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The effects of energy consumption and economic growth on tourism: A path to economic diversification in GCC economies

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ABSTRACT

This research examines the effects of energy consumption and economic growth on tourism in GCC economies. Gulf Corporation Council (GCC) countries have encountered economic growth uncertainties owing to the fluctuations in oil prices and are working to diversify their economies. Reducing reliance on oil and promoting non-hydrocarbon sectors like tourism can achieve economic diversification. The tourism industry requires energy to match the demands of luxury-driven hospitality, and tourism growth contributes to GDP. Using panel data from the GCC countries, we investigate the impact of energy consumption and economic growth on tourism. We employed feasible generalized Least Squares (FGLS) for empirical analysis. We also used panel corrected standard errors (PCSEs) and Driscoll-Kraay standard errors (DKSEs) methods for further robustness checks. Tourism is linked to increased energy consumption and economic growth. Our empirical results revealed that the tourism industry is growing as energy consumption and economic growth rise. Our results hold true even when different tourism proxies and econometric techniques are used. The policy implication is that the governments of the GCC countries should develop appropriate energy policies to boost tourism that help these economies in economic diversification efforts.

Contribution/Originality: This study contributes to tourism literature of the Gulf Corporation Council (GCC). The study examines the impact of energy consumption and economic growth on tourism in GCC economies. This study provides one solution for economic diversification efforts of these economies.

1. INTRODUCTION

The GCC economies that have for so many decades depended on petroleum, oil products, and natural resources are now facing numerous challenges as a result of the global oil price crisis and their countries' uncertain economic growth (EG). Thanks to the oil price shocks, the GCC countries have been obliged to diversify their economies away from oil dependence and increase the share of private sectors in their economies (Boersma & Griffiths, 2016; Young, 2016).

Economic diversification entails the creation of policies that reduce dependence on a single sector's contribution to GDP, government revenues, and export earnings (oil extraction). Non-hydrocarbon sectors such as manufacturing, tourism, agriculture, and services can be developed to create alternative sources of revenue for the government and reduce oil dependence (IMF, 2020). Tourism is one of the non-hydrocarbon activities that have the potential to generate significant revenue for any economy and accelerate economic growth (Gross & Ghafar, 2019; Majeed, Wang, Zhang, & Kirikkaleli, 2021; Waheed, Sarwar, & Dignah, 2020).

The tourism industry impacts the economy by creating new job opportunities and increasing tax revenue. This industry also pushes for increased investment in technology, human capital, and infrastructure. Furthermore, the tourism industry promotes efficiency in domestic firms by creating competition (Mitra, 2019; Shahzad, Shahbaz, Ferrer, & Kumar, 2017). Tourism has been deliberated as the principal source of foreign exchange earnings and an alternative to oil exports that can reduce the balance of payment (BOP) deficit. Existing studies have corroborated the tourism-led growth hypothesis for emerging, developing, and developed countries (Bassil, Hamadeh, & Samara, 2015; Fahimi, Saint Akadiri, Seraj, & Akadiri, 2018; Jones & Li, 2015; Matarrita-Cascante, 2010; Parrilla, Font, & Nadal, 2007; Tang & Tan, 2013; Yang & Fik, 2014). In the case of the GCC countries, this study is the first to highlight the importance of tourism, particularly in the aftermath of the oil price crisis.

The growth of tourism has been influenced by the development of the luxury-driven hospitality industry (Al-Badi & AlMubarak, 2019). The tourism industry needs energy to meet the demands of its activities (Stephenson & Al-Hamarneh, 2017). A general idea regarding tourism and energy has materialized during the last decade: tourism and energy consumption lead to economic development by creating jobs, income, and growth in the energy and tourism sectors (Crouch & Ritchie, 1999). Presently, tourism and energy are linked to global economic sustainability (Daly, 1991; Hall & Page, 2014). As stated by the U.S. Energy Information Administration (henceforth EIA), global energy consumption will rise from 549 to 815 quadrillion British thermal units (henceforth Btu) between 2012 to 2030 (IEA, 2020). Correspondingly, the United Nations World Tourism Organization (UNWTO) revealed that global international tourist arrivals (ITA) will rise from 1.0 to 1.8 billion from 2012 to 2030 (UNWTO, 2013). Energy consumption and tourism movements, particularly in less developed economies, can positively impact employment, the balance of trade, and the host countries' scarce resources (Asif & Muneer, 2007; Cem, 2012; Daly, 1991; Dogan & Seker, 2016; Dogan, Seker, & Bulbul, 2017; Ertugrul, Cetin, Seker, & Dogan, 2016; Hall & Page, 2014; Işık, 2013; Işik, Doğan, & Ongan, 2017; Işık & Shahbaz, 2015).

There are concerns that the tourism industry generates significant CO2 emissions and contributes to climatic variability as travel and tourist activities continue to increase on a global scale (Sharpley & Telfer, 2015). About 90% of energy consumption (EC) occurs during movements to and from the destinations, with airways, railways, sea, and land transports accounting for 43%, 15%, and 42%, respectively (Karabuga, Yakut, Yakut, Selbas, & Üçgül, 2015). The tourism industry contributes 5% of global CO_2 emissions, and this contribution may reduce if appropriate measures are taken (Dogru, Bulut, & Sirakaya-Turk, 2016). For tourism development and long-term economic growth, existing literature suggests reducing traditional energy consumption and boosting the use of alternative energy such as renewable energy etc.[1](Jenkins & Nicholls, 2010; Scott & Becken, 2010). Inbound tourism is also considered a driving factor for economic development (Shah, Khan, Moise, & Abbas, 2022; Zhang & Gao, 2016).

In more developed major tourist generator nations, more consideration has been given to the theory of tourism development from the perspective of developing nations. Nonetheless, more developed countries reap a greater share of the benefits from tourism activities. As compared to developed countries, the contribution of developing nations to energy consumption due to tourism activities is lower (Sharpley & Telfer, 2015). In particular, the tourism industry in GCC countries has improved significantly (Doukas, Patlitzianas, Kagiannas, & Psarras, 2006), and energy

[1]The resources for renewable energy (Biomass Energy, Solar Energy, Geothermal Energy, and Heat Pump) are more appropriate energy formulae for a clean environment that do not pollute during production or regeneration processes (Karabuga et al., 2015).

consumption has increased at a faster rate during the last two decades (Lahn, Stevens, & Preston, 2013). As a result, the economies of the Gulf Cooperation Council present an excellent case study for examining the effect of EC and economic growth on tourism.

Our study finds that the impact of EC (i.e., electricity consumption, energy intensity, and energy use) on international tourist arrivals and tourism receipts is positive and statistically significant. Economic growth also positively influences tourism growth in the GCC countries. Thus, EC and EG are significant contributors to the development of the tourism industry in the GCC countries. Our findings are consistent with those of Adedoyin and Bekun (2020) and Payne and Mervar (2010) but contrast with Nepal, Al Irsyad, and Nepal (2019) and Balaguer and Cantavella-Jorda (2002).

Our study adds to the current research in numerous ways: firstly, it investigates the impact of EC and EG on tourism in the GCC countries using panel data from 1995 to 2014. Secondly, our study examines the effect of EC on tourism in GCC countries, using electricity consumption, energy intensity, and energy use as proxies for EC, and international tourist arrivals and international tourism receipts as proxies for tourism. As far as we our aware, no study has employed these proxies of energy consumption and tourism in the GCC countries.

Section 2 gives an overview of how tourism is growing in the Gulf Cooperation Council. Section 3 reviews the literature on the liaison between EC, economic growth, and tourism. The data and methodology are presented in Section 4. The results and discussion are presented in Section 5, and the study is concluded in Section 6.

2. A SUMMARY OF TOURISM DEVELOPMENT IN GCC

Many GCC countries, including Oman, Qatar, Kuwait, Bahrain, the United Arab Emirates, and Saudi Arabia, have been deliberated as new competitors in the global tourism industry, particularly regarding modern tourism attractions like meetings, leisure, sports, exhibitions, and conventions, as well as adventure tourism activities (Alhowaish, 2016). The GCC countries have initiated several tourism development infrastructure projects in the last decade. GCC countries have started developing national tourism development plans and have significantly increased tourism by implementing location strategies (re-positioning) for tourist sites and tourism initiative functions (Alhemoud, 2003; Stephenson & Al-Hamarneh, 2017). Infrastructures for hospitality, events, leisure, urban development, and sports have all become priorities in these large-scale tourism initiatives. The GCC countries' tourism mega-projects include Atlantis Dubai, Ferrari Land, Asian Games, Formula One, Football World Cup, and Sharjah Biennale. UNESCO has listed nearly 12 sites in GCC countries on its list of world cultural heritage (Alhowaish, 2016). The Al Ain Oasis in Abu Dhabi Emirate, the At-Turaif District (ad-Dir'iyah) and Historic Jeddah (Gate to Makkah) in Saudi Arabia, Bahla Fort, Frankincense Land, and Qal'at Al-Bahrain in Oman, and the Al Zubarah Archaeological site in Qatar are among them (Alhowaish, 2016).

The GCC countries have played a cooperative role in attracting millions of tourists to a number of destinations. Between 1995 and 2012, the number of international tourists increased from 8.6 to 32 million (IMF, 2012). According to the GCC economic impact report (WTTC, 2012) tourism and travel directly generated between 1,092,500 to 1,092,500 jobs between 2014 and 2015. However, tourism and travel's total contribution to GCC overall employment involving indirect job offers was about 1,957,500-2,864,000 between 2014 and 2015. Indeed, the growth of the tourism industry provides the GCC countries with numerous opportunities to move their economies away from single-resource economies and address the socio-economic concerns of unemployment (Stephenson & Al-Hamarneh, 2017).

The creation of "the GCC intra-tourism action plans" was the most updated initiative policy relating to the GCC tourism (Marhaba, 2016). The goal of this policy was to boost intra-regional tourism in the Gulf Cooperation Council. The strategy also motivated GCC officials to speed up cooperative action to ensure that all member countries benefit from mega jamborees such as the International Federation of Association Football (FIFA) World Cup 2022 planned in member states (Alhowaish, 2016). Table 1 shows the economic plans of the GCC countries.

Table 1. GCC countries economic strategies.

Economic plan of the GCC countries	Economic plan of the GCC countries
Bahrain's: The Bahrain economic vision for 2030 is based on the shift away from an oil wealth-dependent economy to an industrious and internationally competitive economy defined by the government and driven by an innovative private sector. The government is placing more emphasis on attracting foreign direct investment (FDI) as a means of job creation. The policy pictures financial services and gas and oil as the primary economic pillars, with tourism, manufacturing, and services businesses supplementing them by 2030.	**Kuwait's:** Kuwait's vision plan for 2035, as well as a recent five-year growth plan, places great emphasis on economic diversification and positioning the country as a financial and regional trade powerhouse. The concept emphasizes infrastructure investment, including a new port, transportation, and business hub development in Subiyah known as "Silk City."
Oman's: The Oman Vision 2020 and subsequent five-year growth plan for increased diversification from the oil sector, as well as infrastructural and human resource development. Its national value policy increases outlay to promote corporate and human resource development. Tourism is perceived as a crucial economic area for boosting growth and creating jobs in the country. The previous development plan spent almost half of the budget on road and airport improvements.	**Qatar's:** Qatar's 2030 national vision and development strategy anticipates a significant role for hydrocarbons in the future economy and recommends steady and controlled diversification strategies for housing, industrial activities, and transportation infrastructure in preparation for the FIFA world cup in 2020.
Saudi Arabia: Saudi Arabia's long-term program, which runs until 2025, focuses on the challenges of increasing youth unemployment and expanding the country's GDP. The goal is to reduce the government's dependence on oil revenue from 72 percent to 37 percent of total exports between 2004 and 2024, while also increasing national income. The ninth development plan addresses goals for increased private sector engagement in an economy.	**UAE:** The UAE 2021 vision statement outlines development objectives for Dubai and Abu Dhabi, with an emphasis on economic diversification in the tourist, financial services, and aviation industries. The United Arab Emirates is positioning itself as a regional center for innovation, research, and renewable energy. Dubai Expo 2020 was anticipated to draw around 25 million visitors and positively influence travel, real estate, and tourism.

Source: Hvidt (2013) and IRENA (2016).

3. LITERATURE REVIEW

3.1. Tourism Development and Economic Growth

The development of tourism has been embraced by governments across the globe as a means to promote long-term EG. The tourism-led growth hypothesis rests on the fact that tourism considerably influences EG. This hypothesis asserts that an economy's growth is impacted not only by capital, labor, exports, and other relevant factors, but also by the number of tourists visiting. Tourism is a driving force that significantly increases an economy's GDP, job creation, and foreign exchange earnings (Alhowaish, 2016). The studies by Balaguer and Cantavella-Jorda (2002); Chen and Chiou-Wei (2009); Dritsakis (2004); Durbarry (2004); Gunduz and Hatemi-J (2005); Modeste (1995); Proença and Soukiazis (2008) and Sanchez Carrera, Brida, and Risso (2008) have advanced several reasons relating to the positive contribution of tourism to EG, such as foreign exchange earnings, which is crucial for the importation of capital, consumer and intermediate goods; the provision of resources that align with country factor endowment; the creation of employment opportunities at the tourist destinations; improvement of the country infrastructures that benefit both tourists and residents; and the transfers of managerial skills and new technology into the economy. The tourism sector has the potential to produce positive links with other sectors of the economy, such as manufacturing, service industries, and agriculture.

Moreover, the growth of an economy plays a positive role in tourism development. EG promotes the tourism industry by improving infrastructure and providing facilities such as transportation, technology, electronic money, restaurants, services, and hotels. The link between EG and tourism has been extensively studied by Balaguer and Cantavella-Jorda (2002); Dritsakis (2004); Gunduz and Hatemi-J (2005); Sanchez Carrera et al. (2008); Chen and Chiou-Wei (2009); Belloumi (2010); Akinboade and Braimoh (2010); Tang and Abosedra (2014) and Tang and Tan (2013). These existing studies validate the tourism-led growth hypothesis. Additionally, the studies by Dritsakis (2004); Kim, Chen and Soo Cheong, (2006) and Lee and Chang (2008) validate the feedback hypothesis, whereas the studies by Oh (2005), Ozturk and Acaravci (2009), Tang and Jang (2009) and Payne and Mervar (2010) show no significant relationship between tourism and EG.

Other studies based on panel or cross-section data have also investigated the EG-tourism nexus. These studies, which have revealed mixed results concerning this association, include Leitão (2015); Tavares and Leitao (2017); LeitÃ and Shahbaz (2016); Sequeira and Campos (2005); Lee and Chang (2008); Po and Huang (2008); Proença and Soukiazis (2008); Falk (2010); Holzner (2011); Ekanayake and Long (2012); Lee and Brahmasrene (2013); Aslan (2014); Chou (2013); Surugiu, Leitão, and Surugiu (2011) and Tugcu (2014). In addition, the findings are also sensitive to a particular group of nations. For instance, Balaguer and Cantavella-Jorda (2002) investigated the EG-tourism nexus using data from Spain from 1975 to 1997 and concluded that the study supported the tourism-led growth hypothesis. Also, they claimed that tourism growth positively impacted a country's growth through the multiplier effect.

Campa, López-Lambas, and Guirao (2016) investigated the relationship between EG and tourism in Latin American nations utilizing data from 1985 to 1998. The study employed the generalized method of moment (GMM) technique. The study found that tourism and EG move in the same direction. Lee and Chang (2008) examined the causal relationships between EG and tourism for the Organization for Economic Co-operation and Development (OECD) and non-OECD samples and found a unidirectional relationship for OECD and a bidirectional relationship for non-OECD nations. Sanchez Carrera et al. (2008) investigated the nexus of tourism, EG, and real exchange rate (RER) for Mexico and found that a unidirectional causality ran from tourism and RER to GDP. Moreover, the study by Chang, Khamkaew, and McAleer (2012) for 159 countries from 1989 to 2008 investigated the association between tourism and EG. The study, which used the threshold method, indicated that tourism has a greater impact on a country's growth.

3.2. Tourism Development and Energy Consumption

The few existing research studies on the tourist-energy nexus have found that energy prices and supplies have a direct relationship with tourism development. Energy is required to meet the demands of luxury-driven hospitality, such as transportation, cooking, cooling, living, and other related services (He, Su, & Swanson, 2020).

Amin, Kabir, and Khan (2020) used a dataset from 1995 to 2015 to analyze the nexus between EG, energy consumption (EC), and tourism for the South Asian economies. Their study found unidirectional causality running from tourism to EC on the one hand and from tourism to EG on the other hand. Ozturk and Acaravci (2009) examined the association between tourism receipts (TR), real exchange rate (RER), international tourist (NT), GDP, and EC in Turkey. The study used data from 1987 to 2007 and found that there was no long-run relationship between the study variables.

Using data from 1990 to 2017, Bano, Alam, Khan, and Liu (2021) examined the dynamic relationship between income, tourism, FDI, renewable energy (RNE), and CO_2 emissions in Pakistan. The study's findings supported the hypotheses of growth-led tourism, tourism-led development, and tourism-led emissions and added that RNE improves tourism. Moreover, Alam and Paramati (2017) explored the impact of tourism investment (TI), trade openness (TO), total population (TPOP), and the gross domestic product per capita (GDPPC) on total tourism contribution (TC) and CO_2 emissions. Their study revealed that TI, PI and TO positively impacted tourism and that TPOP and PI positively influence CO_2 emissions, while TI and TO negatively influenced CO_2 emissions.

Using time series data for the period 1990-2013, Paramati, Alam, and Lau (2018) investigated the relationship between trade openness, REER, GDP PC, tourism investment, and tourism revenue for the EU countries. The study found that tourism investment has both positive and negative impacts on CO_2 emissions and tourism development. Nepal et al. (2019) probed the effect of energy, CO_2, and GDP on tourism and found that an increase in GDP increases tourism while energy negatively influences tourism. A few studies have studied the relationship between tourism, economic growth, and energy consumption in existing research (Akbostancı, Tunç, & Türüt-Aşık, 2011; Işik et al., 2017; Işik & Radulescu, 2017b; Liu, Feng, & Yang, 2011; Moutinho, Costa, & Bento, 2015; O'Mahony, Zhou, & Sweeney, 2012; Oh, Wehrmeyer, & Mulugetta, 2010; Pace, 2016; Sheinbaum-Pardo, Mora-Pérez, & Robles-Morales, 2012).

3.3. GCC Countries Studies

Table 2 describes the existing GCC studies on the association between EG, EC, tourism, FDI, FD, and CO_2 emissions. From earlier studies, we observed that there is no single study that investigated the impact of energy consumption and economic growth on tourism in GCC countries. However, in existing literature, a limited number of studies have examined the nexus between EC, EG, and tourism.

4. DATA AND METHOD

This study investigates the impact of EC and EG on tourism in GCC countries using data from 1995-2014. Following Amin et al. (2020) a panel model is developed, with tourism measured by the log of the number of international tourist arrivals (LITA) and international tourism receipts in log (LITR) as proxies for the dependent variable. EG and EC are included as key independent variables. EG is measured by the log of GDP (LGDP), while EC is measured using three proxies: electricity consumption in log (LELEC), energy intensity (ENIN), and energy use (ENUS). Data on the study's variables are obtained from World Development Indicator (WDI). Table 3 presents a comprehensive description of the study variables.

Table 2. GCC countries studies.

Author, country	Method	Variables	Findings
Al-Iriani (2006) GCC	PC	GDP, EC	LGDP→LEC
Al-Mulali (2011) MENA	PC	OC, CO_2, GDP	LOC↔L CO_2
Arouri, Youssef, M'henni, and Rault (2012) 12 MENA nations	PDA	CO_2, GDP, EC	LGDP→L CO_2
Mehrara (2007) OPEC	PC	GDP, EC	LGDP→LEC
Farhani and Rejeb (2012) MENA	PC, PC, panel causality	GDP, EC, CO_2	LGDP→LCO
Hamdi, Sbia, and Shahbaz (2014) Bahrain	ARDL, VECM GC	FDI, GDP, ELEC	LEC↔LGDP LEC↔LFDI
Ozcan (2013) 12 Middle East countries	PDA	CO_2, GDP, EC	LGDP→L CO_2 LEC→L CO_2
Al-Mulali and Lee (2013) GCC	PDA	GDP, EC	LGDP→LEC
Al-Mulali and Tang (2013) GCC	Panel data, GC	URB, FD, TR, EC, GDP	LEC↔LGDP. LFD↔LGDP LTD↔LGDP.LTD↔LFD LTD↔LUR
Omri (2013) MENA countries	Simultaneous equations models	CO_2, GDP, EC	LGDP↔L CO_2
Damette and Seghir (2013) OPEC	PC	GDP, EC	LEC→LGDP
Farhani, Shahbaz, Sbia, and Chaibi (2014) MENA	PDA	CO_2, TO, GD	L CO_2→LGDP
Chor Foon Tang and Salah Abosedra (2014) MENA	GMM Estimator	Tourism, EC, GDP	LEC→LGDP
Sbia, Shahbaz, and Hamdi (2014) UAE	ARDL	CO_2, GDP, TO, FDI, EC	LGDP→LEC
Haque (2021) GCC	Static panel (POLS and FE) & dynamic panel (System GMM)	EC, OP, GDP, TO, CO_2, POP, URB	OP & EC (- relation) GDP, TO, POP, CO_2 & EC (+ relation)
Mohammad Asif, Sharma, and Adow (2015) GCC	PDA	EG, EC, CO_2, URB	URB, EG, EC& CO_2 (+ relation)
Alhowaish (2016) GCC	Panel data, GC	EG, tourism	EG →Tourism
Qader (2009) GCC	PDA	EC, GHG emissions	EC & GHG emission (+ relation)
Elagouz (2019) GCC	Time series data, VECM	EG, EC	EG →EC
Dhiab and Dkhili (2019) GCC	PC, GC, VECM,	Y, FD, URB, Trade, CO_2	Y, FD, URB, trade, & CO_2 (+ relation)
Waheed et al. (2020) Saudi Arabia	ARDL, Johansen cointegration & Gregory-Hansen cointegration	Non-oil exports, RNE, EG, tourism	Non-oil exports, EG, tourism (+ relation)
Majeed et al. (2021) GCC	CS-ARDL	NR, URB, EGLOB, DAEC, EG, ENVQ.	NR improves ENVQ. EGLOB, REC mitigate emission. URB, EG, NREC deteriorate ENVQ

Note: GCC=Gulf corporation council, GDP= Gross domestic product, EC= Energy consumption, FDI= Foreign direct investment, FD= Financial development, URB= Urbanization, CO2= Carbon dioxide emissions, OC= Oil consumption, OP= Oil price, ELEC= Electricity consumption, TO= Trade openness, RNE= Renewable energy, NREC= Non-renewable energy consumption NR= Natural resources, EGLOB= Economic globalization, DAEC= Disaggregated energy consumption, ENVQ= Environmental quality, PC= Panel Cointegration, PDA= Panel data analysis, GC= Granger causality, CS-ARDL= A cross-sectional autoregressive distributed lags.

Table 3. Variable's description.

Code	Description	Unit	Sources
Dependent			
LITA	International tourist, number of arrivals (Log)	Number of persons	WDI
LITR	International tourism, receipts (Current US$)	Numbers	WDI
Independent			
LGDP	Gross domestic product (Log)	(Constant 2015 US$)	WDI
ENIN	Energy intensity level of primary energy	(MJ/$2011 PPP GDP)	WDI
ENUS	Energy use	(Kg of oil equivalent per capita)	WDI
LELEC	Electricity consumption (Log)	(Kwh per capita)	WDI

Note: ENIN, ENUS, LELE are the measures of energy consumption. LITA, LITR are the measures of tourism.

4.1. Method

Tourism is a fast-growing industry in the GCC countries. For empirical analysis of the effects of EG and EC on tourism development in the GCC, this study uses a panel model with EG and EC as explanatory variables and tourism as the outcome variable. To begin our empirical analysis, we employ the following panel FGLS model recommended by Amin et al. (2020); Rasool, Ul-Haq, and Cheema (2023) and Visas et al. (2023):

$$Tourism_{it} = \beta_0 + \beta_1 EG_{it} + \beta_2 EC_{it} + \varepsilon_{it} \quad (1)$$

International tourist arrival (ITA) and international tourism receipt (ITR) are the two proxies for tourism. The log of the GDP is used as a measure of economic growth, while energy consumption is measured using three proxies: electricity consumption (ELEC), energy intensity (ENIN), and energy use (ENUS). ε is the error term. The subscripts t and i, respectively, denote time and country. Based on our panel diagnostics texts, we used the GLS because, when T = 20 and N = 6, the Parks-Kmenta method for empirical analysis suggests that FGLS is a better choice as T is greater than N (Hoechle, 2007).

This study focuses on the GCC economies as tourism has become their burgeoning industry (Zhou, 2019). The GCC tourism market has grown into one of the globe's most-visited tourist destinations, including inbound and outbound. GCC tourism policies indicate that the tourism industry is a crucial driver of economic and social development (Al-Badi & AlMubarak, 2019).

Moreover, the development of the tourism industry entirely depends on the use of energy. Energy is a driver of tourism development (Amin et al., 2020). It has been proven that tourism activities, including producing goods and services, providing amenities, transportation, and leisure to attract tourists, cannot be achieved without the use of energy (Becken, 2002; Becken, Frampton, & Simmons, 2001; Becken & Simmons, 2002; Becken, Simmons, & Frampton, 2003; Bode, Hapke, & Zisler, 2003; Gössling, 2000, 2002; Tabatchnaia-Tamirisa, Loke, Leung, & Tucker, 1997).

Also, the role of EG in the development of the tourism industry cannot be ignored (Amin et al., 2020). EG promotes the tourism sector, as revealed by the studies of Lee and Chang (2008); Balaguer and Cantavella-Jorda (2002); Durbarry (2004); Gunduz and Hatemi-J (2005); Rasool et al. (2023); Sanchez Carrera et al. (2008); Chen and Chiou-Wei (2009); Akinboade and Braimoh (2010); and Chor Foon Tang and Salah Abosedra (2014) which supported the growth-led tourism hypothesis.

5. RESULTS

5.1. Diagnostics Tests

Table 4 presents the results of the Modified Wald and Wooldridge tests for heteroscedasticity and serial correlation, respectively. The outcomes of these tests show heteroscedasticity and serial correlation.

Table 4. Serial correlation and heteroscedasticity panel diagnostic tests.

Test	(1)	(2)	(3)	(4)	(5)	(6)
Modified Wald ($\chi 2$)	47.35***	47.63***	5.342*	558.40***	1188.54***	344.35***
Wooldridge test	6.588**	4.747*	57.52***	11.775**	10.136**	12.052**

Note: "*", "**", "***" are significant levels at the 0.1, 0.05 and 0.01 respectively. LITA is the dependent variable in 1-3 models and LITR is dependent in 4-6 models. Modified Wald test for heteroscedasticity and Wooldridge test for serial correlation. Test statistics are shown in models (1-3 & 4-6) with *electricity consumption*, energy intensity, energy use respectively. Asterisks indicates significance levels; *** for 1%, ** for 5%, and * for 10%

5.2. Descriptive Statistics

Table 5 summarizes the study's descriptive statistics. The descriptive shows the highest mean for energy use (ENIN) and the lowest mean for energy intensity (ENIN).

Table 5. Descriptive statistics.

Variables	N	Average	S.D	Mini.	Maxi.
ENIN	120	6.3305	2.3301	3.003	11.6268
ENUS	120	9823.97	4651.56	2767.65	22120.43
LELC	120	9.2533	0.5681	7.8560	9.9761
LITA	84	15.1865	0.811	13.906	16.9514
LGDP	120	25.1801	1.0878	23.2494	27.1665
LITR	93	21.0207	1.1327	19.4715	23.4459

5.3. Empirical Analysis

The impact of EG and EC on tourism in the GCC nations is shown in Table 6. Tourism indicators include international tourist arrival (ITA) in columns 1-3 and international tourist receipt (ITR) in columns 4-6. Our study used the FGLS method for this analysis. Table 6 presents the coefficient and standard errors of the independent variables.

Table 6. Energy consumption and tourism in GCC countries (FGLS).

Variables	(1)	(2)	(3)	(4)	(5)	(6)
LGDP	0.4430*** (0.0637)	0.8443*** (0.0441)	0.4377*** (0.0777)	0.7339*** (0.0629)	0.9584*** (0.0422)	0.7541*** (0.0691)
LELC	0.7542*** (0.0732)			0.5956*** (0.0976)		
ENIN		0.3237*** (0.0225)			0.2592*** (0.0210)	
ENUS			0.00002 (0.00002)			0.0001*** (0.00002)
Constant	-3.093** (1.542)	-8.095*** (1.218)	3.877*** (2.022)	-2.667 (1.743)	-4.608*** (1.177)	1.3457 (1.722)
Wald stat.	205.52	373.23	31.73	182.9	544.05	152.12
P-values	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Obs.	84	84	84	93	93	93

Note: LITA is the dependent variable in 1-3 models and LITR is dependent in 4-6 models. Parentheses present S.E. ***, ** indicate $p<0.01$, $p<0.05$.

As shown in Table 6, EG is the most important determinant of tourism development. In all models, the relationship between ITA, ITR, and GDP is positive and statistically significant. Economic growth boosts tourism in the GCC, regardless of the proxy used for tourism. A 1% rise in GDP causes a 0.44% and 0.75% increase in tourism in the GCC countries, as shown in columns 1 and 4, respectively. Existing research finds conflicting evidence for the tourism-growth nexus. Some studies that have validated the tourism-led growth hypothesis include Lee and Chang (2008) for OECD, Gunduz and Hatemi-J (2005) for Turkey, Durbarry (2004) for Mauritius, and Balaguer and Cantavella-Jorda (2002) for Spain. Numerous studies, including Paramati et al. (2018) for the EU, Tang and Jang (2009) for the USA, Oh (2005) for Korea, and Narayan (2004) for Fiji, have corroborated the growth-led tourism hypothesis. Moreover, some studies also found bidirectional causality in the tourism-growth nexus, such as the studies

of Lee and Chang (2008) for non-OECD, Kim, Chen and Soo Cheong, (2006) for Taiwan, and Dritsakis (2004) for Greece. The study of Katircioglu (2009) for Turkey did not find any significant relationship between EG and tourism.

With regards to the impact of EC on tourism development, all of its proxies (i.e., LELC, ENIN, and ENUS) demonstrate a positive and significant effect on tourism (ITA, ITR). The tourism industry flourishes the most as a result of the extensive use of energy. As indicated in Table 6, EC and EG play a major role in supporting the tourism industry. Amin et al. (2020) also demonstrated that energy is a contributing factor to the development of the tourism industry. The positive effect of energy is logical because practically all tourism activities are dependent on energy use. For example, Tang, Tiwari, and Shahbaz (2016) showed that activities related to tourism, infrastructure, and facilities require more energy (oil and electricity) for attractive operations.

For robustness checks, our study then examines the energy, growth, and tourism nexus utilizing the Panel Corrected Standard Errors (PCSE) and Driscoll-Kraay Standard Errors (DKSE) methods to validate the findings of FGLS as shown in Tables 7 and 8.

Table 7. Energy consumption and tourism in GCC countries (PCSE).

Variables	(1)	(2)	(3)	(4)	(5)	(6)
LGDP	0.4603***	0.8345***	0.3384***	0.6797***	1.0649***	0.6692***
	(0.0403)	(0.0526)	(0.0457)	(0.0515)	(0.0450)	(0.0528)
LELC	0.7501***			0.3398***		
	(0.0800)			(0.0746)		
ENIN		0.3255***			0.3009***	
		(0.0275)			(0.0149)	
ENUS			0.00001			0.00005***
			(0.00002)			(0.00001)
Constant	-3.387**	-7.907***	6.511***	0.7980	-7.609***	3.698***
	(1.256)	(1.480)	(1.063)	(1.599)	(1.171)	(1.264)
Wald stat.	199.68	262.25	78.02	175.58	573.64	184.48
P-values	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Obs.	84	84	84	93	93	93

Note: LITA is the dependent variable in 1-3 models and LITR is dependent in 4-6 models. Parentheses present S.E. ***, ** indicate p<0.01, p<0.05.

Table 8. Energy consumption and tourism in GCC countries (DKSE).

Variables	(1)	(2)	(3)	(4)	(5)	(6)
LGDP	0.4603***	0.8345***	0.3384***	0.6797***	1.0649***	0.6692***
	(0.0445)	(0.0449)	(0.0375)	(0.0919)	(0.0861)	(0.0951)
LELC	0.7501***			0.3398***		
	(0.0554)			(0.0723)		
ENIN		0.3255***			0.3009***	
		(0.0299)			(0.0275)	
ENUS			0.00001			0.00005***
			(0.00003)			(0.00001)
Constant	-3.387**	-7.907***	6.511***	0.7980	-7.609***	3.698***
	(1.492)	(1.308)	(0.967)	(2.4732)	(2.237)	(2.300)
F- stat	91.67	194.85	40.71	30.92	77.68	25.21
P-values	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Obs.	84	84	84	93	93	93

Note: LITA is the dependent variable in 1-3 models and LITR is dependent in 4-6 models. Parentheses present S.E. ***, ** indicate p<0.01, p<0.05.

The estimates of the PCSE (Table 7) and DKSE (Table 8) show that economic growth is positively associated with tourism (ITA, ITR). The result reveals that a 1% increase in GDP increases tourism by 0.46% and 0.67% as shown in columns 1 & 4. All measures of EC also show that it favors the development of the tourism industry in the GCC economies. The relationship between EC and tourism is positive. Moreover, our results are robust regardless of the proxy used for tourism, EC, and the econometric methods used. The findings of this paper, consistent with

those of Adedoyin and Bekun (2020) and Payne and Mervar (2010) contrast those of Nepal et al. (2019) and Balaguer and Cantavella-Jorda (2002).

6. CONCLUSION

This paper explored the nexus between EG, EC, and tourism using panel data from the GCC countries. For our empirical analysis, we regressed a panel model utilizing the FGLS method. Our study used GDP for economic growth; electricity consumption, energy use, and energy intensity for energy consumption; and international tourist arrivals and international tourist receipts for tourism. The findings suggest that EG and EC are important factors for the development of the tourism industry. The FGLS approach reveals a positive association between EG and tourism and EC and tourism in GCC countries. Further, PCSE and DKSE methods are applied for robustness checks. The findings of the PCSE and DKSE corroborate the results of the FGLS by showing a one-to-one (direct) relationship between tourism and EG, as well as between tourism and EC.

The findings of this study have significant policy implications. Higher energy consumption is strongly associated with carbon emissions, necessitating effective strategies to reduce tourism-related energy consumption in the GCC. The most important requirement may be that governments provide incentives to tourism stakeholders to use low-carbon natural transportation, cleaner energy, and hybrid energies in order to meet the carbon emission reduction target. Hotels and other tourist-related establishments may be persuaded to use renewable energy sources. To stimulate the acquisition of environmentally friendly technologies, the government should provide low-interest loans.

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