stratified units. Since the FE estimator is consistent when the effects of the stratified units are correlated with the explanatory variables, while the RE estimator is inconsistent, a significant statistical difference between the two estimators is an indication against the choice of the random effects (RE) model.

Suppose that the following model is to be estimated:

$$y_{it} = +X_{it}^{'}\beta + \varepsilon_{it}, \quad i = 1,\ldots,N \ \kappa\alpha\iota \ t = 1,\ldots T \qquad (9)$$

where:

$$\varepsilon_{it} = \alpha_i + u_{it}, \qquad (10)$$

Relation (10) shows that the stochastic term ε_{it} consists of the parts α_i and u_{it}. We assume that $E(u_{it}\varepsilon_{it}) = 0$ indicating that the term u_{it} is not correlated with the variable vector $X_{it}^{'}$. The term α_i is called the individual effect and reflects the behaviour of each of the individual stratification units. The introduction of the term α_i makes it possible, in the context of econometric analysis, to investigate whether the behaviour of each stratification unit remains constant or changes over time. The term u_{it}, has the property of varying from observation to observation and per stratum. The question that arises is: Which methodological approach should be used to estimate the model of equation (9); by the random (REM) or the fixed effects method (FEM)?

Based on Hausman's [40] test, the null hypothesis of Hausman's test is that there is no difference between the estimated coefficients of the FE and RE models, versus the alternative that the two estimators differ:

$$H_0: \textit{The two estimators do not differ } (\textit{so the term } \alpha_i \text{ is not correelated with the } X$$

$$H_1: \textit{The two estimators differ } (\textit{so the term } \alpha_i \text{ is correelated with } X_{it})$$

The test of the null hypothesis is carried out with the statistical criterion:

$$H = \left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right)^{'}\left[var\left(\hat{\beta}_{FE}\right) - var\left(\hat{\beta}_{RE}\right)\right]^{-1}\left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right) \sim \chi^2 \qquad (11)$$

Which follows the distribution χ^2 with degrees of freedom equal to the order of the var $var\left(\hat{\beta}_{FE}\right) - var\left(\hat{\beta}_{RE}\right)$.

Large values of the H statistic indicate that the differences between the estimators are large. For values greater than the critical values of the χ^2, distribution, and with a given level of significance, the hypothesis that the RE estimator does not differ from the FE estimator is rejected, in other words the basic hypothesis of erogeneity does not hold. The rejection of the null hypothesis leads to the conclusion that the random effects estimator is not appropriate because the random effects are likely to be associated with one or more independent variables. Therefore, if the null hypothesis is chosen, the random effects estimator is selected, whereas if the alternative is chosen, the appropriate estimator is the fixed effects estimator.

Empirical Analysis Data

The sample used in the following empirical analysis consists of annual data for the 13 Greek regions which include: Attica (AT), Central Macedonia (KM), Western Greece (DE), Thessaly (TH), Crete (KRIT), Eastern Macedonia-Thrace (AM), Peloponnese (PEL), Central Greece (SE), Epirus (IP), South Aegean (NAIG), Western Macedonia (DM), Ionian Islands (IO) and North Aegean (VAIG)).

The dataset consists of annual data on gross domestic product (hereafter production), employment, gross fixed capital formation (hereafter private investment) and tourism, measured by the number of nights spent in hotels, apartments, tourist apartments, tourist villages, motels, guesthouses and camping sites by domestic and international tourists in each of the thirteen administrative regions of the country (NUTS II). All data were taken from the EUROSTAT database. A detailed presentation of the variables, their definition and their notation is illustrated in Table 1.

Table 1: Definition of Variables Acronyms and Data Sources.

Variable	Definition	Acronyms	Source
Real GDP	Real GDP at market prices based on constant local currency (2010)	$gdp_{i,t}$	EUROSTAT
Labor Force	Total labor force	$lf_{i,t}$	EUROSTAT
Physical Capital	Gross fixed capital formation at constant prices (2015)	$gfcf_{i,t}$	EUROSTAT
Tourism Activity	The number of nights spent in hotels, apartment hotels, tourist apartments, tourist villages, motels, guesthouses and campsites by domestic and international tourists on the mainland and in each of the five consecutive administrative regions of the country	$tour_{i,t}$	EUROSTAT

Both monetary variables, products and investment, are in millions and expressed in constant prices of 2015, while employment is measured in thousands of full-time employees. The decision to measure tourism as number of nights spent is due to the lack of consistent data for other variables such as tourist spending at the regional level. However, the use of this indicator is not new. This indicator of tourism activity has also been used in recent work, such as Cortes-Jimenez [41] or Paci and Marrocu [35], as it reflects the length of stay and therefore provides information on the employment rate of tourism establishments. In this way, it is more informative than other variables, such as the number of arrivals, in which there is no information on such dimensions. All data are converted into logarithmic values in order to measure the relative impact and elasticity of tourism on the economic growth of the Greek regions.

Economic Characteristics of Greek Regions

Greece is divided into four NUTS I regions: northern Greece (VE), Central Greece (KE), Attica (AT) and the Aegean and Crete Islands (NAIG01) and 13 NUTS II regions. These are: Attica (AT), Central Macedonia (KE), Western Greece (DE), Thessaly (TH), Crete (CRITI), Eastern Macedonia-Thrace (AM), Peloponnese (PEL), Central Greece (SE), Epirus (IP), South Aegean (NAIG), Western Macedonia (DM), Ionian Islands (NO) and North Aegean (VAIG).

Table 7.1 presents the most important economic indicators for the NUTS II regions in Greece for the year 2019; values are expressed as percentages of the national total. Looking at the table, the data reveal large differences between the regions. The metropolitan region of Attica, with 4.1 million inhabitants, comprises over 36.33% of the national population (just over 11 million). This is followed by Central Macedonia, with 2 million inhabitants (17.31%), and then the six regions with a population of between 500 000 and 800 000 inhabitants: western Greece (6.58%), Thessaly (6.53%), Epirus (5.43%), the Ionian Islands (5.37%) and the Peloponnese (5.27%). The remaining NUTS II regions have a population of between 198 000 and 400 000 inhabitants.

The population of the dominant regions of Attica and Central Macedonia has been integrated. In 2019, the regional product per capita in the richest region (Attica, 13,794) is twice that of the poorest (Western Greece, 6,4563). The share of employment is higher in the regions with the largest cities, i.e. Athens, Thessaloniki).

The share of Gross Value Added in Energy and Manufacturing ranges from 34.5% (Attica) to 0.75% (Ionian Islands), while the Gross Value Added in Distribution, Hotels and Restaurants, Transport, Storage and Communications ranges from 62.58% (Attica) to 1% (Western Greece). Investment ranges from 34 percent (Attica) to 1.5 percent (Central Macedonia). We can conclude here that there are large regional differences with the economic entity of Greece.

Greece has a number of particularities that affect the geographical distribution of economic activities, resulting in regional differences. According to, Greece, due to the existence of hundreds of inhabited islands and the constraints imposed by its mountainous terrain, is characterised by a highly fragmented physical and economic area.

This fragmentation increases transport and accessibility costs, thus requiring large investments in infrastructure and hindering the internal integration of the economy. In addition, limited accessibility to internal and external markets has created a productive structure dominated by small inward-looking firms serving local markets and with limited capacity to adopt and compete in national and international markets. Partly as a result of these conditions, Greek regions have a low productive structure.

Table 2: The Most Important Economic Indicators for the Regions of Greece (NUTS II), 2019 (Percentages of the national total).

Region	Population	Gdp	Private Consumption	Investments	Employment	Gdp Per Capita
ATTICA (ATT)	36,33	50,12	38,69	34,07	39,90	13.794,60
CENTRAL MACEDONIA (KM)	17,31	13,77	16,69	14,93	17,01	7.951,87
WESTERN GREECE (DE)	6,58	4,10	6,17	6,17	5,84	6.236,20
THESSALIA (TH)	6,53	4,68	6,22	6,60	6,06	7.172,81
CRETE (KR)	5,43	4,84	5,60	6,76	5,47	8.920,10
EASTERN MACEDONIA THRACE (AM)	5,37	3,46	5,08	5,97	4,61	6.456,43
PELOPONNESE (PEL)	5,27	4,29	5,08	3,98	5,33	8.138,74
CENTRAL GREECE (SE)	4,91	4,64	4,34	9,08	4,91	9.446,66
EPIRUS (IP)	3,13	2,34	3,10	3,65	2,94	7.469,50
SOUTH AEGEAN (NAIG)	2,73	2,84	2,80	2,30	2,43	10.387,13
WESTERN MACEDONIA (DM)	2,60	2,05	2,49	3,32	2,16	7.900,14
IONIAN ISLANDS (I N)	2,05	1,59	2,03	1,46	1,76	7.720,57
NORTH AEGEAN (VAIG)	1,76	1,28	1,71	1,72	1,61	7.278,96

Source: EUROSTAT, 2012.

Empirical Analysis Results

As mentioned in the introduction of the paper and taking into account the important contribution of tourism to economic growth, this paper empirically investigates the impact of tourism activity on the economic growth of Greek regions. In our empirical analysis we use 7 years of panel data for the 13 regions of Greece for the period 2013-2019 and estimate three categories of linear panel data models: the Common Constant Model-CCM, the Fixed Effects model-FEM and the Random Effects Models-REM. By estimating these models, the study explores the random and fixed effects, as well as the individual heterogeneity between these regions. In addition, we use Hausman's test to select the most appropriate model.

Model estimations

For the estimation of the model, the least squares method was first used to check the well-fitting of the estimated model and whether the OLS assumptions are violated.. Therefore, the augmented econometric model of Robert Solow's economic growth estimated is as follows:

$$lrgdp_{it} = \alpha + \beta_{1t} llf_{i,t} + \beta_{2t} lgfcf_{i,t} + \beta_{3t} ltour_{i,t} + u_{it} \qquad i = 1,\ldots,13 \ \kappa\alpha\iota \ t = 2013,\ldots,2019 \qquad (12)$$

The model in (12) was estimated by the simple least squares - OLS method. The equation of (1) is the common constant model and there is no heterogeneity.

In addition, to test the individual effects of each region, we estimate the Fixed Effects model-FEM as well as the Random Effects Models-REM. The Fixed Effects model assumes that the gradients are common, but the cross-sections differ between regions, i.e. there is heterogeneity. Therefore, equation (7.13) below is used to estimate fixed effects.

$$lrgdp_{it} = \alpha_t + \beta_{1t} llf_{i,t} + \beta_{2t} lgfcf_{i,t} + \beta_{3t} ltour_{i,t} + u_{it} \qquad i = 1,\ldots,13 \ \kappa\alpha\iota \ t = 2013,\ldots,2019 \qquad (13)$$

The random effects model assumes that intercepts are drawn from a common distribution and the error term consists of two components: an error term which is unique to each observation and constant over time (α_{it}) and an error term representing the extent to which the intercept of a given cross-sectional unit differs from the overall intercept (ε_{it}).

The econometric relationship reflecting the random effects model (REM) is as follows:

$$y_{it} = \beta_{1t} llf_{i,t} + \beta_{2t} lgfcf_{i,t} + \beta_{3t} ltour_{i,t} + (\alpha_{it} + u_{it}), \qquad i = 1,\ldots,N \ \kappa\alpha\iota \ t = 1,\ldots,T \qquad (14)$$

In the above model, the main feature is the random nature of the individual effects. The parameter α in relation (14) is considered as a random variable and is expressed as:

$$\alpha_{it} = \alpha + \varepsilon_{it}, \qquad (15)$$

The estimates of the three models are shown in Tables 3, 4 and 5, accordingly.

Table 3: Estimation results of the Joint Constant Model (Equation 12).

Dependent Variable: LGDP				
Method: Panel Least Squares				
Date: 11/09/23 Time: 20:08				
Sample (adjusted): 2014 2019				
Cross-sections included: 13				
Total panel (balanced) observations: 78				
Convergence achieved after 15 iterations				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-2.811777	0.132969	-21.14615	0
LLF	0.619816	0.027983	22.14962	0
LGFCF	0.481924	0.033222	14.5063	0
LTOUR	0.019972	0.007406	2.696545	0.0084
AR(1)	-2.811777	0.132969	-21.14615	0
R-squared	0.99934	Mean dependent var		8.977057
Adjusted R-squared	0.999303	S.D. dependent var		0.884552

S.E. of regression	0.023346	Akaike info criterion		-4.6148
Sum squared resid	0.039789	Schwarz criterion		-4.46373
Log likelihood	184.9773	Hannan-Quinn criter.		-4.55433
F-statistic	27615.62	Durbin-Watson stat		1.086114
Prob(F-statistic)	0			
Inverted AR Roots	1.00			
	Estimated AR process is no stationary			

Table 4: Estimation results of the Fixed Effects Model (Equation 13).

Dependent Variable: LGDP				
Method: Panel Least Squares				
Date: 11/09/23 Time: 20:22				
Sample (adjusted): 2014 2019				
Periods included: 6				
Cross-sections included: 13				
Total panel (balanced) observations: 78				
Convergence not achieved after 500 iterations				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	7.808541	1.222315	6.388322	0
LLF	0.61854	0.069296	8.925985	0
LGFCF	0.037915	0.028269	1.341224	0.1848
LTOUR	0.092793	0.033962	2.732268	0.0082
AR(1)	0.708958	0.087117	8.137994	0
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.999585	Mean dependent var		8.977057
Adjusted R-squared	0.999476	S.D. dependent var		0.884552
S.E. of regression	0.020242	Akaike info criterion		-4.77205
Sum squared resid	0.024994	Schwarz criterion		-4.25841
Log likelihood	203.1099	Hannan-Quinn criter.		-4.56643
F-statistic	9186.067	Durbin-Watson stat		1.490712
Prob(F-statistic)	0			
Inverted AR Roots	.71			

Table 5: Results of the Random Effects Model.

Dependent Variable: LGDP				
Method: Panel EGLS (Cross-section random effects)				
Date: 11/09/23 Time: 21:48				
Sample: 2013 2019				
Periods included: 7				
Cross-sections included: 13				
Total panel (balanced) observations: 91				
Swamy and Arora estimator of component variances				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-3.427982	0.561427	-6.105842	0

LLF	0.930589	0.057297	16.2415	0
LGFCF	0.152126	0.039659	3.835815	0.0002
LTOUR	0.058902	0.019798	2.975184	0.0038
Effects Specification			S.D.	Rho
Cross-section random			0.127125	0.938
Idiosyncratic random			0.032673	0.062
Weighted Statistics				
R-squared	0.829618	Mean dependent var		0.868181
Adjusted R-squared	0.823743	S.D. dependent var		0.090875
S.E. of regression	0.038152	Sum squared resid		0.126636
F-statistic	141.206	Durbin-Watson stat		0.943437
Prob(F-statistic)	0			
Unweighted Statistics				
R-squared	0.971175	Mean dependent var		8.979222
Sum squared resid	2.020505	Durbin-Watson stat		0.05913

In summary, the Joint Station Model Estimation (Equation 3) assumes that all regions react in the same way after a change in the values of the explanatory variables and the observed individual characteristics α, are the same for all regions. While in the estimated results of the fixed effects model the individual effects are treated as fixed, in the random effects model the individual effects are treated as random and are part of the error term. If there are district effects in the regression model, the pooled OLS or equation (7.12) does not effectively estimate the relationship between the dependent variable and the independent variables. Thus, for the analysis of the significance of the effect of region, the F statistic is used for this purpose. Moreover, in order to verify whether the fixed effects method is more appropriate for the analysis than the random effects method, the Hausman specificity test is used.

Choice Between Fixed and Random Effects Model

The results of the Hausman test are illustrated in Table 4. What we need to check is the value of Prob. Its value is 1.000, which is greater than 5%, so we accept the null hypothesis and conclude that the Random Effects model is the most appropriate.

Table 6: Results of the Hausman Test.

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
	Chi-Sq.	Chi-Sq. d.f.	Prob.
Test Summary	Statistic		
Cross-section random	0	3	1

Then we choose equation (14) of the random effects model and our following discussion is based on this model. According to the results, the key variables of the Economic Growth model are Labor Force $\left(llf_{i,t}\right)$ and Physical Capital $\left(lgfcf_{i,t}\right)$. The coefficients have the expected sign and are statistically significant. More specifically, the estimated coefficient of labor force is 0.930589, which is statistically significant at the 5 percent level. Also, the estimated coefficient on physical capital is 0.152126, which is statistically significant at the 5 percent level. Finally, the tourism activity index $\left(ltour_{i,t}\right)$ has a significantly positive relationship with economic growth, it is positive and also statistically significant. The coefficient of the variable $\left(ltour_{i,t}\right)$ was estimated at 0.058902, indicating that tourism activity acts as a driver of economic growth for the Greek regions. Continued economic growth will also generate a continuous increase in tourism growth.

Conclusion

It has been recognized that the effects of tourism have a huge positive impact on local economies. With the global growth of the tourism industry, an increasing number of regions in many countries have realized the importance of tourism as a driver of local economic growth. Tourism contributes to economic growth through multiple channels: it provides income and employment opportunities, encourages investment in infrastructure and improves the national balance of payments. Given the importance of tourism in economic growth, this paper empirically investigates the impact of tourism activity on the economic growth of Greek regions. The empirical analysis consists of 7 years of panel data for the 13 regions of Greece for the period 2013-2019. Using econometric panel regression techniques, several subsamples are estimated and analyzed. In particular, three categories of linear models of panel data are estimated: the Common Constant Model-CCM, the Fixed Effects Model-FEM and the Random Effects Models-REM. By estimating specific models, the study explores random and fixed effects, as well as individual heterogeneity among these regions. In addition, Hausman test was used to select the most appropriate model. The estimation results in all types of models show that tourism has a positive and significant impact on the economic development of Greek regions and can act as a driver of regional growth. The findings underline the necessity of policy implementation at the regional level.

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Conflicts of Interest

There is no conflict of interest.

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