TOURISM DEVELOPMENT AND PER CAPITA INCOME IN VIETNAM'S SOUTH CENTRAL COAST: EVIDENCE FROM A PANEL ARDL/ECM FRAMEWORK

PHÁT TRIỂN DU LỊCH VÀ THU NHẬP BÌNH QUÂN ĐẦU NGƯỜI Ở VÙNG NAM TRUNG BỘ VIỆT NAM: BẰNG CHỨNG TỪ MÔ HÌNH PANEL ARDL/ECM

Le Hoang Thi Ngan Ha[1,2]*

[1]*University of Khanh Hoa, Vietnam*
[2]*PhD Candidate, The University of Danang - University of Economics, Vietnam*

*Corresponding author: lehoangthinganha@ukh.edu.vn

(Received: April 06, 2026; Revised: July 01, 2026; Accepted: July 22, 2026)

DOI: 10.31130/ud-jst.2026.24(8).211E

Abstract - This study examines the relationship between tourism development and per capita income in five provinces of Vietnam's South Central Coast during 2010–2024. Tourism is decomposed into a volume channel (tourist arrivals per 1,000 residents) and a value channel (real tourism revenue per visitor). A Panel ARDL/ECM model is estimated using PMG as the benchmark, with MG and DCCE as robustness checks. PMG results indicate positive long-run associations for both tourism channels and institutional quality. However, MG results show greater stability for the volume channel, while DCCE estimates weaken the tourism coefficients, particularly for the value channel, after common factors are controlled for. The tourism–income relationship is therefore conditional rather than universal. Given the small panel, the findings should be interpreted as cautious regional evidence.

Key words - Tourism development; per capita income; Panel ARDL; PMG; DCCE; Vietnam South Central Coast

Tóm tắt - Nghiên cứu phân tích mối quan hệ giữa phát triển du lịch và thu nhập bình quân đầu người tại năm tỉnh thuộc vùng Nam Trung Bộ Việt Nam giai đoạn 2010–2024. Du lịch được phân tách thành kênh khối lượng, đo bằng số lượt khách trên 1.000 dân, và kênh giá trị, đo bằng doanh thu du lịch thực bình quân trên mỗi lượt khách. Nghiên cứu ước lượng mô hình Panel ARDL/ECM với PMG làm tham chiếu, còn MG và DCCE được dùng để kiểm tra độ vững. Kết quả PMG cho thấy hai kênh du lịch và chất lượng thể chế có quan hệ dương trong dài hạn với thu nhập bình quân đầu người. Tuy nhiên, MG cho thấy kênh khối lượng ổn định hơn, còn DCCE làm suy yếu hệ số của các biến du lịch, đặc biệt là kênh giá trị, sau khi kiểm soát các nhân tố chung. Vì vậy, mối quan hệ du lịch–thu nhập mang tính điều kiện thay vì phổ quát. Do mẫu nhỏ, các phát hiện cần được diễn giải thận trọng như bằng chứng cho vùng nghiên cứu.

Từ khóa - Phát triển du lịch; thu nhập bình quân đầu người; Panel ARDL; PMG; DCCE; Nam Trung Bộ Việt Nam

1. Introduction

Tourism is widely regarded as an important contributor to regional economic development, particularly in coastal economies where natural amenities and service activities create favorable conditions for visitor-oriented growth [1], [2]. Through demand expansion, employment creation, and inter-sectoral spillovers, tourism may contribute to higher local income and broader economic transformation. In Vietnam, tourism has increasingly become an important component of regional development strategies, especially in coastal regions such as the South Central Coast.

Despite extensive research on the tourism-led growth hypothesis, the relationship between tourism development and local income remains theoretically and empirically debated. While tourism may stimulate economic activity, its effects are not necessarily uniform across destinations [2], [3]. In some contexts, tourism growth may generate limited local value added due to tourism leakage, weak institutional capacity, or dependence on low-spending visitor segments [4], [5]. In addition, higher-income regions may themselves attract more tourism investment and visitor demand, raising concerns regarding reverse causality.

Recent studies further suggest that tourism-led growth after COVID-19 may differ substantially across destinations depending on tourism resilience, institutional conditions, and exposure to common shocks [6], [7]. Moreover, provincial economies within the same region are likely to share common tourism cycles and macroeconomic conditions. Ignoring such cross-sectional dependence may therefore bias conventional panel estimators [8], [9].

These debates imply that tourism should not be treated as a homogeneous growth driver. However, much of the existing literature continues to rely on aggregate tourism indicators, making it difficult to distinguish between tourism expansion driven by visitor scale and tourism development associated with higher economic value per visitor.

Against this backdrop, the present study examines the relationship between tourism development and per capita income in five provinces of Vietnam's South Central Coast. Tourism development is decomposed into two dimensions: a volume channel, measured by tourist arrivals per 1,000 residents, and a value channel, measured by real tourism revenue per visitor. Methodologically, the study applies a Panel ARDL model in an error-correction framework using PMG as a benchmark estimator, while MG and DCCE specifications are employed as robustness checks under alternative assumptions regarding heterogeneity and common factors.

The study contributes to the literature in three respects. First, it provides provincial-level evidence on the tourism–income relationship for Vietnam's South Central Coast using a dynamic panel framework. Second, it distinguishes between tourism volume and tourism value channels, thereby offering a more nuanced interpretation of tourism development. Third, the study evaluates the robustness of the tourism–income relationship under cross-sectional dependence and alternative assumptions regarding heterogeneity.

2. Literature Review and Methodology

2.1. Theoretical framework and research gap

Rather than treating tourism as a homogeneous demand-generating sector, this study conceptualizes tourism as a value-creating system operating through distinct channels. Specifically, tourism may affect local income through a volume channel, reflecting the scale of tourist flows, and a value channel, reflecting the economic value generated per visitor.

The volume channel captures the expansion of tourism activity. A larger number of visitors increases demand for accommodation, food services, transportation, retail, and related activities, thereby potentially generating employment and income spillovers [1], [2]. By contrast, the value channel reflects the economic intensity of tourism, including visitor spending, length of stay, service quality, tourism product composition, and the extent to which local economies retain tourism-generated value added [4], [5].

These two channels are not necessarily aligned. A destination may experience rapid growth in tourist arrivals while generating relatively limited value added per visitor. Conversely, destinations with fewer visitors may still achieve stronger local income effects through higher-spending tourism segments and stronger local linkages. As a result, aggregate tourism indicators may mask important differences in the economic mechanisms through which tourism affects local income.

The ability of tourism to generate local economic gains also depends on institutional conditions. Institutional quality influences business climate, investment incentives, market coordination, and the capacity of local economies to absorb and distribute tourism-related gains. In this study, institutional quality is proxied by the Provincial Competitiveness Index (PCI), which reflects local governance quality and the business environment. This perspective is consistent with institutional approaches emphasizing that economic outcomes depend not only on resource endowments but also on governance and institutional capacity [10].

The tourism-led growth hypothesis has received broad empirical support in the international literature. Early studies by Balaguer and Cantavella-Jordà [1] and Lee and Chang [2] find that tourism contributes positively to long-run economic growth, while Brida and Pulina [3] provide a comprehensive review of the tourism-growth literature. However, more recent studies suggest that the tourism–income relationship is context-dependent and sensitive to model specification, institutional conditions, and common shocks [6], [9]. In particular, post-COVID tourism recovery patterns appear highly uneven across destinations depending on tourism resilience and structural conditions [6], [7].

Methodologically, recent studies increasingly emphasize the importance of accounting for cross-sectional dependence and unobserved common factors in tourism-growth analysis [8], [9]. Regional economies within the same country are likely to share common tourism cycles, macroeconomic conditions, and policy environments. Ignoring these factors may bias conventional panel estimators and overstate tourism-growth relationships.

For Vietnam, existing studies generally support tourism-led growth, although results vary by context and specification [11]–[13]. At the regional level, tourism has been found to contribute positively to economic growth in the Central Key Economic Region [14] and to act as a complementary growth driver alongside institutional quality in Central Vietnam [15]. Nevertheless, these studies primarily assess tourism through aggregate indicators. Three gaps therefore remain. First, evidence that separates the expansion of visitor numbers from the increase in real revenue per visitor remains scarce. Second, the comparative stability of these two dimensions under provincial heterogeneity has not been established. Third, limited attention has been paid to whether their estimated relationships persist after common shocks and cross-sectional dependence are explicitly controlled for in regional panels.

Against this backdrop, the present study examines the relationship between tourism development and per capita income in five provinces of Vietnam's South Central Coast. By distinguishing between tourism volume and tourism value channels and evaluating robustness under alternative assumptions regarding heterogeneity and common factors, the study aims to provide a more nuanced interpretation of the tourism–income relationship in a regional developing-economy context.

2.2. Data and variable measurement

Based on the conceptual framework, the variables are constructed to capture per capita income, tourism development (through volume and value dimensions), and institutional conditions. The dataset is a balanced provincial panel covering five provinces in Vietnam's South Central Coast, namely Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan, and Binh Thuan, over the period 2010–2024. These provinces represent the major coastal tourism economies of the region and share relatively similar tourism-oriented development characteristics. The data are compiled from official statistical yearbooks, provincial statistical reports, tourism sector publications, and PCI reports [16]–[19].

Although the dataset includes only 75 observations ($N = 5$, $T = 15$), it covers the full set of key coastal provinces within the study region during the pre-restructuring provincial administrative period. Therefore, the study aims to provide regional evidence rather than universal generalization for all provinces in Vietnam. Given the

relatively small cross-sectional dimension, the empirical findings should be interpreted cautiously, particularly for estimators developed under large-sample asymptotic assumptions. For this reason, the analysis emphasizes robustness comparisons across alternative estimators rather than relying exclusively on a single model specification.

The dependent variable is real gross regional domestic product per capita, transformed into logarithmic form (lnGRDPpc). Tourism development is measured through two complementary dimensions. The volume channel is represented by tourist arrivals per 1,000 residents (lnG1000), reflecting tourism intensity relative to population size. The value channel is measured by real tourism revenue per visitor (lnREVPG), capturing the economic value generated per tourist. This decomposition distinguishes between tourism growth driven primarily by visitor scale and tourism growth associated with higher value added per visitor.

Institutional quality is proxied by the PCI. In extended specifications, the analysis additionally includes urbanization (lURB) and trained labor (lH) as structural control variables. A COVID dummy is also included in the short-run equation and takes the value of 1 for 2020–2021 and 0 otherwise in order to capture the common shock associated with the pandemic period.

The dataset reflects the provincial administrative structure prior to the recent administrative restructuring process in Vietnam. Therefore, the findings should be interpreted within the context of the pre-restructuring provincial system during 2010–2024.

Table 1. *Variable definitions and expected signs*

Variable	Symbol	Measurement	Role	Expected sign
Per capita income	lnGRDPpc	Log of real GRDP per capita	Dependent variable	—
Tourism volume channel	lnG1000	Log of tourist arrivals per 1,000 residents	Main explanatory variable	+
Tourism value channel	lnREVPG	Log of real tourism revenue per visitor	Main explanatory variable	+
Institutional quality	PCI	Provincial Competitiveness Index	Long-run control	+
Urbanization	lURB	Urbanization indicator (extended model)	Structural control	+
Trained labor	lH	Trained labor indicator (extended model)	Structural control	+
COVID shock	COVID	Dummy = 1 for 2020–2021, 0 otherwise	Short-run control	Undetermined

Table 2 reports the descriptive statistics of the variables used in the analysis. The results indicate moderate variation in per capita income across provinces and over time, as reflected by the dispersion of lnGRDPpc. In contrast, the tourism variables exhibit substantially higher variability. In particular, lnG1000 shows considerable dispersion, suggesting significant differences in tourism intensity across provinces. Similarly, lnREVPG displays wide variation, reflecting heterogeneity in tourism value per visitor.

The institutional variable (PCI) exhibits relatively smaller variation, indicating more limited differences in governance quality across provinces compared to tourism indicators. Overall, the descriptive statistics support the relevance of distinguishing between the volume and value channels of tourism, as these dimensions display distinct patterns of variation in the data.

Table 2. *Descriptive statistics (Obs = 75)*

Variable	Mean	Std. Dev.	Min	Max
lnGRDPpc	3.351	0.305	2.684	3.935
lnG1000	7.694	0.711	6.033	9.050
lnREVPG	−0.283	0.703	−1.347	1.199
PCI	61.724	4.218	53.36	69.61
lURB	−0.578	0.261	−1.195	−0.199
lH	−1.611	0.338	−2.302	−1.036

Note: Author's calculations based on GSO, provincial statistical yearbooks, provincial tourism reports, and PCI reports, 2010–2024.

2.3. Model specification and estimation strategy

To examine both long-run relationships and short-run adjustments, the study employs a Panel ARDL model in error-correction form [20], [21]. Let $y_{it} = \ln GRDPpc_{it}$ denote the dependent variable, and let the long-run vector of explanatory variables be defined as $x_{it} = \{\ln G1000_{it}, \ln REVPG_{it}, PCI_{it}\}$.

The model is specified as follows:

$$\Delta y_{it} = \phi_i(y_{i,t-1} - \theta_i' x_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \beta'_{ij} \Delta x_{i,t-j} + \gamma_i COVID_t + u_{it}$$

where $(y_{i,t-1} - \theta_i' x_{i,t-1})$ represents the deviation from the long-run relationship, ϕ_i is the error-correction coefficient, λ_{ij} and β_{ij} capture short-run dynamics, and u_{it} is the disturbance term.

The COVID dummy is incorporated primarily as a parsimonious control for the pandemic shock in the short-run dynamics rather than as a formal structural break specification. Given the relatively limited time dimension of the panel (T = 15), introducing more complex break structures or regime-shift models could substantially reduce degrees of freedom and affect estimation stability. The COVID variable is therefore intended mainly to absorb the exceptional short-run disturbance associated with the pandemic period while preserving model parsimony in a small-sample setting.

Given the relatively small sample size (N = 5, T = 15), the lag structure is intentionally kept parsimonious in order to avoid over-parameterization and loss of degrees of freedom. The empirical analysis therefore focuses on a compact specification with one lag for the dependent and explanatory variables.

In Panel ARDL settings, PMG, MG, and DFE estimators represent alternative specifications based on different assumptions regarding parameter homogeneity.

PMG allows short-run heterogeneity while imposing long-run homogeneity across provinces, MG allows both long-run and short-run heterogeneity, whereas DFE imposes stronger homogeneity restrictions on both long-run and short-run dynamics. Given the heterogeneous tourism structures across provinces in the South Central Coast, DFE is considered potentially restrictive in the present context and is therefore not adopted as the primary specification.

The baseline analysis uses the PMG estimator as a parsimonious benchmark under the assumption that provinces may share partially common long-run dynamics despite heterogeneous short-run adjustments [21]. However, the study does not treat PMG as a definitive representation of the tourism–income relationship. Instead, MG and DCCE-MG estimators are employed to evaluate the sensitivity of the findings under weaker homogeneity assumptions and stronger controls for unobserved common factors. Given the relatively small cross-sectional dimension (N = 5), formal slope heterogeneity tests may have limited finite-sample reliability and should therefore be interpreted cautiously. Instead of relying exclusively on formal homogeneity testing, the study evaluates parameter sensitivity through robustness comparisons across PMG, MG, and DCCE-MG specifications under alternative assumptions regarding heterogeneity and common factors [22], [23].

Because the panel exhibits cross-sectional dependence, the study further estimates Dynamic Common Correlated Effects Mean Group (DCCE-MG) specifications [22], [23]. The purpose of these models is not to replicate the PMG error-correction structure directly, but rather to provide more demanding robustness checks under common shocks, shared regional trends, and potential unobserved common factors. In this sense, the empirical strategy emphasizes consistency across alternative specifications rather than reliance on a single estimator.

Before estimation, the study conducts cross-sectional dependence tests [24], panel unit root tests under cross-sectional dependence [25], and panel cointegration tests [26]–[28]. Given the relatively small cross-sectional dimension, these tests are interpreted as supportive rather than mechanically decisive, and the findings are evaluated cautiously in conjunction with robustness comparisons across estimators.

3. Results and Discussion

3.1. Cross-sectional dependence, integration order, and implications for estimation

The results indicate substantial cross-sectional dependence among most variables, suggesting that the provinces in the sample are affected by common shocks, regional spillovers, or shared macroeconomic trends. This pattern implies that estimators that ignore cross-sectional dependence may conflate the effects of tourism variables with those of broader unobserved factors.

Panel unit root tests show that the variables are characterized by mixed integration orders, with no evidence of I(2) processes. This finding supports the application of the Panel ARDL framework. At the same time, panel cointegration tests provide mixed evidence. Some statistics suggest the presence of long-run relationships, whereas others do not strongly reject the null of no cointegration. In a small-sample setting, such inconsistency is not unusual and reinforces the need for cautious interpretation and robustness analysis. This motivates the use of MG and DCCE specifications alongside the baseline PMG estimator.

Table 3. *Cross-sectional dependence tests*

Variable	CD-test	p-value	corr	abs(corr)
lnGRDPpc	11.99	0.000	0.979	0.979
lnREVPG	2.840	0.004	0.232	0.370
lnG1000	10.81	0.000	0.883	0.883
PCI	10.98	0.000	0.896	0.896
lURB	0.350	0.724	0.029	0.652
lH	10.91	0.000	0.891	0.891

Note: The null hypothesis is cross-sectional independence. Small p-values indicate cross-sectional dependence.

Table 4. *Panel unit root and cointegration results*

Variable / statistic	Level	Conclusion	First difference	Integration / interpretation
lnGRDPpc (CIPS)	−2.367	Borderline at 5%	−3.058	I(1), treated cautiously
lnG1000 (CIPS)	−1.385	Non-stationary	−5.536	I(1)
lnREVPG (CIPS)	−1.697	Non-stationary	−2.592	I(1)
PCI (CIPS)	−4.391	Stationary	—	I(0)
lURB (CIPS)	−1.064	Non-stationary	−4.280	I(1)
lH (CIPS)	−2.623	Stationary	—	I(0)
Pedroni modified PP t	1.9911	p = 0.0232	—	Evidence supportive of cointegration
Pedroni PP t	−6.5070	p = 0.0000	—	Evidence supportive of cointegration
Pedroni ADF t	−1.2737	p = 0.1014	—	Marginal at 10%
Westerlund variance ratio	0.6271	p = 0.2653	—	Fails to reject no cointegration

3.2. PMG results: long-run signals and the role of tourism channels

Baseline PMG estimates suggest that both tourism channels are positively associated with per capita income in the long run. The coefficients on lnG1000 and lnREVPG are positive and statistically significant, and PCI also enters positively. In this framework, provinces with greater tourism intensity and higher real tourism revenue per visitor tend to be associated with higher per capita income levels over time.

The error-correction term is negative and statistically significant, suggesting the presence of a gradual adjustment mechanism consistent with a potential long-run relationship. The magnitude of the coefficient suggests that deviations from equilibrium are corrected gradually rather

than immediately, which is consistent with the cumulative nature of economic processes linking tourism to income.

By contrast, the short-run coefficients on tourism variables are not statistically significant. This pattern suggests that tourism-related effects are more visible in long-run dynamics than in contemporaneous annual changes. It also supports the interpretation that tourism influences local income through gradual accumulation, investment, and spillover processes rather than through instant year-to-year responses.

The coefficient on the COVID dummy in the short-run equation should be interpreted cautiously. It is included primarily to absorb the common shock associated with the pandemic period, rather than to support a substantive claim about the direct short-run effect of COVID on provincial income. The positive coefficient may partly reflect short-run recovery dynamics, fiscal support measures, or post-pandemic adjustment effects rather than a direct positive impact of the pandemic itself.

Table 5. *Baseline PMG-ARDL/ECM estimates*

Variable	Coefficient	Std. Error	z	p-value
Long run: lnG1000	0.1386***	0.0348	3.99	0.000
Long run: lnREVPG	0.1082***	0.0323	3.35	0.001
Long run: PCI	0.0321***	0.0084	3.84	0.000
ECM(t−1)	−0.1955***	0.0622	−3.14	0.002
ΔlnG1000	0.0216	0.0168	1.28	0.200
ΔlnREVPG	0.0135	0.0162	0.83	0.405
ΔPCI	0.0009	0.0019	0.48	0.631
COVID (2020–2021)	0.0344***	0.0110	3.14	0.002
_cons	0.1136***	0.0155	7.35	0.000

*Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.*

3.3. Robustness checks: alternative PMG specifications, MG, and DCCE

Table 6. *Alternative PMG specifications*

Variable	(1) Baseline without COVID	(2) Volume channel + COVID	(3) Value channel + COVID	(4) Extended model + COVID
lnG1000	0.1071***	0.1347**	—	0.1602***
lnREVPG	0.1105***	—	0.1053*	0.1028***
PCI	0.0511***	0.0393***	0.0621***	0.0322***
lURB	—	—	—	0.1415
lH	—	—	—	−0.1156
ECM(t−1)	−0.1183***	−0.1563***	−0.1477***	−0.2013**
ΔlnG1000	0.0084	0.0231	—	0.0153
ΔlnREVPG	0.0076	—	0.0006	0.0152
ΔPCI	0.0009	0.0017	−0.0004	0.0008
ΔlURB	—	—	—	0.1037
ΔlH	—	—	—	−0.0151
COVID	—	0.0260***	−0.0414	0.0462

*Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.*

Alternative PMG specifications show that the long-run signs of tourism variables remain broadly positive, but the degree of robustness differs across channels. The volume channel remains more stable across specifications, while the value channel becomes weaker and in some cases only marginally significant. This suggests that tourism scale is more consistently identified in the provincial data than tourism value per visitor.

MG estimates reinforce this interpretation. Once long-run homogeneity is relaxed, the coefficient on the volume channel remains positive and statistically significant in key specifications, whereas the value channel loses significance. The sign instability of the value channel under MG specifications further suggests that tourism value effects may vary substantially across provinces and may depend on local structural and institutional conditions. The Hausman test does not strongly reject PMG at conventional levels, but its result still supports a cautious reading of PMG as a useful benchmark rather than a definitive representation of provincial heterogeneity.

Table 7. *MG estimates and Hausman comparison with PMG*

Variable	MG with COVID			MG without COVID		
	Coef.	Std. Error	p-value	Coef.	Std. Error	p-value
Long run: lnG1000	0.4690***	0.1135	0.000	0.1738**	0.0756	0.021
Long run: lnREVPG	−0.0547	0.2531	0.829	−0.3896	0.3010	0.195
Long run: PCI	−0.0014	0.0135	0.918	0.0568**	0.0229	0.013
ECM(t−1)	−0.2808*	0.1602	0.080	−0.1618***	0.0429	0.000
ΔlnG1000	0.0407	0.0310	0.189	0.0021	0.0178	0.908
ΔlnREVPG	−0.0597	0.0540	0.269	0.0107	0.0165	0.517
ΔPCI	−0.0008	0.0019	0.672	−0.0002	0.0008	0.783
COVID	0.1194	0.1393	0.391	—	—	—
_cons	−0.2528	0.3135	0.420	0.0270	0.0965	0.780

Hausman test: $\chi^2(3) = 6.26$; $p = 0.0995$.

*Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.*

Table 8. *DCCE-MG estimates and residual cross-sectional dependence diagnostics*

Variable / diagnostic	DCCE-MG (cross-sectional averages of lnGRDPpc)			DCCE-MG (cross-sectional averages of dependent and tourism variables)		
	Coef.	Std. Error	p-value	Coef.	Std. Error	p-value
L.lnGRDPpc	0.1588	0.1069	0.137	0.1135	0.1048	0.279
lnG1000	−0.0059	0.0258	0.820	0.0416*	0.0239	0.081
lnREVPG	0.0068	0.0240	0.776	0.0203	0.0221	0.359
PCI	0.0020**	0.0009	0.0009	0.0032***	0.0010	0.0010
CD statistic	−1.25	—	0.2121	−1.19	—	0.2325
CDw	—	—	—	−1.07	—	0.284
CDw+	—	—	—	13.10	—	0.000
CD*	—	—	—	1.95	—	0.051

*Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, CDw, CDw+, and CD* denote alternative residual cross-sectional dependence diagnostics.*

The DCCE-MG results provide the strongest qualification to the baseline findings. Once unobserved common factors are more explicitly controlled for, the

statistical significance of tourism variables weakens substantially. In the more demanding DCCE specifications, the value channel becomes insignificant, and the volume channel remains at best marginally significant. In contrast, PCI remains positive and comparatively more robust. This pattern suggests that part of the tourism–income relationship captured by PMG may reflect common regional or macroeconomic influences rather than tourism-specific effects alone. Although the DCCE specifications help account for common factors and reduce several indicators of residual cross-sectional dependence, some residual dependence diagnostics (particularly CDw+ and borderline CD*) remain statistically significant, suggesting that unobserved common influences may not be fully eliminated in a small-sample regional setting. This finding further supports a cautious interpretation of the estimated tourism effects and their generalizability.

3.4. Discussion of findings

Taken together, the findings suggest that the relationship between tourism development and per capita income in Vietnam's South Central Coast is conditional rather than uniform across model specifications. Under the baseline PMG framework, both tourism channels are positively associated with per capita income in the long run. However, the robustness analysis indicates that the magnitude and stability of these relationships vary substantially across tourism dimensions and estimation approaches.

The volume channel appears empirically more stable than the value channel across PMG, MG, and alternative specifications. One possible explanation is that increases in tourist arrivals generate broader and more direct demand spillovers across accommodation, transportation, retail, and food services, thereby producing relatively observable income effects at the provincial level [1], [2]. By contrast, the value channel depends more heavily on visitor spending structure, service quality, tourism product composition, and the extent to which tourism-generated value added is retained within local economies [4], [5]. In destinations characterized by tourism leakage, imported intermediate inputs, or concentration in low-value tourism segments, higher tourism revenue per visitor may not translate proportionally into local income gains.

The weakening of tourism coefficients under DCCE specifications also provides an important qualification to the baseline PMG results. Once unobserved common factors and shared regional trends are more explicitly controlled for, the estimated tourism effects become substantially smaller and less stable. This suggests that part of the tourism–income relationship identified under conventional Panel ARDL specifications may partly reflect broader macroeconomic conditions, synchronized tourism cycles, infrastructure expansion, or common post-COVID recovery dynamics rather than purely tourism-specific effects [6]–[9]. This interpretation is broadly consistent with recent studies emphasizing the importance of cross-sectional dependence and common shocks in tourism-growth analysis.

In contrast, institutional quality, proxied by PCI, remains comparatively more robust across specifications. This pattern is consistent with institutional perspectives emphasizing that local governance quality and business environment conditions play a relatively stable role in shaping the capacity of provinces to transform tourism activity into broader economic gains [10]. Institutional conditions may therefore influence not only tourism performance itself but also the extent to which tourism-generated income is retained and distributed within local economies.

The baseline PMG results are consistent with previous evidence of a positive tourism–growth relationship in Central Vietnam [14], [15]. However, the relationship weakens after accounting for provincial heterogeneity and unobserved common factors. Real tourism revenue per visitor is not robust across the MG and DCCE specifications, while the visitor-volume channel remains comparatively more stable. Thus, tourism's economic contribution varies by tourism dimension and model specification.

4. Conclusion

This study examines the relationship between tourism development and per capita income in five provinces of Vietnam's South Central Coast within a Panel ARDL/ECM framework. Rather than relying on a single aggregate tourism indicator, the study decomposes tourism development into a volume channel and a value channel in order to distinguish between tourism expansion driven by visitor scale and tourism development associated with higher economic value per visitor.

The empirical findings provide conditional evidence consistent with a positive long-run tourism–income relationship, particularly through the volume channel under baseline specifications. Under the baseline PMG specification, both tourism dimensions are positively associated with per capita income. However, the PMG estimator is employed primarily as a benchmark specification rather than as a definitive representation of the underlying long-run relationship in a heterogeneous regional setting. The robustness analysis further reveals that these relationships are sensitive to alternative estimators and controls for common factors. In particular, the statistical significance of tourism variables weakens considerably under DCCE specifications, while institutional quality remains comparatively more stable across models. These findings suggest that tourism should not be interpreted as an automatically stable engine of regional income growth, but rather as a conditional contributor whose effects depend on institutional conditions, common shocks, and the structure of local tourism development.

From a policy perspective, the results imply that provincial development strategies should move beyond a narrow focus on increasing tourist arrivals. While tourism scale remains relevant, greater attention should also be given to improving tourism quality, increasing local value added, strengthening tourism linkages with the local

economy, and improving institutional and business environment conditions that shape the local transmission of tourism-related gains.

Several limitations of the study should also be acknowledged. First, the analysis is based on a relatively small provincial panel (N = 5, T = 15), and the estimators employed are largely developed under large-sample asymptotic assumptions. The findings should therefore be interpreted cautiously and primarily as regional evidence rather than universally generalizable estimates. In particular, the relatively small cross-sectional dimension limits the extent to which the results can be generalized beyond the specific regional context examined in this study. Second, the dataset reflects the provincial administrative structure prior to the recent administrative restructuring process in Vietnam, which may affect the future policy applicability of province-level results. Third, although the study attempts to address cross-sectional dependence and robustness concerns through dynamic panel techniques and alternative estimators, potential endogeneity, bidirectional relationships between tourism development and income, and unobserved structural heterogeneity may still remain.

Future research could extend the spatial and temporal scope of the dataset, incorporate alternative identification strategies for endogeneity, and employ more detailed indicators of tourism quality, tourism structure, and local value retention. Further studies may also explore post-restructuring administrative contexts and post-COVID tourism transformation dynamics in Vietnam.

REFERENCES

[1] J. Balaguer and M. Cantavella-Jordà, "Tourism as a long-run economic growth factor: The Spanish case," *Applied Economics*, vol. 34, no. 7, pp. 877–884, 2002, doi: 10.1080/00036840110058923.

[2] C.-C. Lee and C.-P. Chang, "Tourism development and economic growth: A closer look at panels," *Tourism Management*, vol. 29, no. 1, pp. 180–192, 2008, doi: 10.1016/j.tourman.2007.02.013.

[3] J. G. Brida and M. Pulina, "A literature review on the tourism-led-growth hypothesis," *CRENoS Working Paper*, no. 2010/17, Centro Ricerche Economiche Nord Sud, 2010.

[4] D. Meyer, "Pro-poor tourism: From leakages to linkages. A conceptual framework for creating linkages between the accommodation sector and 'poor' neighbouring communities," *Current Issues in Tourism*, vol. 10, no. 6, pp. 558–583, 2007, doi: 10.2167/cit313.0.

[5] R. Scheyvens and R. Biddulph, "Inclusive tourism development," *Tourism Geographies*, vol. 20, no. 4, pp. 589–609, 2018, doi: 10.1080/14616688.2017.1381985.

[6] S. Gössling, D. Scott, and C. M. Hall, "Pandemics, tourism and global change: A rapid assessment of COVID-19," *Journal of Sustainable Tourism*, vol. 29, no. 1, pp. 1–20, 2021, doi: 10.1080/09669582.2020.1758708.

[7] G. D. Sharma, A. Thomas, and J. Paul, "Reviving tourism industry post-COVID-19: A resilience-based framework," *Tourism Management Perspectives*, vol. 37, Art. no. 100786, 2021, doi: 10.1016/j.tmp.2020.100786.

[8] A. Chudik, K. Mohaddes, M. H. Pesaran, and M. Raissi, "Long-run effects in large heterogeneous panel data models with cross-sectionally correlated errors," *Advances in Econometrics*, vol. 36, pp. 85–135, 2016, doi: 10.1108/S0731-905320160000036013.

[9] A. Hussain and M. A. Nawaz, "Economic growth through tourism: A global analysis using CS-ARDL approach," *iRASD Journal of Economics*, vol. 6, no. 2, pp. 513–528, 2024, doi: 10.52131/joe.2024.0602.0221.

[10] D. C. North, *Institutions, Institutional Change and Economic Performance*. Cambridge, United Kingdom: Cambridge University Press, 1990.

[11] N. H. M. Trang, N. H. C. Duc, and N. T. Dung, "Research note: Empirical assessment of the tourism-led growth hypothesis—the case of Vietnam," *Tourism Economics*, vol. 20, no. 4, pp. 885–892, 2014, doi: 10.5367/te.2013.0307.

[12] T. P. T. Hoang, "The effect of financial and economic growth on tourism development in emerging economies: A study of Vietnam for the interval 1990–2020," *Tourism and Hospitality Management*, vol. 28, no. 3, pp. 641–659, 2022, doi: 10.20867/thm.28.3.9.

[13] R. R. Kumar, P. J. Stauvermann, and L. T. M. Dau, "Exploring the tourism and economic growth relationship in Vietnam: A cointegration analysis with model-specific structural breaks," *Economies*, vol. 13, no. 2, Art. no. 29, 2025, doi: 10.3390/economies13020029.

[14] N. D. Quang and B. Q. Binh, "Studying the relationship between tourism and economic growth in the Central Key Economic Region," *The University of Danang - Journal of Science and Technology*, vol. 22, no. 8, pp. 31–36, 2024.

[15] N. D. Khoi, "Industrialization, urbanization, tourism, and institutional quality in economic growth: An FE-DKSE model analysis in Central Vietnam," *The University of Danang - Journal of Science and Technology,* vol. 24, no. 2, pp. 28–35, 2026, doi: 10.31130/ud-jst.2026.24(2).477.

[16] General Statistics Office of Vietnam, *Statistical Yearbook*. Hanoi, Vietnam, 2010–2024.

[17] Statistical Offices of Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan, and Binh Thuan, *Statistical Yearbooks and Related Statistical Reports*. Vietnam, 2010–2024.

[18] Vietnam Chamber of Commerce and Industry, *Provincial Competitiveness Index (PCI) Reports*. Hanoi, Vietnam, 2010–2024.

[19] Departments of Tourism and Departments of Culture, Sports and Tourism of the South Central Coast provinces, *Annual Tourism Statistical Reports and Sectoral Reports*. Vietnam, 2010–2024.

[20] M. H. Pesaran, Y. Shin, and R. P. Smith, "Bounds testing approaches to the analysis of level relationships," *Journal of Applied Econometrics*, vol. 16, no. 3, pp. 289–326, 2001.

[21] M. H. Pesaran, Y. Shin, and R. P. Smith, "Pooled mean group estimation of dynamic heterogeneous panels," *Journal of the American Statistical Association*, vol. 94, no. 446, pp. 621–634, 1999.

[22] M. H. Pesaran, "Estimation and inference in large heterogeneous panels with a multifactor error structure," *Econometrica*, vol. 74, no. 4, pp. 967–1012, 2006, doi: 10.1111/j.1468-0262.2006.00692.x.

[23] J. Ditzen, "Estimating dynamic common-correlated effects in Stata," *Stata Journal*, vol. 18, no. 3, pp. 585–617, 2018, doi: 10.1177/1536867X1801800306.

[24] M. H. Pesaran, "General diagnostic tests for cross section dependence in panels," *IZA Discussion Paper*, no. 1240, IZA Institute of Labor Economics, 2004.

[25] M. H. Pesaran, "A simple panel unit root test in the presence of cross-section dependence," *Journal of Applied Econometrics*, vol. 22, no. 2, pp. 265–312, 2007.

[26] P. Pedroni, "Critical values for cointegration tests in heterogeneous panels with multiple regressors," *Oxford Bulletin of Economics and Statistics*, vol. 61, suppl. S1, pp. 653–670, 1999.

[27] P. Pedroni, "Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the purchasing power parity hypothesis," *Econometric Theory*, vol. 20, no. 3, pp. 597–625, 2004.

[28] J. Westerlund, "Testing for error correction in panel data," *Oxford Bulletin of Economics and Statistics*, vol. 69, no. 6, pp. 709–748, 2007.