

DO TOURIST ARRIVALS AND ECONOMIC COMPLEXITY DRIVE LONG-TERM ECONOMIC GROWTH IN RCEP COUNTRIES? NEW EMPIRICAL EVIDENCE USING POOL MEAN GROUP

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Abstract: This study aims to revisit the debate on the tourism-growth nexus, emphasising the importance of tourism and environmental sustainability in shaping long-term economic growth. The analysis particularly applies to Regional Comprehensive Economic Partnership (RCEP) policymakers who aim to optimise tourism's economic potential while addressing environmental concerns. Mainly, this study empirically analyses the impact of tourism, carbon (CO₂) emissions, economic complexity (ECI), and foreign direct investment (FDI) on economic performance, measured by GDP per capita using data from 14 RCEP countries (Australia, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Myanmar, New Zealand, Singapore, South Korea, Thailand, and Vietnam) from 1995–2022. To address the objectives, we employ a panel-ARDL estimator, specifically the Pooled Mean Group (PMG). The main findings indicate the existence of long-run cointegration between all the selected variables. The PMG results confirm the positive impacts of tourism, ECI, FDI, and carbon emissions on economic growth in RCEP countries within the period under study. In the short term, only tourism and carbon emissions show significant effects, while ECI and FDI do not have an immediate impact. Causality tests reveal a bidirectional relationship between ECI and growth, as well as between carbon emissions and growth. However, there is no causal relationship between tourism and growth, thereby rejecting the Tourism-Led Growth hypothesis in the short-term context. Based on these findings, the study suggests that RCEP countries prioritise enhancing economic complexity through innovation policies and industrial diversification, strengthening quality investments, promoting environmentally sustainable tourism, and reinforcing economic structures to withstand post-pandemic external shocks.

Keywords: tourism arrivals, economic complexity, carbon (CO₂) emissions, FDI, RCEP countries, PMG estimator

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INTRODUCTION

Regional Comprehensive Economic Partnership (RCEP) is a significant development in the global tourism sector, due to the extensive membership, comprising several of the world's largest economies. RCEP is a vital platform for advancing trade and tourism in the Asia-Pacific region because it was established in 2020 and consists of the ten member states of the Association of Southeast Asian Nations (ASEAN) as well as China, Japan, South Korea, Australia, and New Zealand. With the heterogeneous and diverse membership, the agreement aims to facilitate economic integration, which has the potential to transform tourism landscape by enhancing connectivity and cooperation among members (Chaisse & Pomfret, 2018; Koh et al., 2024; Wu, 2020). Substantial empirical evidence has reported a positive relationship in tourism-growth nexus (Sequeira & Nunes, 2008; Shaheen et al., 2019; Sun et al., 2025; Zhang & Zhang, 2021; Zhang & Gao, 2016). Specifically among RCEP countries, tourism arrivals have been recognized as a significant determinant of economic performance, providing a fundamental motivation for promoting regional cooperation (Adeleye, 2023; Nguyen et al., 2025; Shahbaz et al., 2017; Zhang & Zhang, 2021).

However, the empirical evidence of tourism-led growth (TLG) hypothesis remains mixed (Chen & Chiou-Wei, 2009; Shahbaz et al., 2017; Zhang & Zhang, 2021). For instance, Shahbaz et al. (2017) and Zhang & Zhang (2021) discovered a bidirectional causal relationship between tourism and GDP in Malaysia and China, indicating that the two factors mutually reinforce each other. In contrast, other studies have reported a negative or insignificant relationship, possibly due to over-tourism, uncertainty in tourism demand, and environmental degradation (Chen & Chiou-Wei, 2009; Maneejuk et al., 2022). A significant gap also remains in the literature regarding TLG hypothesis within context of RCEP group.

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In a different context of studies, several articles have focused on the interconnectedness among tourism, environmental quality, foreign direct investment (FDI), and sustainability growth (Andrei et al., 2025; Danish & Wang, 2018; Ghoshray & Lorusso, 2025; Jean Baptiste Bernard Pea-Assounga et al., 2025; Nguyen et al., 2025).

Abd Alah & Ojekemi (2025) found that FDI, renewable energy, and economic growth significantly caused an increase in carbon dioxide (CO₂) emissions. Another study by Nguyen et al. (2025) highlighted the intricate relationship among CO₂ emissions, FDI, and economic growth in Asian countries.

From an environmental perspective, RCEP has prompted increasing discussions on how to sustain the ecological integrity of tourism-growth nexus. Member states are increasingly recognizing the importance of positioning tourism development with sustainable practices, particularly considering the ecological footprint associated with increased travel (Ngoc, 2022; Thach & Ngoc, 2023). The intersection between tourism expansion and environmental sustainability is crucial, as several RCEP countries face ecological degradation (Ngoc, 2022; Pang & Zheng, 2022). Therefore, achieving a balance between tourism growth and the preservation of natural resources is essential for long-term viability.

Recent studies have underscored economic complexity as a key determinant of long-term economic growth (Zhu & Li, 2017). In the tourism-environment-growth nexus, several studies have also incorporated the economic complexity measure to evaluate the interlinkages between the drivers (Ghosh et al., 2022; Labidi, 2025; Panagiotou & Katrakilidis, 2023; Qayyum et al., 2023). Therefore, the early studies that overlooked this factor are expected to suffer from omitted variable bias, yielding potentially misleading results. Recent studies have shown that economic complexity, as measured by the Economic Complexity Index (ECI), has emerged as a robust predictor of income levels and a crucial driver of sustained economic development (Hausmann et al., 2013; Hidalgo & Hausmann, 2009; Zhu & Li, 2017). Economic complexity, which reflects a country's ability to produce and export a wide range of advanced goods, suggests deeper strengths in knowledge, innovation, and production, even while tourism adds significantly to foreign exchange revenues and job creation (Ferraz et al., 2021; Hartmann et al., 2017).

Existing studies have examined these factors in isolation and predominantly at the national level, without adequately considering the regional heterogeneity and structural interactions present in integrated economic blocks, such as RCEP. Therefore, the nexus between tourism and economic complexity as relevant drivers of long-term growth in RCEP countries has received limited scholarly attention. This was conducted to address the shortcomings by examining the joint effects of tourism, economic complexity, FDI, and environmental quality on long-term economic growth in RCEP countries, thereby providing fresh insights into regional development dynamics and policy design.

Most studies relied on conventional panel methods, although recent investigations have started to adopt methods that differentiate between short-term state and long-term dynamics (Jama & Abdi, 2025; Xuan, 2025b, 2025a). This study contributes to the literature by using new methods to offer more robust evidence on the impact of tourism on economic growth, particularly within RCEP countries. It specifically uses the Pooled Mean Group (PMG) estimator, which was created by Pesaran et al. (1999) and allows for heterogeneity in short-term dynamics while enforcing homogeneity in long-term interactions across nations. This strategy works particularly effectively in environments with a variety of regional differences, such as the RCEP. In light of the explanation above, this study uses the PMG estimator to investigate the short- and long-term correlations between FDI, environmental quality, economic growth, tourism, and economic complexity in 14 chosen RCEP nations. This approach accommodates heterogeneity in short-term dynamics across countries while assuming homogeneity in long-term relationships. Prior to estimating the growth model, a cross-sectional dependence (CSD) test was carried out to capture potential interlinkages and spillover effects among RCEP countries.

In general, the COVID-19 epidemic sharply reduced foreign visitor visits; in 2020, inflows fell by about 70% worldwide (UNWTO, 2025). Due to the potential for structural breaks (Kumar & Patel, 2024), this study contributes to addressing the issues by incorporating a COVID dummy variable into tourism-growth hypothesis.

The results have important policy implications, particularly for governments that intend to diversify economic base and improve long-term growth trajectories. For example, the dual roles of tourism and economic complexity can guide investment strategies, infrastructure development, and innovation policy. Academically, the results contribute to the literature by integrating two under-explored but critical variables in a regional growth framework, using advanced panel econometrics. This study also makes a methodological contribution by employing the PMG estimator to capture both short- and long-term dynamics in a multi-country context. The structure of the article is as follows: Section 2 reviews the background of RCEP and the empirical evidence on the impacts of tourism, ECI, CO₂ emissions, and FDI on economic growth. Section 3 describes the data and methodology, including the PMG estimator. Section 4 reports and discusses empirical findings, and Section 5 outlines the policy implications and conclusions.

Background of RCEP

Background of Economic Growth and Basic Information of RCEP

The Asia-Pacific region's growing economic interdependence prompted the creation of the RCEP. With 15 nations, including the 10 ASEAN members, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam, as well as China, Japan, South Korea, Australia, and New Zealand, the RCEP, which was signed on November 15, is the largest trade agreement in the world. These countries together account for around 30% of worldwide trade, nearly 30% of the world's population, and about 32.6% of global GDP (World Bank, 2025). The primary objective of RCEP is to encourage regional economic integration by lowering tariffs and removing non-tariff barriers among member states, thereby streamlining trade flows and strengthening economic cooperation (Jiang

& Husin, 2024; Wei et al., 2024). It represents the largest free trade agreement globally, reflecting an ongoing shift toward mega-regionalism in trade and emphasizing the crucial role of regional agreements in shaping economic policy in an increasingly fragmented global trade environment (Chong, 2021). The varying levels of development among member states pose both opportunities for collaboration and challenges in achieving equitable benefits from the agreement (Verico, 2024).

A key economic strategy in RCEP is to enhance value-added trade among member countries. China plays a significantly crucial role in regional supply chains. Due to the agreement, the country ability to drive deeper integration with other RCEP members is expected to expand its influence in both regional and global trade frameworks (Estrades et al., 2023). The harmonisation of trade standards and practices is anticipated to simplify cross-border trade procedures, thereby promoting greater intra-regional trade and cooperation (Wei et al., 2024).

The influence of RCEP goes beyond merely facilitating trade, encompassing key socio-economic dimensions. For instance, it may mitigate the adverse effects of geopolitical tensions, such as the U.S.-China trade war, by strengthening regional ties that buffer economies against external shocks (Mahadevan & Nugroho, 2019). Additionally, the RCEP includes clauses pertaining to e-commerce, intellectual property rights, investment, and assistance for SMEs, exhibiting a thorough approach to economic cooperation and emphasizing its importance for regional sustainability (Lee, 2022).

The tourism sector in RCEP countries is ready for a significant transformation driven by economic integration and cooperation. The implications stretch beyond mere economic metrics, comprising environmental sustainability, resilience to crises, and long-term socio-economic development. As these nations collaborate to enhance tourism landscapes, the balance between economic growth and environmental stewardship will be crucial in ensuring that tourism sector flourishes within the boundaries of sustainable development.

LITERATURE REVIEW

Based on the idea of export-led growth, the TLG hypothesis recognises tourism as a significant new source of foreign cash. In addition to producing job possibilities, it also draws in foreign investment and has a favourable knock-on effect on industries other than tourism, such as manufacturing, infrastructure, and services. (Dogru & Bulut, 2018; Sequeira & Nunes, 2008; Zhang & Gao, 2016). Table 1 presents empirical studies that highlight the significant role of tourism as a global driver influencing socio-economic and environmental outcomes (Adeleye, 2023; Danish & Wang, 2018; Shaheen et al., 2019; Zhang & Zhang, 2021). Although numerous studies have demonstrated the direct contribution to GDP growth (Brida et al., 2016; Chen & Chiou-Wei, 2009; Del Pablo-Romero & Molina, 2013; Nunkoo et al., 2020; Panagiotou & Katrakilidis, 2023; Sequeira & Nunes, 2008), the relationship is reportedly mixed. Several studies found positive impacts of tourism on economic growth (Danish & Wang, 2018; Indriani, 2022; Selvanathan et al., 2021), while others reported a negative association (Adeleye, 2023). Khan et al. (2020) found that growth-led tourism has no significant contribution to economic growth. Kumar & Patel (2024) found that tourism had insignificant impacts on the economy of Pacific Island countries. Specifically, for developed nations, Gedikli et al. (2022) examined 28 OECD nations and found no evidence of a direct link between tourism and economic growth.

Recent studies have observed the potential non-linear TLG relationship (Kumar & Stauvermann, 2016; Panagiotou & Katrakilidis, 2023). Numerous studies have shown that there is a reciprocal relationship between tourism and GDP growth in addition to the direct influence of tourism on economic growth (Indriani, 2022; Isik et al., 2018; Panagiotou & Katrakilidis, 2023; Zhang & Zhang, 2021).

TLG hypothesis has been widely investigated in both developed and developing countries (Antonakakis et al., 2015; De Vita & Kyaw, 2016; Khan et al., 2020; Lin et al., 2018; Scheyvnes, 2007). Recent studies, including those by Adeleye (2023), Chingarande & Andrea (2018), and Sun et al. (2025), supports the view that tourism significantly promotes to economic growth, particularly in countries with strong human capital, a robust financial system, high institutional quality, and advanced ICT infrastructure.

Within RCEP member countries, characterized by diverse levels of economic development and varying stages of infrastructure, the impact of tourism on economic growth can differ. Nations with lower economic growth often gain greater benefits from tourism development (Sahni et al., 2021), whereas those with higher economic growth tend to place less emphasis on promoting the tourism industry or inbound tourism (Rasool et al., 2021).

Recent trends in the tourism-growth nexus have emphasized the complex relationship by incorporating environmental quality variables, inflows of FDI, and complexity (Balsalobre-Lorente & Leitão, 2020; Danish & Wang, 2018; Isik et al., 2018; Shaheen et al., 2019; Teng et al., 2021; J. Zhang & Zhang, 2021). Hausmann et al. (2007) stated that the composition of exports of a country is crucial to determining performance. Furthermore, Hidalgo & Hausmann (2009) developed a composite index that captures the diversifying and ubiquity of export products, known as ECI. Ideally, ECI measures the country production structure capability and represents the volume of knowledge in the population. Countries with diverse and complex capabilities, as well as knowledge, tend to produce more diverse and ubiquitous products. The capabilities include non-traded inputs, namely high-quality human capital and institutions, as well as advanced technology (Hidalgo & Hausmann, 2009). Therefore, countries with higher ECI are expected to have higher economic growth, higher income, and more equitable income distributions (Chu, 2021; Hartmann et al., 2017; Zhu & Li, 2017). The relationship among economic complexity, economic growth, and environmental quality remains an empirical issue. Ghosh et al. (2022) found that ECI has increased CO₂ emissions for G7 countries, while Abbasi et al. (2021) reported that ECI positively influenced CO₂ emissions in both the short and long run for the top 18 ECI-ranked countries. In contrast, Qayyum et al. (2023) discovered that ECI decreased CO₂ emissions in high-income nations while increasing them in low-income countries.

As the tourism sector expands, concerns over environmental sustainability have intensified due to its substantial environmental costs, particularly regarding CO₂ emissions. The relationship between tourism, CO₂ emissions, and economic growth is still contested. Some research imply that economic expansion leads to higher emissions (Ghoshray & Lorusso, 2025; Raihan, 2024; Shaheen et al., 2019), while others have shown that economic growth reduced CO₂ emissions (Abbasi et al., 2021). Some studies show a negative influence of CO₂ emissions on economic growth, while others show equivocal data about tourism's impact on environmental quality (Ahmad et al., 2018).

These findings imply that although tourism can drive economic growth, it often contributes to environmental degradation if not managed sustainably (Koçak et al., 2020; Tugcu & Topcu, 2018).

FDI is usually viewed as an important driver of economic growth, particularly in developing countries. It promotes economic development by creating job opportunities, allowing the transfer of skills and technology, increasing productivity, and fostering long-term growth (Tabash et al., 2023). Furthermore, for many countries, foreign direct investment (FDI) is a vital tool for developing their tourism sectors. The rise of tourism and the income generated contribute to economic development, with tourism revenues playing a vital role in propelling growth, and a strong link between foreign investments and overall capital gain (Huseynli, 2022).

Although the existing literature (Table 1) provides mixed results on both TLG and ECLG, studies that explicitly focus on RCEP region remain unexplored. Most empirical studies focused on either individual country cases (Chen & Chiou-Wei, 2009; Shahbaz et al., 2017; Zhang & Zhang, 2021) or on subregional groupings such as ASEAN or Asian (Adeleye, 2023; Adeleye et al., 2022; Indriani, 2022; Maneejuk et al., 2022; Nguyen et al., 2025).

This gap is particularly significant, as RCEP represents the largest trade agreement, comprising both developed and developing countries with diverse structural characteristics. Neglecting this regional view limits the understanding of how tourism and ECI interact in highly integrated but heterogeneous blocks. It also constrains policymakers from designing strategies that leverage cross-country spillovers and regional cooperation mechanisms.

Table 1. Summary of Literature Review (Source: Authors' own work, 20)

Authors	Objective	Data	Variables	Method	Result
TLG					
Brida et al. (2020)	Analyze the dynamics of economic growth and tourism evolution	80 countries 1995-2016	TOUR GDP	A non-parametric, non-linear approach (minimum spanning trees and hierarchical trees)	Heterogeneity in the relationship between economic growth and tourism.
Indriani (2022)	Analyze the long-run relationship between tourism and economic growth	10 ASEAN 1995-2019	GDP TOUR INF GFCF	ARDL	Confirm TLG theory. In the long run, TOUR increases EG, while INF reduces EG. In the short run, only TOUR increases EG; Confirm bi-directional TOUR-GDPC
Khan et al. (2020)	Analyze the causal relationship between tourism, economic growth, capital investment, energy consumption, and environmental pollutants.	Pakistan	GDP GFCF CO ₂ ENE	ARDL-VECM	No significant TLG theory; Positive effect of TOUR on ENE, GFCF, CO ₂ ; Negative effect CO ₂ on TOUR; Positive effect of GFCF on CO ₂ ; Positive effect of ENE on CO ₂ ; In the short run, TOUR, GFCF, ENE rise CO ₂
Shaheen et al. (2019)	Analyze the relationship between tourism, energy, CO ₂ , and economic growth.	10 tourism-induced countries 1995–2016.	TOUR GDP CO ₂ ENE; TOP FDI;POP	Panel Cointegration FMOLS	TOUR, FDI, ENE contribute to GDP; ENE, FDI and GDP increase CO ₂ ; TOUR reduces CO ₂ . Support EKC; Bidirectional causality between TOUR-ENE and CO ₂ -TOUR.
Adeleye (2023)	Analyze the moderating effect of ICT on the TLG relationship.	33 East Asia and Pacific 2010-2020	GDP TOUR GFCF LAB POP ICT INS R&D EDU	PSCC MMQR GMM	Tourism has a direct negative impact on growth; ICT positively moderates TLG; The moderation effect is consistently positive across all quantiles of Q0.25, Q0.50 and Q0.75 The results are sustained when omitted variables (growth enablers) – institutions, R&D, and human capital – are accounted for.
Isik et al. (2018)	Analyze the relationships between tourism development, renewable energy consumption, and economic growth.	United States, France, Spain, China, Italy, Turkey, and Germany 1995-2012	ENE TOUR GDP	CD Emirmahmutoglu-Kose bootstrap Granger causality	Bidirectional TOUR-GDP in Germany. TOUR induce GDP in China and Turkey. GDP induces TOUR in Spain. GDP induce REN in China, Turkey, and Germany. REN induce GDP in Spain. Bidirectional REN-GDP in the Italian and U.S. REN induce TOUR in the US, Spain, Italy, Turkey TOUR induce REN in China.

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Sun et al. (2025)	Analyze the moderating effect of institution quality on the TLG relationship.	182 countries 1998-2022	GDP; TOUR; TOP; UNE GFCF; INF INS; POP	GMM OLS Quantile Regression	TOUR positively contributes to economic growth TOUR-EG moderated by INS
Kumar & Patel (2024)	Analyze TLG, considering structural breaks	3 Pacific Island countries 1979-2020	GDP GFCF TOUR	Fourier ARDL	No significant TLG theory Structural breaks matter and affect results.
Zhang & Zhang (2021)	Analyze the short-run and long-run causal relationships among tourism, economic growth, energy, and CO ₂	30 Chinese provinces 2000–2017.	TOUR GDP CO ₂ ENE	VECM Granger Causality	Long-run equilibrium among variables; Short-run bidirectional between GDP-TOUR; Long-run bidirectional between CO ₂ -GDP, CO ₂ -TOUR and GDP-TOUR
Danish & Wang (2018)	Analyze the dynamic relationship between tourism, economic growth, and CO ₂	BRICS 1995 to 2014	CO ₂ ; GLOB GDPC TOUR INV	CSD Panel cointegration D&H 2GC	Confirms TLG theory TOUR increases CO ₂ ; INV and GLOB induce EG; Confirm EKC; Bidirectional CO ₂ -TOUR
Antonakakis et al. (2015)	Analyze the dynamic relationship between tourism growth and economic growth	10 EU 1995-2012	IND TOUR	Panel VAR	The tourism-economic growth relationship is not stable over time
Gedikli et al. (2022)	Analyze the impact of international tourism on economic growth and carbon emissions.	28 OECD 1995-2020	GDP TOUR CO ₂ ENE GFCF TOP	CSD Panel VAR IRF	No presence of a causal link between the variables using the Granger causality test. IRF analysis confirmed that the responses of carbon emissions and economic growth to an unexpected international tourism shock are positive and significant.
Panagiotou & Katrakilidis (2023)	Analyze the TLG relationship.	127 countries 1995-2020	GLOB ECI; TOUR GDPC	2GC; CS-ARDL; PY; 2GC; D&H; PSD;	U-shape in TLG nexus Bidirectional among all variables except for between TOUR-ECI
Shahbaz et al. (2017)	Analyze the tourism-growth nexus.	Malaysia 1975-2013	TOUR GDP CAP FD; TOP	ARDL	Cointegration among the variables TOUR has a positive effect on GDP. CAP, FD and TOP have a positive effect on GDP in SR and LR.
DETERMINANTS OF CO ₂					
Ghosh et al. (2022)	Analyze the association between economic complexity (ECI), tourism, urbanisation, and globalisation, natural resources and renewable energy on carbon dioxide emissions, ecological footprint and carbon footprint.	G7 countries 1990-2018	GDP CO ₂ ECI URB GLOB NTRR RE; TOUR EF; CF	CSD FMOLS DOLS D&H ARDL	In the long run, TOUR reduce CO ₂ EKC in GDP-CO ₂ nexus GLOB, ENE, and NAT negatively affect CO ₂ . ECI increases CO ₂
Ghosh (2025)	Analyze the impact of environmental quality on international inbound tourist arrivals.	E7 and G7 countries 1997-2017	TOUR CO ₂ ; ECI TOP; RER POP; INS	CSD Panel Unit Root Panel Cointegration DOLS; FMOLS; D&H	“U” shaped CO ₂ -tour and TOP and INS increase TOUR
Ghoshray & Lorusso (2025)	Analyses the link between economic growth, CO ₂ emissions and energy Consumption.	ASEAN-4 Q11990-Q42018	ENE GDP CO ₂ PAT	VECM IRF	GDP is positively associated with ENE and CO ₂ . PAT positively affects GDP in the short run.
Abbasi et al. (2021)	Analyze the association of economic complexity, tourism, GDP, GDP per capita, and energy on CO ₂	18 High ECI 1990-2019	ECI TOUR GDPC ENE; CO ₂	2GC CS-ARDL PY 2GC;D&H; PSD	Positive SR and LR association among ECI, GDP and CO ₂ . TOUR, GDPC and EPI reduce CO ₂ in SR and LRECI, TOUR, GDP
Ahmad et al. (2018)	Analyze the impact of tourism on environmental pollution.	5 provinces OBOR 1991–2016	CO ₂ GDPC ENE TOUR	FMOLS	Negative impact of tourism on the environment in Ningxia, Qinghai, Gansu, and Shanxi. Positive impact of tourism on the environment in Xinjiang.
Abd Alah & Ojekemi (2025)	Analyze the influence of coal, GDP, renewable energy, and FDI on CO ₂ .	Brazil Quarterly data 990Q1 to 2020Q4.	COAL GDP ENE FDI CO ₂	QQKRLS QQGC	COAL, GDP, and FDI exert a positive impact on CO ₂ ; REN significantly reduces CO ₂ ; ECI, TOUR, GDPC, EPI are significant predictors of CO ₂ FDI and economic growth in both driving emissions and offering potential for sustainable transition.

Labidi (2025)	The effect of economic growth on environmental quality.	Canada 1980-2022	CO ₂ ; ENE TOP; FD ICT; FDI GDP; GPR	ARDL	EKC hypothesis GPR positively contributes to CO ₂ Bidirectional GDPC-CO ₂ Uni CO ₂ – GDPC
Qayyum et al. (2023)	Analyse the impact of economic complexity, energy, tourism, and economic growth on carbon emissions.	102 countries 1994-2018	CO ₂ ; ECI ENE NAT TOUR GDP	FEM, REM Sys-GMM	ECI has a negative effect on CO ₂ on HICs, and positive effects for LICs. Economic growth has a negative effect on CO ₂ in LICs, and a positive effect for HICs.
Note: 2GC = second-generation cointegration; ARDL = autoregressive distributed lag; CS-ARDL = cross-sectionally augmented; autoregressive distributed lag; D&H = Humitrescu and Hurlin Granger causality test; DOLS = Dynamic ordinary least squares; FEM = Fixed effect model; FMOLS = Fully modified ordinary least squares; GMM = Generalised method of moments; IRF = Impulse response function; MMQR = Method of moments quantile regression; OLS = ordinary least squares; PSD = Pesaran Cross-Dependent; PSCC = Panel spatial correlation consistent; PY = Pesaran and Yamagata slope heterogeneity; QQKRLS = Quantile-on-Quantile Kernel-Based; Regularised Least Squares; QQGC = Quantile Granger Causality; REM = Random effect model; Sys-GMM = System GMM; VAR = Vector autoregressive; VECM = Vector error correction model					GDP = Gross Domestic Product (per Capita); TOUR = Tourism arrival/receipts; INV = Tourism investment; CO₂ = Carbon dioxide emissions; TOP = Trade openness; UNE = unemployment; GFCF = Domestic investment; INF = Inflation; INS = Institutions; POP = Population; NAT = Natural resources; ENE = Energy; EDU = Educations; ICT = Information and communication technology; GPR = Geo-political risk; FDI = Foreign direct investment; FD = Financial development; COAL = Coal; GLOB = Globalisation; EDU = Education/School; URB = Urbanisation; LAB = Labour force; IND = Industrial production; PAT = Patent application;

MATERIALS AND METHODS

Empirical Model Specification

The main objective of this study is to empirically investigate the effects of tourist arrivals and the Economic Complexity Index (ECI) on the economic growth of 14 RCEP countries over the period 1995–2022. Accordingly, the empirical model is specified as follows (Authors, 2025):

$$GDP_{it} = \alpha_0 + \alpha_1 TOR_{it} + \alpha_2 ECI_{it} + \alpha_3 CO_{2it} + \alpha_4 FDI_{it} + \varepsilon_{it} \quad (1)$$

where GDP_{it} represents the real GDP per capita as a proxy of economic growth for 15 RCEP countries ($i = 1, \dots, 15$) from 1995 to 2022 ($t = 1995, \dots, 2022$). TOR refers to international tourist arrivals, ECI refers to Economic Complexity Index, CO₂ refers to carbon dioxide emissions, and FDI refers to foreign direct investment inflows. ε_{it} is the error term of country i in period t . α_i is the estimated coefficient for selected regressors.

The data analysis used the panel Autoregressive Distributed Lag (ARDL) method. To determine whether the regressors had both long- and short-term consequences for RCEP-15 countries, PMG estimator was used following the method by Pesaran et al. (1999), as shown in equation 2 (Author, 2025):

$$GDP_{it} = \beta_0 + \sum_{j=1}^k \beta_{j2} DGDP_{i,t-j} + \sum_{j=1}^k \gamma_{j2} \alpha_2 DECI_{i,t-j} + \sum_{j=1}^k \delta_{j2} DCO_{2i,t-j} + \sum_{j=1}^k \omega_{j2} DFDI_{i,t-j} + \varphi ECT_{i,t-j} + \varepsilon_{it} \quad (2)$$

where β_{j2} , γ_{j2} , δ_{j2} and ω_{j2} are the coefficients, ε_{it} is the white noise term, φ is the coefficient of error correction term (ECT). This study also considered the impact of the COVID-19 pandemic on economic growth by introducing a dummy variable, $Covid_{it}$, which takes the value of 1 for 2020 and 2021 and 0 otherwise, equation 3 (Authors, 2025).

$$GDP_{it} = \beta_0 + \sum_{j=1}^k \beta_{j2} DGDP_{i,t-j} + \sum_{j=1}^k \gamma_{j2} \alpha_2 DECI_{i,t-j} + \sum_{j=1}^k \delta_{j2} DCO_{2i,t-j} + \sum_{j=1}^k \omega_{j2} DFDI_{i,t-j} + \sum_{j=1}^k Covid_{2020} + \sum_{j=1}^k Covid_{2021} + \varphi ECT_{i,t-j} + \varepsilon_{it} \quad (3)$$

The long-term relationship among the variables was tested using ECT, as shown in equation (4) (Authors, 2025), which illustrates how the variables are interconnected over time.

$$ECT_{i,t-j} = GDP_{it} - \beta_0 + \sum_{j=1}^k \beta_{j1} GDP_{i,t-j} - \sum_{j=1}^k \gamma_{j1} \alpha_2 ECI_{i,t-j} - \sum_{j=1}^k \delta_{j1} CO_{2i,t-j} - \sum_{j=1}^k \omega_{j1} FDI_{i,t-j} \quad (4)$$

where β_{j1} , γ_{j1} , δ_{j1} and ω_{j1} are the coefficients.

Testing Procedure

This work used a thorough pre-estimation approach to assure the panel ARDL estimator's dependability. The method started with preliminary diagnostics, such as correlation analysis and the Variance Inflation Factor (VIF), to identify potential multicollinearity among the independent variables. A VIF number above 10 is often considered evidence of severe multicollinearity, whereas values between 5 and 10 suggest moderate correlation that may still require attention (Gujarati & Porter, 2009). Second, this study adopted robust econometric methods specifically tailored to the nature of the panel dataset, where the number of cross-sectional units ($n = 14$ RCEP countries) exceeded the time dimension ($t = 1995\text{--}2022$). This empirical framework systematically addressed key econometric issues commonly observed in macro panel settings, namely cross-sectional dependence (CSD), non-stationarity, and potential endogeneity, thereby enhancing the reliability and validity of the estimated results. CD test developed by Pesaran et al. (1999) was used to detect the existence of cross-sectional dependence. The results showed statistically significant interdependence among RCEP-15 countries, indicating that economic and policy shocks in one member country are expected to spill over to others.

This result undermines the premise of cross-sectional independence, necessitating the use of second-generation panel unit root tests to account for cross-sectional correlations. Cross-sectionally Augmented Dickey-Fuller (CADF) and Cross-sectionally Augmented IPS (CIPS) tests, developed by Pesaran (2007), were employed to evaluate the stationarity properties of the variables while accounting for CSD. These tests addressed CSD by using cross-sectional averages of dependent and independent variables in regression equations. To address potential endogeneity issues, this study considered two key sources, namely omitted variable bias and measurement errors. The Ramsey RESET test was used to assess omitted variable bias, which determines whether non-linear combinations of explanatory variables significantly increase model explanatory power. A statistically significant RESET result would suggest possible model misspecification due to the exclusion of relevant variables. Measurement error, another frequent issue in macroeconomic panel datasets, was assessed using the test proposed by Delgado & Manteiga (2001). This test is particularly useful for determining the consistency of instrument variable estimators when measurement or data inaccuracies are suspected. The step is crucial in macroeconomic data, which is often affected by aggregation bias or inconsistencies in reporting. Third, the Kao (1999) cointegration test was used to determine the presence of a long-term equilibrium relationship between the variables. This test can be used for panel data and assumes that the cointegrating vector is consistent across cross-sections.

The test results show significant cointegration between tourism, economic complexity, CO₂ emissions, foreign direct investment, and economic growth. The Dumitrescu & Hurlin (2012) panel Granger causality test was conducted to address the issue of simultaneity and causality. This test is designed for heterogeneous panel datasets and allows for individual cross-section dynamics by considering both fixed and random effects. It assesses the direction and significance of causal links between the panel units. The findings provide insights into whether changes in one variable can predict changes in another. Specifically, it was applied to examine the bidirectional or unidirectional causality among international tourist arrivals, ECI, CO₂ emissions, FDI, and economic growth. The results will help determine whether these variables act as drivers or outcomes of economic performance in the panel framework.

Source and Description of Data

This analysis used annual panel data from 14 selected RCEP countries from 1995 to 2022: Australia, China, Indonesia, Japan, Cambodia, South Korea, Laos, Myanmar, Malaysia, New Zealand, the Philippines, Singapore, Thailand, and Vietnam. Table 2 shows the variables, their descriptions, and the data sources.

Table 2. Variables, description, and relationship (Source: Authors' own work, 2025)
(Notes: ATLAS (2025): <https://atlas.hks.harvard.edu/rankings>; WDI (2025): <https://databank.worldbank.org/source/world-development-indicators> ; UNWTO (2025): <https://www.unwto.org/>; UNCTAD (2025): www.unctad.org/)

Variable	Description	Sign	Sources
GDP	GDP per capita (real 2015 US\$)	NR	WDI (2025)
TOUR	International tourism (Number of arrivals)	+/-	World Tourism Organization (UNWTO) (2025)
ECI	Index of Economic Complexity (Hidalgo and Hausmann, 2009)	+	ATLAS (2025)
CO ₂	CO ₂ emissions (metric tons per capita)	+/-	WDI (2025)
FDI	Foreign direct investment, net inflows (% of GDP), stocks	+	UNCTAD (2025)

The empirical analysis employed annual panel data spanning the period from 1995 to 2022, sourced from several authoritative international databases. Economic growth, measured as the natural logarithm of GDP per capita in constant USD (lnGDPCR), was obtained from the World Development Indicators (World Bank, 2025). Tourism activity, represented by the logarithm of international tourist arrivals (lnTOUR), was sourced from the World Tourism Organization (UNWTO, 2025), capturing the economic impact of tourism sector. Environmental conditions were proxied by CO₂ emissions per capita (lnCO₂), measured in metric tons and also sourced from the World Bank (2025), reflecting the environmental pressures associated with economic activity. Foreign direct investment (lnFDI), measured as net inflows (stocks) as a percentage of GDP, was retrieved from the United Nations Conference on Trade and Development (UNCTAD, 2025), highlighting the role of external capital in supporting economic development.

The Atlas of Economic Complexity (2025) provided data on ECI, which represents the diversity and sophistication of a country's production capacity. All variables were transformed into logarithmic form to ensure consistency in interpretation, mitigate heteroscedasticity, and improve the robustness of the econometric analysis. The dataset was used to investigate the

dynamic interactions between the variables, with a focus on verifying the TLG hypothesis and determining the role of economic complexity in promoting long-term sustainable economic development among RCEP countries.

RESULTS

Descriptive Analysis

Table 3 shows the basic statistics for all the variables used in this study from 1995 to 2022 for the 15 RCEP countries. The average value of lnGDPR was 26.28, with some variation among countries, ranging from 22.03 to 30.40. For lnTOUR, the average was 15.41, with a range from 10.27 to 18.91. ECI had an average value of 0.42, and lnCO₂ had an average of 1.03, with a range from -2.52 to 2.96. Finally, lnFDI had an average of 3.30, with a range from 0.51 to 6.35.

Table 3. Descriptive Analysis (Source: Authors' own work, 2025)

Variable	Mean	Standard deviation	Minimum	Maximum
lnGDPR	26.27955	1.899617	22.0316	30.40361
lnTOUR	15.41452	1.424098	10.26625	18.90642
ECI	0.4196462	1.075761	1.465415	2.858869
lnCO ₂	1.033584	1.429652	2.520298	2.956846
lnFDI	3.298403	1.100711	0.510826	6.345724

Correlation and Variance Inflation Factor (VIF)

Table 4 shows the correlation coefficients and VIF values used to assess the degree of linear relationship between variables and identify potential multicollinearity in the model. According to the findings, the correlation between the dependent variable (lnGDPR) and all independent variables was significant at the 5% level. The correlation among the independent variables demonstrated the absence of multicollinearity, since all coefficients were below the threshold of 0.85, which is usually used to highlight potential concerns regarding multicollinearity (Gujarati & Porter, 2009). VIF values remained below the widely accepted threshold of 10 (Gujarati & Porter, 2009) showing that multicollinearity was not a significant concern in the model.

The highest VIF observed was 3.03 for lnTOUR, while the rest of the variables ranged between 1.35 and 2.42, falling to acceptable limits. These results confirm the robustness of the regression estimates and support the inclusion of all variables in the empirical model, eliminating the need for corrective measures related to multicollinearity.

Table 4. Correlation and Variance Inflation Factor (VIF) (Source: Authors' own work, 2025)
(*significant at level 0.050, ln refers to the natural logarithm)

Variable	1	2	3	4	5	VIF
lnGDPR (1)	1.0000					-
lnTOUR (2)	0.6681*	1.0000				3.03
ECI (3)	0.7072*	0.5238*	1.0000			2.42
lnFDI (4)	0.9650*	0.7191*	0.6262*	1.0000		1.72
lnCO ₂ (5)	-0.4221*	-0.0523	-0.3044*	-0.3769*	1.0000	1.35

Panel Unit Root Test

Table 5 presents the results of both CADF and CIPS tests, indicating that most variables, namely lnGDPC, lnTOUR, ECI, and lnCO₂ are non-stationary at the level but become stationary after first differencing. This suggests that the variables are integrated of order one, *I*(1). The variable lnFDI showed mixed results, as it appeared significant at the level in both tests, but demonstrated more robust significance at the first difference. Consequently, lnFDI variable was more appropriately treated as *I*(1). These results support the suitability of using PMG estimation method.

Table 5. Cross-Section Dependence and Second-Generation Panel Unit Root Test
(Source: Authors' own work, 2025) (***)significant at level 0.010)

Variable	Pesaran (2004) CD	CADF (0)	CADF (1)	CIPS (0)	CIPS (1)
lnGDPR	49.461***	-0.985	-8.478***	-2.572***	-5.231 ***
lnTOUR	43.874***	-2.139	-2.817**	-2.043	-4.276***
ECI	8.564***	-2.016	-3.225***	-2.574	-5.427***
lnCO ₂	9.155***	-1.740	-3.106***	-1.925	-4.599***
lnFDI	19.436***	-2.918**	-3.117***	-2.793**	-4.923***

Endogeneity Test

The endogeneity test results in Table 6 show several key findings about the model. In Table 5, the Ramsey RESET test shows a significant result ($p = 0.0173$), suggesting that some important variables may be missing from the model. This indicates possible omitted variable bias. The Delgado and Manteiga test for measurement error also yielded a significant result ($p = 0.016$), indicating potential inaccuracies in the data, which is a common issue in macroeconomic studies due to reporting or aggregation errors. The results support the need for using robust estimation methods. Given the presence of *I*(1) variables and long-term equilibrium relationships, PMG method was considered appropriate for estimating the model. However, the presence of endogeneity, as indicated by RESET and measurement error tests, supports the use of robust estimation methods in PMG framework.

Table 6. Omitted Variable Bias and Measurement Error Test (Source: Authors' own work, 2025)

Type	Test	Result
Omitted Variable Bias	Ramsey RESET:	
	F(3, 384)	3.43
	Prob > F	0.0173
Measurement Error	Delgado and Manteiga test:	
	CvM	8.274e-06
	p(CvM < CvM*)	0.016

Cointegration test

Table 7 displays the results of the cointegration test (Kao, 1999), which demonstrate a long-term link between the variables in the model. Several versions of the test, including the Modified Dickey-Fuller t -statistic, Dickey-Fuller t , and Augmented Dickey-Fuller t -statistic, were statistically significant at the 1% level with p -values of 0.0070, 0.0072, and 0.0063, respectively. These findings reject the null hypothesis of no cointegration, indicating the existence of a cointegrated relationship among the variables. In other words, there is a stable long-term association among economic growth (lnGDPGR), international tourist arrivals (lnTOUR), ECI, carbon dioxide emissions per capita (lnCO₂), and foreign direct investment (lnFDI).

Table 7. Kao test for cointegration (Source: Authors' own work, 2025)

Type of Test	Statistic	p-value
Modified Dickey-Fuller t	2.4567	0.0070
Dickey-Fuller t	2.4479	0.0072
Augmented Dickey-Fuller t	2.4961	0.0063
Unadjusted modified Dickey-Fuller	1.5128	0.0652
Unadjusted Dickey-Fuller t	1.1503	0.1250

Pooled Mean Group

Table 8 shows the results from PMG estimation, where lnGDPGR (the natural logarithm of real GDP) is the dependent variable. In the long-term equation, all the explanatory variables were statistically significant at the 5% level. Tourism (lnTOUR), economic complexity (lnECI), CO₂ emissions (lnCO₂), and foreign direct investment (lnFDI) all had positive coefficients, indicating a substantial positive contribution to long-term economic growth. Specifically, a 1% increase in tourism was associated with a 0.134% rise in GDP, while a 1% increase in economic complexity contributed to a 0.144% increase in GDP. CO₂ emissions exerted the strongest effect, with a 1% increase linked to a 1.125% rise in GDP, likely reflecting the impact of industrial activities. FDI also had a positive impact on GDP, although a minor one (0.026%).

In the short-term error correction model (ECM), ECT was negative and statistically significant (-0.069, $p = 0.001$), proving the presence of a long-term link and demonstrating how the system responds to restore equilibrium after a short-term shock. Among the short-term variables, tourism (DlnTOUR) and CO₂ emissions (DlnCO₂) remain significant, with no effect on GDP. However, economic complexity and FDI did not show significant short-term effects. The COVID-19 dummy variables for 2020 and 2021 were statistically insignificant, indicating that the pandemic impact was not strong enough to alter GDP in the model. The results in Table 8 also show the superiority of PMG over MG, while DFE is statistically insignificant. Therefore, the relationship is established under the assumption of no cross-sectional dependence.

Table 8. PMG long-run and short-run estimation (lnGDPGR is the dependent variable) (Source: Authors' own work, 2025)

Variable	Coefficient	Standard Error	t-statistic	Probability
Long-run Equation				
lnTOUR	0.134	0.018	7.64	0.000
lnECI	0.144	0.054	2.68	0.007
lnCO ₂	1.125	0.069	16.30	0.000
lnFDI	0.026	0.010	2.52	0.012
ECM equation (Short-run)				
ECT (-)	-0.069	0.022	-3.21	0.001
DlnTOUR	0.018	0.008	2.16	0.030
DECI	0.019	0.023	0.83	0.405
DlnCO ₂	0.168	0.058	2.88	0.004
DlnFDI	0.005	0.003	1.67	0.095
Covid_2020	-0.003	0.029	-0.09	0.930
Covid_2021	0.044	0.031	1.43	0.153
Constant	1.306	0.388	3.37	0.001
Log Likelihood	899.3962			
p-value	(Hausman) _{mg/pmg} = 0.1818			
	(Hausman) _{mg/DFE} = 0.9694			
Remarks	PMG is efficient and consistent			

Pairwise Dumitrescu-Hurlin Panel Causality Test Results

There is no causal association between tourists and economic growth in either direction, according to the findings of the

Dumitrescu-Hurlin panel Granger causality test, which are displayed in Table 9. Economic growth and economic complexity, however, were strongly causally related in both directions. Economic growth and CO₂ emissions were found to be correlated in a similar way. There was no proof that foreign direct investment led to economic expansion. According to these findings, economic complexity, environmental effect, and foreign direct investment's reactions to growth are important elements, even though tourism does not directly drive growth in this model.

Table 9. Dumitrescu-Hurlin Panel Granger Causality Test Results (Source: Authors' own work, 2025)

Hypothesis	W-statistic	Z-bar statistic	p-value	Decision
lnTOUR → lnGDPR	0.6039	-1.0479	0.2947	Fail to Reject H ₀
lnGDPR → lnTOUR	1.1951	0.5161	0.6058	Fail to Reject H ₀
ECI → lnGDPR	2.1139	2.9471	0.0032***	Reject H ₀
lnGDPR → ECI	4.8277	10.1270	0.0000***	Reject H ₀
lnCO ₂ → lnGDPR	1.9515	2.5174	0.0118***	Reject H ₀
lnGDPR → lnCO ₂	3.5544	6.7582	0.0000***	Reject H ₀
lnFDI → lnGDPR	0.5899	-1.0851	0.2779	Fail to Reject H ₀
lnGDPR → lnFDI	2.9478	5.1533	0.0000***	Reject H ₀

DISCUSSION

This study empirically analyzed the short- and long-term effects of tourism arrivals and economic complexity on the economic growth of 14 RCEP countries, using the most recent available data from 1995 to 2022. The analysis also controls the inflows of FDI and the quality of the environment, measured by CO₂ emissions, and incorporates the COVID effect in 2020. The results provide several important insights into the long-term and short-term determinants of economic growth in RCEP countries. The Kao (1999) cointegration test shows the existence of a long-term relationship among economic growth, international tourist arrivals, ECI, CO₂ emissions, and FDI. Furthermore, the PMG results reveal that all of the selected explanatory variables (tourist arrivals, ECI, FDI, and CO₂) are substantial and contribute favorably to RCEP nations' long-term economic growth. Previous studies have shown that tourist arrivals have a major positive impact on long-term economic growth (Lee & Chang, 2008; Oh, 2005). Thus, the analysis of this study shows that tourism and long-term economic growth in the RCEP group are positively correlated. The Granger causality test finds no apparent link between GDP growth and tourism. The result is similar to that of Khan et al. (2020), but fails to support the evidence from Dritsakis (2004) and Kreishan (2010). This situation suggests that the long-term effect of tourism may be mediated through structural or policy-related factors rather than direct economic feedback. As a result, governments in RCEP nations should build comprehensive tourism strategies that not only attract international visitors but also integrate the industry into infrastructure, innovation, and workforce development initiatives.

Long-term growth was found to be positively and significantly impacted by the economy's complexity as determined by ECI. This outcome demonstrates how crucial export product diversification and ubiquity are in influencing the economic performance of RCEP nations. In high-complexity nations, Abbasi et al. (2021) demonstrated a high and positive link between ECI and economic growth in the long run. Similarly, Chacua et al. (2024) stated that economic complexity reflects a country's capacity for technology and innovation. Complexity economies tend to be more productive, resilient, and innovative. Lee & Vu (2020) mentioned that ECI reflects a country's capability in terms of the level of human capital and the quality of institutions, as well as the knowledge volume within the population. RCEP countries that form the ASEAN region, and struggle to achieve the status of HICs, including Malaysia and Indonesia, as well as China, should focus on upgrading production capability. Further studies are needed on the potential of the moderation factor to magnify the effects of ECI on economic growth. The result is consistent with the bidirectional causality between ECI and GDP observed in this study as well as in Qayyum et al. (2023), who reported that a more complex economy not only fosters growth but also economic expansion, leading to greater diversification and technological sophistication. Hausmann et al. (2007) stated that a country's export composition influences performance.

Even though it plays a minor role, FDI plays a big part in helping RCEP members' economies expand over the long run. FDI may have an indirect effect on economic growth through changes to the structure. Antonietti & Franco (2020) showed that FDI could lead to an increase in ECI, particularly when supported by quality investments in knowledge- and technology-intensive sectors. Therefore, a more complex economic structure has the potential to attract quality FDI that strengthens technological advancement and the value-added of the domestic industry. Stable, large, and advanced countries tend to attract investors (Habibi et al., 2018; Tang, 2017). However, the Granger Causality test demonstrates that FDI does not generate economic growth but rather flows into countries already experiencing growth. To attract high-quality FDI, countries need to strengthen domestic fundamentals, including good governance, policy stability, and investment in infrastructure and talent. This result suggests that to attract more productive and growth-enhancing FDI, countries must first strengthen domestic fundamentals such as market size, institutional quality, and policy stability.

Among the variables, CO₂ emissions have the most considerable impact. The significant role of environmental quality in economic growth is consistent with Zhang & Zhang (2021), who found the bidirectional relationship in CO₂-Growth. Furthermore, CO₂ emissions per capita have a major impact on economic growth both in the long and short run. Based on the results, environmental quality continues to affect growth in RCEP region. The argument over sustainable development centers on the relationship between economic expansion and CO₂ emissions (Abd Alah & Ojekemi, 2025; Khan et al., 2020). This study offers empirical evidence for this issue, showing the bidirectional effects between CO₂ emissions and GDP growth.

In contrast to Abbasi et al. (2021), who found that a rise in GDP reduces CO₂, this study, in the context of RCEP countries, indicates a trade-off between economic growth and environmental sustainability. Although GDP growth is a proxy for economic growth, reflecting the rise of industrial activity in RCEP economies, it creates sustainability concerns that necessitate proactive environmental policy measures. RCEP countries need to urgently shift towards a green growth model through investments in renewable energy, clean technology, and carbon emission control without compromising economic competitiveness. The study found that only tourism and CO₂ had a substantial impact on economic growth in the short and long run. ECI and FDI, on the contrary, have a long-standing relationship. The COVID-19 factor is not statistically significant but indicates a negative impact on GDP in 2020, consistent with the disruptions in tourism and trade sectors observed in studies by Dogru & Bulut (2018) and Wu (2020). The pandemic variables for 2020 and 2021 were statistically insignificant in the model, suggesting that, although the crisis disrupted economic activity, the effect on the long-term trend of GDP was not statistically distinguishable in the model. Post-pandemic recovery strategies need to emphasize structural resilience, economic diversification, and digitalisation to minimize the impact of future external shocks, as also mentioned by Koh et al. (2024) in the context of Asia-Pacific economic recovery.

The results offer several important policy implications. Tourism development should be strategically integrated into broader economic planning, with an emphasis on promoting quality tourism, developing sustainable infrastructure, and building resilience against external shocks such as pandemics or climate-related disruptions. Furthermore, enhancing economic complexity should be considered a long-term policy priority. This can be achieved through sustained investments in education, the strengthening of national innovation systems, and the development of high-value-added export sectors capable of elevating the overall sophistication of the economy. Environmental sustainability must be embedded in national development strategies (Ferdos et al., 2026; Mamirkulova et al., 2025). While industrial activity continues to drive economic growth, it is essential to transition toward cleaner technologies and implement carbon-reduction policies to ensure that progress does not compromise environmental and social well-being. Policies designed to attract FDI should go beyond conventional fiscal incentives, emphasising the enhancement of domestic capabilities, the improvement of regulatory frameworks, and investments in infrastructure and human capital to support high-value industries. Finally, regional cooperation through RCEP presents a valuable opportunity to share best practices, harmonize regulatory standards, and support member countries in collectively upgrading industrial bases and innovative capacities.

CONCLUSION

This study examines the short-term and long-term relationships between tourist arrivals, the Economic Complexity Index (ECI), carbon emissions, foreign direct investment (FDI), and economic growth among RCEP countries from 1995 to 2022. Through a robust econometric approach using the PMG estimator, the main findings indicate that tourism, ECI, CO₂, and FDI have a positive and statistically significant impact on long-term economic growth.

This confirms that sustainable growth in the region is partly dependent on the strength of a more complex economic structure, the development of the tourism sector, and continued foreign investment. However, in the short term, only tourism and carbon emissions have a direct influence on GDP per capita, while ECI and FDI are not significant, indicating that the effects of these variables require time and stability to take effect. The significant two-way relationship between ECI and economic growth also confirms the importance of innovation, product diversification, and knowledge wealth in supporting long-term development. These findings align with the theory of economic complexity, which emphasises a country's ability to produce and export complex goods as a key indicator of technological capability and advanced economic structure (Felipe et al., 2012). Interestingly, CO₂ is seen to have a significant positive impact on growth, reflecting the region's economic dependence on industrial activities and fossil fuels. Although this contributes to GDP growth, it poses long-term risks to environmental sustainability. Therefore, it highlights the urgent need for a green growth approach that balances productivity and sustainability. Furthermore, the findings suggest that FDI does not cause growth causally but rather tends to follow existing growth. This suggests that countries need to strengthen their domestic foundations, including policy stability, infrastructure, and human capital, to attract high-quality investments.

Finally, the impact of the COVID-19 pandemic on growth is not statistically significant in the model; however, it shows an adverse effect in 2020, reflecting the major disruptions to the tourism and trade sectors. Therefore, future economic recovery strategies need to emphasise structural resilience, digitalisation, and the integration of the tourism and technology sectors to ensure economic resilience against recurring external shocks. Overall, this study highlights the importance of a balanced development approach that integrates economic diversification, strategic investment, and environmental sustainability to achieve sustained, long-term growth in the post-pandemic era.

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