Deepti Singh / Qamar Alam

Investigating the Credible Linkages Between Tourism and Economic Growth Across Different States in India Using Panel Data Approach

Abstract

Tourism has catalyzed India's economic growth by creating jobs, boosting businesses, export revenues, government earnings, and overall infrastructure development. The objective of this paper is thus to find out the long-run relationship and causal nexus between tourism and the economic growth of different states in India for the last two decades. The impact of government expenditure on tourism, along with domestic and international tourist visits, has been analyzed concerning the economic growth of different states in India. The PMG ARDL modelling approach with error correction terms and heterogenous Dumitrescu and Hurlin(D-H) based causality techniques have been employed. The tourism-led growth hypothesis, which emphasizes focus on inbound tourism as a long-term factor affecting economic growth, proves invalid in the Indian context at the state level. However, the government-allocated tourism expenditure and domestic tourist visits within the country proved significant in establishing the long-run nexus between tourism and economic growth.

Keywords: tourism-led growth hypothesis, PMG ARDL model, D-H causality, tourism economics, India

1. Introduction

Tourism has acted as the catalytic force driving economic growth at different levels worldwide. The investment in tourism is increasing daily for various tourist destinations and acts as a promising driver of progress in socio-economic terms. Policymakers are always keenly interested in improving those sectors that will ultimately accelerate the economic growth rate and the overall welfare of their nation, and tourism is assured to be one such promising sector. It seems imperative to analyse its impact nationwide, among various groups of nations and within a country's different states/regions. In this context, the literature is filled with ample evidence of time series analysis; this research investigates the impact of the tourism sector on the state level of India using panel datasets. The relationship between inbound tourism (international tourism) and economic growth in recent times has been well justified by the so-called (TLG) Tourism-led growth hypothesis. This hypothesis is based on the credence that international tourism has the potential to boost the economy and establishes a long-run causal relationship with economic growth. The adherents of the tourism-led growth hypothesis have always claimed that international tourism not only brings in foreign exchange earnings and macro-level government revenues but also generates lots of employment opportunities and even induces local investments, thereby leading to a rise in the GDP growth rate.

India is blessed with iridescent culture, majestic nature, and rich heritage, which offers an enabling and conducive opportunity for the impressive growth of the country's tourism sector. The significant impact of tourism expansion in recent decades has captivated the attention of policymakers and the Indian

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government, whose fundamental objective has constantly been to boost economic growth and development. Therefore, the government of India has launched many programs for tourism expansion like India Tourism Mart fairs, Paryatan Parv, Swadesh Darshan Scheme (launched 2015), Atithi Devo Bhavah (launched 2009), Incredible India 2.0, Internal TV campaign in Europe (2010-2011), National Mission on Pilgrimage Rejuvenation and Spiritual Augmentation Drive (2015) covering 51 sites in different states, various awareness-based workshops, etc.

Therefore, the main goal of the research is to find out the long-run relationship, interdependence, and possible causal nexus between tourism expansion and economic growth at the state level using a dynamic modelling framework. To represent and incorporate the tourism sector as an independent parameter, variables such as foreign tourist visits, domestic tourist visits, and government-allocated tourism expenditure are selected. This panel data-based study is different and unique because most previous studies have concentrated more on a macro level with particular reference to one specific area or country. The regional analysis covering different states within a country is new in literature, and the emphasis on the other Indian States has not been done yet in the selected period. Another unique feature is analysing the impact of both domestic and inbound tourism on the state-level GDP.

The rest of the paper has been organized as follows. Section 2 covers the literature review for panel data or disaggregated data on tourism and economic growth across different regions. The third section presents a brief economic profile of variables based on tourism across the states of India. It represents the trend analysis of other variables. The fourth part describes the data and the methodology used in the study, while the fifth section represents an analysis of the findings. The last part ends with a discussion and conclusion, presenting the key highlights and valuable remarks on the focused goal and area of the study.

2. Review of literature

The tourism sector has raised the economic expectations of different scholars working in the direction of tourism and economic development, and this has led to the availability of comprehensive literature on this topic. However, this study exclusively focuses on panel data analysis based on empirical papers. Across the literature, past studies based on tourism demand research have predominantly focused on one area and country only and not on cross-sectional units of regions. Estimators of different econometric models have shown positive and significant impacts from tourists' arrival to GDP across different regional units. In most cases, the research accepted the long-run relationship between inbound tourism and economic development (Dritsakis,2012; Rasool et al.,2021; Saglam, 2018). In a few cases, results reject the hypothesis. The regional analysis covering different states within a country is new in the literature. While exploring the relationship between tourism and economic growth across different groups of regions or countries, the results do not follow a similar pattern due to differences in areas, period of analysis, and modelling techniques. The reviewed evidence has been presented in the tabular form as follows for simplicity in understanding the trend (Table 1).

Table 1
Literature review

Authors (year)	Countries	Datasets period	Method	Findings
Fayissa (2008)	42 African countries	1990-2004	GMM	Tourism will affect GDP.
Lee & Chang (2008)	OECD versus non-OECD countries	1990-2002	FMOLS and Causality	Causality is unidirectional from tourism receipts to GDP in OECD countries, while it is bidirectional in the case of non-OECD countries.
Mahmoudinia (2011)	MENA countries	1995-2007	FMOLS and VECM	Bidirectional causality between tourism receipts and growth.

Table 1 ***(continued)***

Dritsakis (2012)	7 Mediterranean countries	1980-2007	Panel cointegration and FMOLS	The long-run relationship between GDP, exchange rate and tourism development
Caglayan (2012)	135 countries	1995-2008	Granger causality based on panel VAR.	Mixed causality with Asian, Middle Eastern North African, and Sub-Saharan African nations shows no causality between tourism and economic growth.
Chou (2013)	Ten transition countries	1988-2011	Bootstrap panel granger causality	Only Cyprus, Latvia, and Slovakia show tourism and growth nexus. Bulgaria, Romania, and Slovenia showed no significance or causality.
Bilen et al. (2015)	12 Mediterranean countries	1995-2012	Dumitrescu and Hurlin's causality	Bidirectional causality between tourism and economic growth.
Mallick (2016)	23 Indian states	1997-2011	PMG ARDL and DFE	Positive and significant impacts from per capita tourists' arrival to per capita state GDP in the long run.
Wu et al. (2017)	11 states of China	1995-2015	Bootstrap panel Granger causality	Inbound tourism and the GDP of a region are not interdependent.
Dogru & Bulut (2017)	7 European nations	1996-2014	Dumitrescu and Hurlin's technique	Economic growth rate and tourism expansion are interdependent.
Saglam (2018)	Commonwealth countries	1995-2015	Hadri-Kurozomi (unit root tests, Durbin-Hausman (DH) cointegration, & Dumetriscu-Hurlin causality	Results reject the hypothesis for commonwealth countries.
Fuihnas et al. (2020)	Latin American and Caribbean countries	1995-2014	ARDL (Autoregressive distributed lag model)	The results seem ambiguous in the long run, depending on the indicator of the chosen tourism sector.
Kostakis (2020)	5 South European countries	2000Q1-2018Q4	Pedroni, Kao, Westerlund and Fully modified (FMOLS)	Tourism positively affects the per capita GDP growth rate.
Khan et al. (2020)	5 Gulf Council Countries	2000-2018	Panel Cointegration and Dumitrescu & Hurlin Causality	The fixed-effect model shows no parameters that influence economic growth. Dumitrescu & Hurlin's (2012) panel causality shows no causation from tourism expenditure and economic growth.
Ozer (2021)	OECD countries	2005-2019	Panel VECM model	Unidirectional causality, both in the long and short run
Rasool et al. (2021)	BRICS countries	1995-2015	Panel ARDL-based cointegration and Dumitrescu-Hurlin panel technique	Tourism, financial development and economic growth are cointegrated in the long run.

Nuno et al. (2013) published a review paper based on a meta-analysis of 13-panel approach-based studies. They gave knowledgeable insights that tourism usually contributes positively to a country's GDP. However, the degree of empirical impact varies from one case study to another due to the methodological procedure followed and the combination of proxy and explanatory variables chosen. Over the years, it has been observed that publications are going more and more in-depth analysis of validating the causal nexus (tourism-led growth hypothesis) and finding all possible relationships and linkages as well as positive spillover effects flowing between the tourism sector and economic growth across various countries. Also, more focus has recently been shifted to panel data analysis and regional benefits. No common conclusion can be drawn, and this is true in the Indian context as well.

3. Tourism-based economic profile of different states in India

The contribution of tourism to India's earning figures is significantly increasing in terms of GDP. The statistics of total earnings seem to be rising approximately in double folds from 2005 onwards till 2015, and thereafter, the total earnings reached approximately 14 million to roughly 20 million (refer to Table 2). Earnings per foreign tourist are increasing steadily, and the figures support the need to boost the tourist sector to benefit from the foreign liquid cash.

Table 2
Earnings from tourism: Recent trends

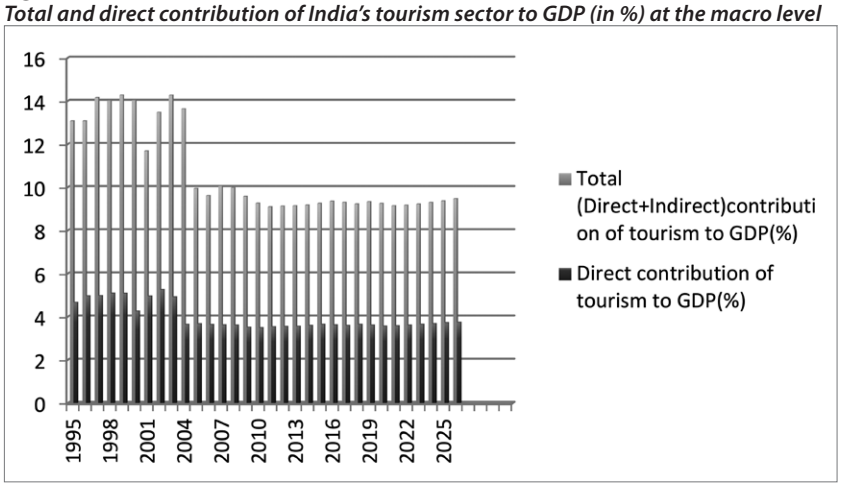
Year	Earnings per foreign tourists (in Indian rupees)	Total earnings from foreign tourists (in Rs. millions)
2005	85,045.30	348,710.00
2010	111,482.90	660,950.00
2015	170,496.80	1,406,350.00
2019	199,245.90	2,034,860.00

Source: India Tourism Statistics reports at a glance.

Year by year, in the past two decades, it has been observed that total earnings from the visit of each foreign tourist have steadily risen in manifold amounts. The most obvious reason is the number of foreign tourists visiting India for leisure and work. The socio-economic benefits derived from the travel and tourism sector in recent years in employment, income, foreign exchange earnings, exports, and output hold a lot of strategic importance within India. India is expected to maintain its position in the top ten fastest-growing destinations for leisure travel spending for the decade of 2016-2026(WTTC Report, 2020).

Recognizing the sizable impact of tourism in India, the government has allowed 100% FDI to be completed in tourism-related projects through automatic routes responsible for developing tourism-related products and services. It is imperative to shift focus to the macro level, where the emphasis is on exploring tourism's direct, indirect, and overall contribution to GDP.

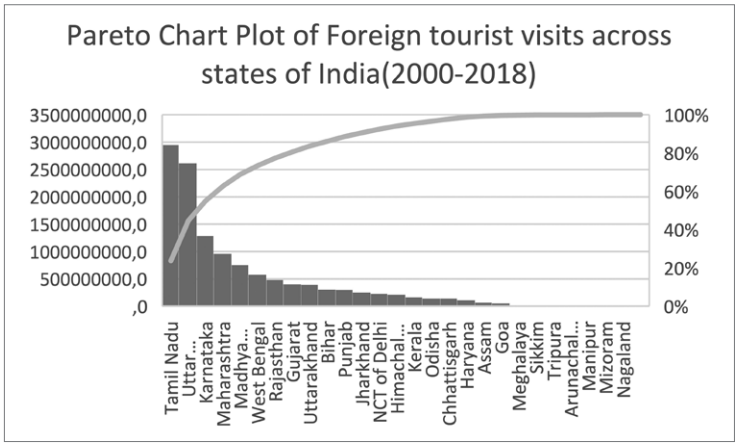
Figure 1
Total and direct contribution of India's tourism sector to GDP (in %) at the macro level



Source: The author's plot is based on the States of India, CMIE database.

As can be seen from the bar chart of Figure 1, the direct contribution of tourism to GDP was approximately 3.8% in 2019, while the total was 9.34 % and has remained around 9% over the past decade. This can be seen from the graph that from 2004 onwards the bar length does not exceed the limit of 10% and this stagnancy is synchronizing well with the direct tourism contribution as well, which is represented by red bars in the chart where they could not exceed the limit of 4%. However, it is to be noted that from 1995 to 2003 tourism has contributed quite significantly with the contribution values in the much higher range. Therefore, tourism and its allied sectors are a key impelling force in boosting India's GDP, but they currently need intense rumination.

Figure 2
Pareto Plots of foreign tourist visits across states of India (2000-2018)

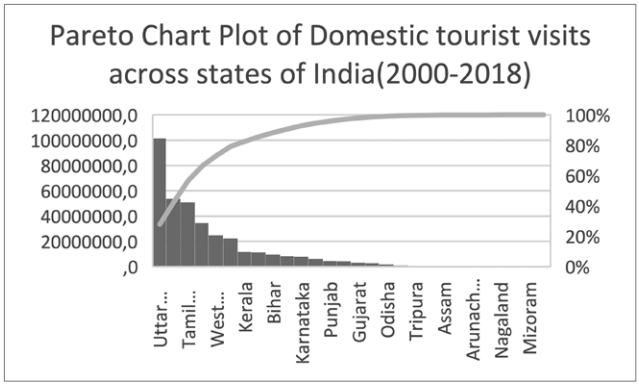


Source: The author's plot is based on the States of India, CMIE database.

Going by the descending order of ranking in the bar diagram (Figure 2) from right to left, it seems Tamil Nadu, Uttar Pradesh, Karnataka, Maharashtra and Madhya Pradesh attract a maximum number of foreign tourists to their various tourist destinations over the last 18 years. The least visited zone resides in the majority of the northeastern states of India, as is visible in the extreme right of the graph, where Nagaland, Mizoram, Manipur, Arunachal Pradesh and Tripura have lived for approximately the last two decades.

The significant categories of states having domestic tourist visits are Uttar Pradesh, Maharashtra, Tamil Nadu, NCT of Delhi and West Bengal, while the states like Mizoram, Manipur, Nagaland, Chhattisgarh and Arunachal Pradesh are showing very low cumulative values of number of visitors to the state. Therefore, as a part of its domestic campaigns in 2018, the government launched many TV campaigning-based promotions to capture the attention of tourists to its northeastern states.

Figure 3
Pareto plots of domestic tourists flow into different states of India

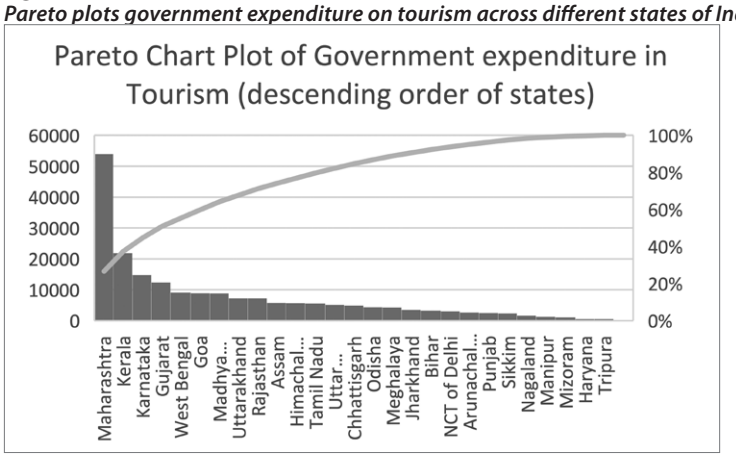


Source: The author's plot is based on the States of India, CMIE database.

Now, examining domestic and foreign visit data across states in Figure 3 shows that most states are shared in the top 10 destinations in both charts. However, some states fall in domestic or foreign visits and do not synchronize the list. Such states are Karnataka and Gujarat, which are preferred among foreigners, while in the case of domestic travellers, Delhi, Kerala, and Goa remain among the top-visited states. Another noticeable

trend for picture clarity is that Tamil Nadu, Uttar Pradesh, and Maharashtra represent the 'vital few' categories, which implies that these are the regions most visited in the country.

Figure 4
Pareto plots government expenditure on tourism across different states of India



Source: The author's plot is based on the States of India, CMIE database.

Exploring the cumulative sum of total expenditure across each state through vertical bars, it is very evidently clear from Figure 4 that Maharashtra, Kerala, Karnataka, Gujarat, and West Bengal do maximum government expenditure on tourism, and the states of Tripura, Haryana, Mizoram, Nagaland, and Manipur are the least influential category of states.

Intriguingly, the states with a decent budget allocation to the tourism sector are also the ones where domestic and foreign tourist visits are higher than those with a lower budget allocation. While allocating these budgets, the government keeps the objective of specific destination development in focus. For example, the Golden Triangle building focuses on Delhi, Agra, and Jaipur as interconnected tourist destinations. These funds are used to improve tourist facilities, preserve historical monuments and sites and promote traditions and related products.

4. Data and methodology of the study

4.1. Definitions of variables

Foreign tourist arrivals: The term indicates the number of multiple trips made by an individual to another country and does not represent the number of persons. Each time a person visits a country, it is counted as a new arrival.

Foreign visits: It refers to the number of visits made by a foreign visitor who visits a host country on their foreign passport for activity not waged or acting as a source of income within the country. It means a foreign visit made by a foreign tourist falls under the category of leisure, recreational activities, business, and family meetings.

Domestic tourist: A person who visits some region(s) other than their residence within the home country and stays within an accommodation based on a commercial basis. The accommodation includes hotels, Dharamshalas, musafirkhanas, choultries and alike. The duration of the stay should be at least twenty-four hours and should be at most twelve months. The purpose of the visit should be any of the following: (1) Education and health-related, (2) Business-oriented meetings and conferences, (3) Religious, pilgrimage, and similar social event celebrations, (4) Leisure and holidaying.

Domestic tourism refers to travelling residents of a given nation within the geographical domain of that region only.

Inbound tourism concerning a given country refers to non-residents travelling within the host nation.

4.2. Methodology of the model

Data was collected from different sources to estimate the impact of tourism on the gross value of other states from 2001-2018. Real Gross State Domestic Product (GSDP) at Constant Prices (With the Base Year Of 2004-2005) (in millions), Actual State Government Outlay (Expenditure) of Tourism (in millions), Foreign Tourist Visits (in numbers), and Domestic Tourist Visits (in numbers) are being extracted from the database of the Centre for Monitoring Indian Economy Private Ltd. (CMIE) where various state-level statistical data has been compiled by official statistical documents released by the state governments.

The PMG (panel mean group) based ARDL available in Eviews 13 and Dumitrescu-Hurlin (D-H) panel causality have been employed for the study.

The analysis begins with the standard testing of stationarity using two types of unit root tests of Levin et al. (2002) (LLC) and Im et al. (2003) (IPS), where the tests give results of the unit root of a common group. Both of them consider the framework of ADF-based regression as mentioned:

$$\Delta y_{it} = \alpha y_{i,t-1} + \sum_{k=1}^{pi} \theta_{i,k} \Delta y_{i,t-k} + X_{it}\delta + \varepsilon_{it} \quad (1)$$

where i=1,2,3...N are the total cross-sectional units and t=1,2,3 ...T is the period. In equation (1), Xi denotes the exogenous or independent variables of the model, α and δ are the representatives of fixed effects or autoregressive coefficients of variables Y and X, respectively ε_{it} is the error terms or idiosyncratic disturbance terms which are mutually independent. Both tests evaluate the null hypothesis of the presence of a unit root. At the same time, the alternate implies the absence of a unit root, which means the stationarity in the data. However, both tests vary in parameter-based assumptions.

After determining the unit root in the data series, the next step is to determine whether there is a possibility of a long-run relationship between the selected bunches of panel datasets.

The Kao and Pedroni tests compute the test statistics and determine the cointegration. All the tests consider a common null hypothesis that 'there is no cointegration'. In contrast, the alternate hypothesis in the case of all the seven Pedroni tests and the Kao test implies all the variables are cointegrated across all the panels. Once the relationship is confirmed, the analysis begins with the standard modelling and estimating of the PMG ARDL Model.

The autoregressive distributed lag model or ARDL model is based on the lagged values of regressors, and regress is the standard regression model. To estimate the long-run relationship among the variables using panel-based ARDL, one of the most popular estimators given by Pesaran et al. (1999) of Pooled Mean Group (PMG) is being taken. The intercepts, cointegrating terms, and short-run coefficients in this panel setting differ across each cross-sectional term. The equation of the PMG model can be expressed as:

$$\Delta y_{i,t} = \varphi_i EC_{i,t} + \sum_{j=0}^{q-1} \Delta X'_{i,t-1} \beta_{i,j} + \sum_{j=1}^{p-1} \lambda^*_{i,j} \Delta y_{i,t-j} + \epsilon_{i,t} \quad (2)$$

Where $EC_{i,t} = y_{i,t-1} - X'_{i,t}\,\theta$ and θ is the long run coefficients and φ_i is the adjustment parameter of the model. The modelling begins by determining the optimal lag length for the ARDL model, and among the 16 estimated models, the one with ARDL (1,0,0,0) is chosen.

When testing the causality at the panel level with heterogeneity in the data, approaches extend beyond the traditional bivariate regression-based granger causality. The general framework, however, remains the same with the following form:

$$y_{i,t} = \alpha_{0,i} + \alpha_{1,i} y_{i,t-1} + \ \ldots + \alpha_{k,i} y_{i,t-k} + \beta_{1,i} x_{i,t-1} + \cdots \ldots + \beta_{k,i} x_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

$$x_{i,t} = \alpha_{0,i} + \alpha_{1,i} x_{i,t-1} + \cdots + \alpha_{k,i} x_{i,t-k} + \beta_{1,i} y_{i,t-1} + \cdots \ldots + \beta_{k,i} y_{i,t-k} + \varepsilon_{i,t} \quad (4)$$

Where 't' and 'i' have their usual notations as time and cross-sectional dimension, respectively.

A new approach given by Dumitrescu-Hurlin (2012) is known as D-H panel causality, which assumes different coefficients across different cross-sectional units. The test can be represented with all its features in equation form as:

$$y_{it} = \alpha_i + \sum_{k=1}^{k} Y_i^k Y_{i,t-k} + \sum_{k=1}^{k} B_i^k X_{i,t-k} + \epsilon_{i,t} \quad (5)$$

Where K represents the optimal lag interval, Y_i^k is the autoregressive parameter, B_i^k is the regression coefficient, which can change, X and Y will be used to test the possible causality. In this approach, Granger causality-based regressions (based on equations (3) and (4)) are carried out for each cross-section unit individually. Thereafter, the average of the calculated test statistics is taken, referred to as the Wbar statistic. Along with this statistic, a standardized version of the statistic weighted with unbalanced panels is calculated, known as the Zbar statistic, which follows a normal distribution. Among these two test statistics that are calculated, Wbar statistic is given by

$$W_{N,T}^{H} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T} \quad (6)$$

Where $W_{i,T}$ represents the individual test statistics across cross-sections with asymptotic distribution.

5. Results and discussion

5.1. Pre-requisites analysis

The panel data modelling of the multidimensional database has been used for 18 years. The data is annual, and their logarithmic transformation has been done when exposed to econometric panel modelling. The individual graphs of the stacked panel data series have been presented for each period.

Figure 5
Graphical representation of the data for all the selected variables across all states (2000-2018)

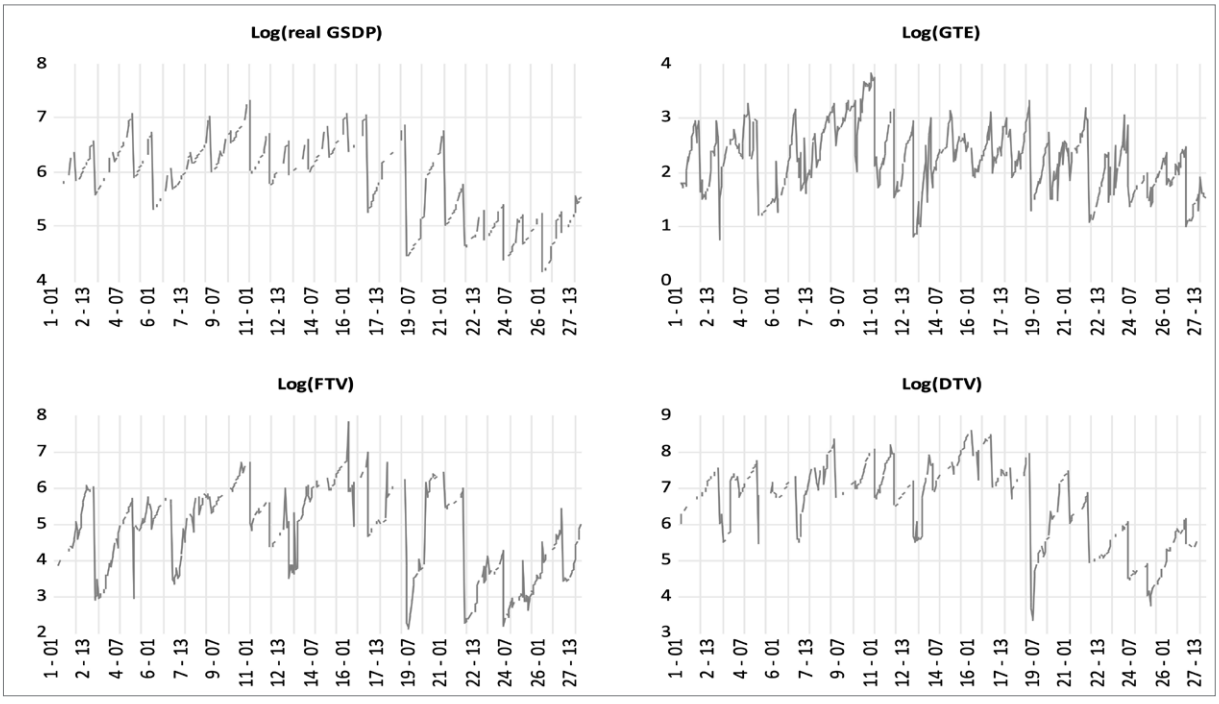


Table 3
Descriptive statistics of the variables

	LOG REAL GSDP	LOG GTE	LOG FTV	LOG DTV
Mean	5.8648	2.2270	4.877	6.6065
Median	6.0104	2.2529	5.1002	6.8518
Maximum	7.3094	3.8185	7.8375	8.5864
Minimum	4.4144	0.7634	2.0899	3.3414
Std. dev.	0.7130	0.5922	1.1826	1.0663
Skewness	-0.4177	0.0795	-0.3983	-0.5630
Kurtosis	2.2257	2.5683	2.1391	2.5590
Jarque-Bera	25.294	4.285	27.8591	29.6134
Probability	0.003	0.117	0.0000	0.000
Sum	2850.33	1082.36	2370.41	3210.763
Sum sq. dev.	246.598	170.116	678.319	551.4825
Correlation matrix				
LOG REAL GSDP	1.000			
LOG GTE	0.5777	1.000		
LOG FTV	0.7351	0.5428	1.000	
LOG DTV	0.8790	0.5813	0.8543	1.0000

Data summary through descriptive statistics, correlation matrix, and graphical plots has been accomplished. The data does not have missing values and is all balanced. The values of real GSDP and foreign and domestic tourists' visits are skewed negatively, while government tourism expenditure is positively skewed.

Correlation Matrix- The tabulated values show a significant positive association between FTV, DTV, and Real GSDP.

The LLC, Fisher-type ADF, PP and IPS panel unit root are applied (Table 4). The lag length criteria based on AIC, Schwarz Hannan-Quinn, etc, can be chosen, and here, the AIC information criteria are followed.

Table 4
Panel unit root test results

Level	**Intercept**				**Intercept and trend**			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
Ln GSDP	4.429 (1.000)	10.486 (1.000)	1.689 (1.000)	0.776 (0.000)	-3.979 (0.000)	0.022 (0.508)	43.213 (0.853)	36.733 (0.965)
Ln GTE	-2.519 (0.006)	2.189 (0.985)	72.285 (0.048)	72.325 (0.486)	-5.345 (0.000)	-4.127 (0.000)	101.378 (0.000)	125.110 (0.000)
Ln FTV	-5.463 (0.000)	-3.219 (0.006)	356.907 (0.000)	152.412 (0.000)	3.008 (0.998)	-4.127 (0.000)	135.511 (0.000)	203.236 (0.000)
Ln DTV	-3.105 (0.001)	-0.262 (0.396)	181.236 (0.000)	110.467 (0.000)	-4.816 (0.000)	-5.031 (0.000)	112.339 (0.000)	137.861 (0.000)
First difference	**Intercept**				**Intercept and trend**			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
Ln GSDP	-20.604 (0.000)	-14.774 (0.000)	280.301 (0.000)	299.047 (0.000)	-16.976 (0.000)	-10.919 (0.000)	198.061 (0.000)	281.400 (0.000)
Ln GTE	-17.156 (0.000)	-15.712 (0.000)	344.000 (0.000)	722.408 (0.000)	-16.503 (0.000)	-15.917 (0.000)	275.642 (0.000)	395.961 (0.000)
Ln FTV	-72.357 (0.000)	-32.903 (0.000)	1074.28 (0.000)	2083.43 (0.000)	-58.519 (0.000)	-31.362 (0.000)	276.149 (0.000)	392.415 (0.000)
Ln DTV	-15.265 (0.000)	-15.039 (0.000)	360.027 (0.000)	1168.10 (0.000)	-21.217 (0.000)	-16.543 (0.000)	256.015 (0.000)	295.020 (0.000)

In the unit tests results, Gross State Domestic Product (GSDP) becomes stationary at the first difference and is non-stationary at level form. While all the other variables partially show the order of cointegration, with

trend and intercept form, the variables are integrated of the order 0, i.e. I (0). Overall, all the combination of tests supports mixed stationarity. Since the test results are of mixed stationarity of I (0) and I (1), the dynamic modelling framework of PMG ARDL should be used instead of Fixed and Random effect models.

After carrying out the standard unit root procedure, a test of cointegration becomes essential to provide evidence for the existence of a long-run relationship between the data series, even if the values are deviating the values away from equilibrium temporarily. The tests of Pedroni and Kao have been implemented to compute the test statistics values of the combined panel data, raising the test results' power. The null hypothesis of all three tests indicates that dependent and independent variables are not cointegrated. The rejection of the null hypothesis will indicate the stationarity in error terms and cointegration among the variables.

Table 5
Results of panel cointegration tests

Method	Statistic	Individual intercept	Individual intercept & individual trend
Pedroni test	Panel v-statistic	-0.386(0.5427)	3.733(0.000) *
	Panel rho-statistic	1.698(0.901)	3.094(0.999)
	Panel PP statistic	-0.326(0.109)	-1.498(0.067) ***
	Panel ADF-statistic	-0.002(0.098) ***	-1.874(0.030) **
	Group rho-statistic	3.170(0.999)	-4.717(0.001) *
	Group PP-statistic	-0.776(0.218)	-2.854(0.002) *
	Group ADF-statistic	-0.810(0.208)	-2.454(0.007) *
Kao test	t-statistic	-2.953(0.002) *	-7.821(0.000) *

*, ** and *** represents 1%, 5% and 10% level of significance.

First-generation Pedroni test results with seven test statistics and Kao test t statistics are tabulated above in Table 5 with the “individual intercept” and “individual intercept and individual trend”. The AIC criterion is used to select the lag length automatically. The Kao test supports the long-run relationship with a very low p-value at 0.01% level. This means most of the cointegrating tests support the existence of cointegration within the selected bunch of variables, but the evidence gives little vague results at the individual intercept level. However, the evidence of six out of seven Pedroni tests is compelling enough at different levels to reject the null hypothesis of no cointegration and conclude the long-run equilibrating relationship of the mixed order.

5.2. Estimated results of the model

To encapsulate the relationship between tourists’ visits (both national and international), tourism expenditure by the government and the economic growth of states, the analysis employs a panel-based PMG ARDL model. The optimal lag length is to be determined to estimate the Autoregressive distributed lag model ARDL (p,q,q,q,q). The lag length is chosen on the standard AIC, BIC, and HQ criteria, with all three criteria giving the minimum value with the estimated model 16 of ARDL (1,0,0,0) lag order (Table 6).

Table 6
Lag length selection criteria

Model	Log L	AIC*	BIC	HQ	Specification
16	1.680154	0.135740	0.427687	0.251000	ARDL (1,0,0,0)
8	1.680154	0.260740	0.806964	0.476387	ARDL (2,0,0,0)
12	1.680154	0.260740	0.806964	0.476387	ARDL (1,1,0,0)

ARDL model does not require any similarity/symmetry in lag lengths of different variables, implying different variables can have different lag length numbers. The panel ARDL equation of our model is represented as:

$$\ln \mathbf{GSDP_{it}} = \alpha_i + \sum_{j=1}^{p} \alpha_{1,ij} ln\ GSDP_{i,t-j} + \sum_{j=0}^{q1} \alpha_{2,ij} lnGTE_{t-j} + \sum_{j=0}^{q2} \alpha_{3,ij} ln\ FTV_{i,t-j} + \sum_{j=0}^{q3} \alpha_{4,ij} lnDTV_{i,t-j} + \varepsilon_{it} \quad (7)$$

After establishing the long-run relationship based on the previous equation, the model-specific form of the ARDL panel with the error correction term is given by:

$$ln\Delta GSD_{it} = \alpha_i + \sum_{j=1}^{p} \alpha_{1,ij} ln\Delta GSDP_{i,t-j} + \sum_{j=0}^{q1} \alpha_{2,ij} ln\Delta GTE_{i,t-j} + \sum_{j=0}^{q2} \alpha_{3,ij} ln\Delta FTV_{i,t-j} + \sum_{j=0}^{q3} \alpha_{4,ij} ln\Delta DTV_{i,t-j} + \theta_i ECM_{i,t-1} + \epsilon_{it} \quad (8)$$

Where GSDP is the dependent variable, and the list of independent variables includes foreign tourist visits (FTV), domestic tourist visits (DTV), central government expenditure on the tourism sector (GTE) and also p and q are the lag orders of the regress and regressors respectively.

The Mean Group estimation method is also performed to align with the results' robustness. Both estimators have been chosen based on appropriate lag length criteria. The estimator was developed by Pesaran and Shin (1999).

Table 7
PMG ARDL and MG results

Dependent variable: Ln GSDP			
PMG ARDL estimates			
Variable	Coefficient	t-statistic	p-value
Long run coefficients			
Log GTE	0.468	3.229	0.0013
Log FTV	0.078	0.707	0.479
Log DTV	0.901	4.140	0.000
Coint eq	-0.055	-4.521	0.000
Mean group (MG) estimates			
Log GTE	0.3923	4.1662	0.000
Log FTV	-0.3133	-0.8245	0.4100
Log DTV	0.7074	1.9616	0.0504
Coint eq.	-0.3288	-7.5071	0.000

The results of PMG-based ARDL tests (in Table 7) indicate that Government tourism expenditure (GTE) and domestic tourist visits (DTV) are the two significant independent variables. Meanwhile, foreign tourists' visits (FTV) are insignificant, with a p-value of 0.4794. Therefore, in the long run, across all the cross-sectional units together, FTV turns out to be irrelevant, indicating that the tourism-led economic growth hypothesis based on international(inbound) tourism in contexts of India at the state level is invalid. However, domestic tourism, often ignored in tourism impact-based literature, turns out to be quite significant. Another new finding concerns central government-based tourism expenditure allocated to the tourism sector with a p-value of 0.0013 and an estimated coefficient value of 0.468. The role of domestic tourism or tourists across different states should not be ignored, as the estimated coefficient value is highly significant at 0.901. In other words, as the volume of GTE and DTV increased, economic growth also increased. Interpretation of the significant coefficients follows in elasticity terms. The elasticity of the coefficient of actual gross state domestic product (GSDP) shows that a one-cent increase in DTV will lead to an estimated rise of 0.90 % in actual gross state domestic product in the long run, with everything else remaining the same. Similarly, a one per cent (1%) improvement in tourism expenditure by the central government will lead to a rise in economic growth by 0.468 % in the long run.

The direction of results of Mean group estimates stressed inclination towards the PMG ARDL-based outcomes as the long run coefficient of GTE DTV is significant in the long with the same signs as the PMG-based ARDL

model gives. Similarly, the results also support insignificance in terms of p-values of FTV with 0.4100. Thus, the findings support domestic tourism's rousing role in influencing the state's economic growth. The error correction term is highly significant, with the estimated value of -0.055 indicating the speed of adjustment at a 1% significance level. No short-run coefficients calculated by the MG and PMG model mean that the tourism growth hypothesis does not exist in the short run for state-level panel analysis. The states whose data has been available and included in the study are also exposed to bounds tests across different cross-sectional units.

5.3. Results of Dumitrescu and Hurlin (D-H) panel causality

Considering the heterogeneity across different cross-sectional data of Indian states, the framework of causality follows Dumitrescu and Hurlin(D-H) (2012) based heterogeneous causality testing. The null hypothesis follows no causality in a panel group. At the same time, the alternate implies the existence of causality across at least one panel—two standard versions of the Wald statistics, namely Wbar-statistic and Zbar-statistic.

The test's null hypothesis implies that a variable, say 'X', does not cause 'Y' while the alternate hypothesis suggests that 'X' does homogeneously cause 'Y'. The null hypothesis is rejected if the p-value is less than 0.05, suggesting panel causality among the subgroups.

Table 8
Results of subgroups in Dumitrescu and Hurlin (D-H) (2012) panel causality

Null hypothesis	W stat	Zbar-stat	Prob.
Log GTE does not homogenously cause Log GSDP	3.6845	2.1029	0.0355
Log GSDP does not homogenously cause Log GTE	6.3006	6.5389	0.0000
Log DTV does not homogenously cause Log GSDP	6.5215	6.9136	0.000
Log GSDP does not homogenously cause Log DTV	4.7583	3.9237	0.000
Log FTV does not homogenously cause Log GSDP	3.6234	1.9992	0.0456
Log GSDP does not homogenously cause Log FTV	3.1839	1.2540	0.2098
Log DTV does not homogenously cause Log GTE	5.4352	5.0714	0.0000
Log GTE does not homogenously cause Log DTV	4.6069	3.6670	0.0002
Log FTV does not homogenously cause Log GTE	3.9619	2.5732	0.0101
Log GTE does not homogenously cause Log FTV	4.5741	3.6113	0.0003
Log FTV does not homogenously cause Log DTV	4.0174	2.6673	0.0076
Log DTV does not homogenously cause Log FTV	5.5497	5.2657	0.0000

From the results of the estimates (refer to Table 9), the most significant outcome in support of cointegration results derived previously is that there is no causality between gross state domestic product (GSDP) and foreign tourists' visits (FTV) denying the international tourism-growth nexus based on causality too. All the other subgroups show bidirectional causality, and none show unidirectional causality. Therefore, bidirectional causality runs between government tourism expenditure and actual gross state domestic product, between domestic tourism and gross state domestic product, and between domestic tourism and government tourism expenditure. Although foreign tourist visits do not cause economic growth, they also have a significant causal nexus between government and domestic tourism expenditure. These causality results can be tabulated as follows:

Table 9
Summary of causality results in simplified form

Variable subgroups	Causality
1. GTE and GSDP	Bidirectional
2. DTV and GSDP	Bidirectional
3. FTV and GSDP	None
4. GTE and DTV	Bidirectional
5. FTV and GTE	Bidirectional
6. FTV and DTV	Bidirectional

6. Discussion and concluding remarks

Studies have shown different directions regarding questioning the causality between the tourism sector variables and the state's economic growth. The results of this study show no causality between inbound tourism and economic development, and this result is supported by Khan et al. (2020) and Saglam (2018) and contrasted by Rasool et al. (2021) and Bilen et al. (2015). The research endorses the central government's intervention through expenditure and tourism expansion strategies because of the immense significance that the central government holds at the state level in legitimizing the role of tourism expenditure in positively impacting absolute GDP values and boosting tourism-led real GDP growth nexus across states. It becomes apparent that domestic tourism holds a firm stance over the economy regarding the economic impact of tourism across different regions/ states. Domestic tourism-based awareness activities and pledges concerning tourist security should be encouraged well. The far-reaching advantage of testing tourism-led growth nexus across the regional level will also aid the regional authorities and policymakers in procuring specific locational inferences regarding long-run goals and strategies.

Future scope lies for other researchers to extend their causality analysis and even cover broader definitions of growth, such as inclusive growth, regional development, etc. In future, bootstrap-based causality can be carried out to check individual nexus across each cross-sectional unit. The entire research focuses on testing the tourism-led economic growth hypothesis, which has delineated the tourism sector's demand side while ignoring the supply side's impact. On the demand side, outbound tourism is not considered either. Analyses can be extended to cover outbound, inbound and domestic tourism. Many other environmental and social externalities must be addressed to encapsulate a broader picture of tourism's impact. The economic impact is just one type of impact of tourism.

The research has tried to explore the long-run relationship and causality between the tourism sector and economic growth based on the theory of tourism-led growth hypothesis across the states of India for selected 27 Indian states. Since the data reflect the mixed level of stationarity, Panel Mean Group-based ARDL was used to test the existence of the long-run relationship. The tourism-led growth hypothesis, as explained by Balaguer and Cantavell-Jorda, which emphasizes focus on Inbound Tourism as a long run factor affecting economic growth collectively proves invalid in the Indian context at the state level. Therefore, tourism spurs state development, but the channel is not international tourism. The government-allocated tourism expenditure and within-country domestic tourist visits are responsible for the significant long-run relationship established in this study (Caglayan et al., 2012). The impact potential of domestic tourism across different Indian states turns out to be greater than inbound tourism, and this is a new outcome that is entirely unexpected for India in the panel modelling framework.

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