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Significance of Air Transport to Tourism-Induced Growth Hypothesis in E7 Economies: Exploring the Implications for Environmental Quality

Abstract

The study seeks to examine the significance of the tourism-induced growth hypothesis from the perspective of air transportation among seven emerging (E7) countries, including China, India, Brazil, Mexico, Russia, Indonesia, and Turkey. The combined impact of energy consumption and globalization was also factored into the analysis in order to draw cogent implications for environmental quality as energy demand in E7 economies continues to rise amidst growing urbanization in recent times. The study leverages on second-generational panel data estimators, namely cross-sectional autoregressive distributed lag, augmented Mean Group, and Dumitrescu-Hurlin Causality techniques. Having established a long-run equilibrium relationship among the outlined variables, the result validates the pertinent role of air transport in enhancing economic growth as a percent rise in airline passengers' arrivals significantly enhances growth in the E7 economies by 0.77%. In addition, the feedback causality between the variables also strengthens the pivotal roles of air transport in economic growth, thereby giving credence to the tourism-led growth hypothesis (TLGH) in the E7. However, there are detrimental environmental implications for the E7 when considering the causal nexus between economic growth and the dynamics of carbon-inducing energy consumption among the countries. Hence, investments in clean energy and transport infrastructures are recommended to ensure a sustainable environment where the tourism industry can flourish.

Keywords: air transportation, sustainable environment, tourism-led growth hypothesis, energy consumption, emerging (E7) economies

1. Introduction

As the world is gradually recovering from the Covid-19 pandemic that has inflicted various damages to the global economy, the tourism industry remains one of the most affected sectors. After the initially reported cases emerged from Wuhan, a Chinese mainland city, in late 2019, the virus has spread to other countries, thereby affecting the global tourism ecosystem, air travel, and individual vacation plans, among others (Harchandani & Shome, 2021; Gössling et al., 2020; Čorak et al., 2020; Peluso & Pichierri, 2020; Uğur & Akbıyık, 2020). The unfortunate global health crisis has resulted in a major setback in economic activities across the globe while

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also acting as a cog in the wheel of the rising impacts of the tourism-led growth hypothesis that has been upheld in different economies over the past couple of years (Aliyev & Ahmadova, 2020; Shahzad et al., 2017; Tang & Abosedra, 2016; Suryandaru, 2020; Ertugrul & Mangir, 2015; Tang & Tan, 2015; Balsalobre-Lorente et al., 2020). Nevertheless, the contributions of tourism to the emerging (E7) economies cannot be overemphasized.

Over the past years, E7 countries have benefited immensely from their tourism industry. Aside from revenue generation and job creation which are crucial factors to fiscal stability and socioeconomic development, most E7 countries also enjoy other benefits like foreign exchange earnings from the growing tourism sector. Some E7 countries are reputable among the world's most popular destinations for international tourist arrivals—considering the unique cases of China, Turkey, Russia, and Mexico. These countries are among the top 20 countries for international tourist arrivals by country of destination, despite the tumultuous experience the global tourism industry saw in 2020 (World Tourism Organization [UNWTO], 2020). Besides, a substantial amount of foreign currency from the tourism industry is often crucial for the stability and overall performance of the domestic currencies in some of these countries, especially in the case of Turkey, among others (Feridun, 2011; Ertugrul & Mangir, 2015). Hence, important factors that affect tourism development, such as transportation, among others, have always attracted the attention of researchers, policymakers, and other practitioners that are keen on the issues of growth and tourism development.

Over the years, tourism and transportation have remained two closely related entities with interwoven economic activities. In recent times, among the available alternatives in the transportation industry, the sway of air transport has notably grown to become a major intermediate in the tourism industry. Depending on travel distance, geographical factors, and economic constraints, among other issues, studies show air transport continues to receive the largest patronage in terms of tourists' preferred mode of transportation. This is mainly due to its speed and efficiency, allowing tourists to cover a long distance in a reasonable time-space (Prideaux, 2000; Thrane, 2015).

In the past, several studies have made efforts to empirically substantiate the impacts of the tourism sector on economic growth, i.e., the tourism-led growth hypothesis in various economies. However, only a few have made efforts to integrate air transport impacts into the TLGH. As such, the development of global air transportation is connected to the economic growth and sustainability of the tourism industry in the literature (Duval, 2013; Balsalobre-Lorente et al., 2020; Njoya, 2020).

However, while some studies were carried out on isolated cases of individual countries, others have failed to address the crucial links between energy dynamics while integrating air transport into the TLGH framework. Besides, most of the empirical studies on environmental challenges often focus on other sectors aside from tourism (Alola et al., 2021; Gyamfi et al., 2021). In the meantime, the awareness of the potential detrimental effects of tourism vis-à-vis the development of the growing impacts of air transport carbon emission is gradually receiving attention in the literature (Al-Mulali et al., 2015; Saarinen, 2018; Azam et al., 2020; Brtnický et al., 2020). Hence, in the quest for a sustainable environment where the tourism industry can flourish, this study analyzes the dynamic impact of air transportation on economic development in E7 economies while accounting for the combined effect of energy consumption and rapid urbanization. This study stands out as the first to examine the tourism-led growth hypothesis specifically for the E7 within the scope of air transport. Furthermore, given the dynamics of globalization in recent times, the study also provides a contemporary empirical analysis of the theme through methodologies that circumvent common econometric flaws in extant studies. Unlike previous studies, the current study utilized the case of the E7 countries within the framework of advanced panel estimators to provide a comprehensive analysis of the tourism-economic growth nexus from the perspective of air transportation while shedding light on the environmental implications thereof.

The study is hereafter structured into four other sections, including the literature and the methodological parts, followed by the discussion of the results with the concluding part that is accompanied by the policy directions.

2. Literature review

Conventional thoughts could impress a positive connection between tourism expansion and countries' economic growth; however, the empirical literature on TLGH has produced mixed evidence over the years. The evaluation of the TLGH hypothesis may yield varying results subject to various factors, including methodological approaches, samples, and even the prevailing stage of the concerned tourism area, among other issues (Mitra, 2019; Zuo & Huang, 2018). Pata (2021) argued that the impact of tourism could be two ways noting that positive occurrences in tourism developments can contribute to economic growth, but the expected growth can be hindered if there are negative developments in the tourism industry. This conclusion was drawn from the study conducted for the G10 economies, which shows that tourism strongly Granger causes growth in the G10. As a result, Gwenhure and Odhiambo (2017) have earlier noted that there is no unanimous agreement on the direction of relationship or causality between tourism expansion and the economic growth of countries.

Several studies in the empirical literature have validated TLGH in various economies, while some fail to uphold the validity of the same hypothesis. The study of Ohlan (2017), while applying Bayer and Hanck's combined cointegration test and causality analysis, concluded that tourism drives economic growth, thus, validating TLGH for the case of India. Similarly, other studies like those of Brida et al. (2010), Tang and Tan (2013), and the study of Eyuboglu and Eyuboglu (2020) have also provided strong evidence in support of TLGH in the case of Uruguay, Malaysia, and for Argentina, Turkey, and the Philippines, respectively. As such, these studies show that tourism has been a catalyst for growth among the aforementioned economies.

Likewise, in an empirical finding that is relatively close to the conclusions of Brida et al. (2010), Tang and Tan (2013), Eyuboglu and Eyuboglu (2020), the study of Tang and Abosedra (2016), and Roudi et al. (2019) also upheld TLGH in Lebanon, and for the case of some small island developing states (SIDS) respectively. Furthermore, in a different clime, Balsalobre-Lorente and Leitão (2020) applied a combination of fixed effects (F.E.) technique, and fully modified least squares (FMOLS), and the dynamic ordinary least squares (DOLS) to validate the TLGH for twenty-eight (28) European (E.U.) countries.

However, despite the foregoing evidence in support of TLGH, as seen in the literature, a few studies have also shown no clear direction of causality or sufficient evidence of a cointegration relationship in support of the link between tourism and economic growth that can substantiate the validity of the TLGH. For example, the study of Pérez-Rodríguez et al. (2020) via fractional cointegration techniques found minimal clear evidence of TLGH in a group of seven (7) European countries. Hence, their findings do not conform with the claims of Balsalobre-Lorente and Leitão (2020) regarding the validity of the TLGH in the E.U. In a relatively close finding to the study of Pérez-Rodríguez et al. (2020), the empirical analysis conducted by Sokhanvar (2019) also failed to uphold the tourism-led growth hypothesis for the case of Croatian and the Portuguese economies. Furthermore, the results of the empirical examination of the TLGH conducted by Aliyev and Ahmadova (2020) using ARDLBT approach to cointegration also reject the hypothesis for the case of the Georgian economy thus supporting similar findings by Sokhanvar (2019) for the case of Croatian and the Portuguese economies.

In recent times, attention is gradually shifting from the traditional approach to assessing TLGH toward accounting for other major intermediates in the tourism industry (such as the impacts of air transport). Dimitrios and Maria (2018), while exploring the connection between air transport and economic developments, noted that the aviation industry exerts a significant impact on economic activities and overall growth using the case of Greece as an important tourist destination around the Mediterranean. Their findings are not in isolation, as some other studies have also observed supportive evidence from different economies. For instance, Balsalobre-Lorente et al. (2020), when exploring TLGH, observed air transport exerts crucial

positive implications on the economic growth of Spain. In harmony with the findings of Balsalobre-Lorente et al. (2020), the study of Njoya (2020) also establishes the crucial role of air transport to the TLGH in the Egyptian economy, such that the study concluded that crucial reforms to air transport services would produce desired benefits for the Egyptian tourism industry.

In this study, the TLGH model is expanded to accommodate air transport as a major intermediate in the tourism sector, while effort is made toward accounting for energy consumption, urbanization, and economic globalization among E7 economies. The current study differs from extant works as the first to examine the tourism-led growth hypothesis specifically for the E7 within the scope of air transport. Aside from this, considering the nature of globalization in recent times, the study also provides a contemporary empirical analysis of the theme through methodologies that circumvent common econometric flaws in extant studies. As air transport booms alongside increasing energy consumption among the major emerging economies of the world, the imperativeness of the current study hinges on the crucial need to ensure a sustainable environment where the tourism industry can flourish.

3. Data and methodology

This investigation utilized a panel of seven emerging global economies, including China, India, Brazil, Mexico, Russia, Indonesia, and Turkey. Data from 1995 to 2016 was sourced from the World Bank development indicator (WDI) database the KOF Swiss Economic Institute. The periodicity of the data is limited to the accessibility of data from sampled nations. The summary of variables and descriptions is presented in Table 1.

Table 1
Coefficients explanation

Coefficient	Acronym	Measurement	Source
Income	Y	it is proxied by the gross domestic product per capita (2010 Constant USD)	WDI
Economic globalization	EG	KOF globalization Index	
Renewable energy consumption	REC	% of total final energy consumption	WDI
Fossil fuel	F.F.	Fossil fuel energy consumption (% of total)	WDI
Air transport	AT	passengers carried	WDI
Urban population	UP	(% of total population)	WDI

Source: Authors' compilation.

From Table 1, The variable used to proxy for economic growth as the dependent variable across countries under consideration is denoted by *Y*. The income values are converted from local currencies to US$ by applying the current exchange rate. A positive change in income of the panel countries would indicate economic growth. The lead explanatory variable under evaluation is air transport *AT*, as proxied by the number of passengers who travel by air. Air passengers carried include both domestic and international aircraft passengers of air carriers registered in the country. A positive impact from *AT* to *Y* signifies a boost to the economic expansion agenda but could imply possible challenges to environmental quality depending on the energy consumption dynamics. Hence, we controlled for relevant variables. Fossil fuel (F.F.) is one of the explanatory variables used as a control variable to cover the impacts of non-renewable energy sources. Fossil fuel comprises natural gas, oil, coal, and petroleum. A positive impact from fossil fuels would imply a boost to economic growth but connotes a potentially detrimental effect on environmental sustainability. On the other hand, the variable *REC* was used as a proxy for renewable energy comprising solar, wind, hydro, tidal, geothermal, and biomass. Also, we control for the impacts of urban population (*UP*) and economic globalization (*E.G.*) among the countries in line with the growing relevance of these variables in the literature (Shahbaz et al., 2018; Onifade, Alola, et al., 2021; Wang et al., 2019; Onifade, Gyamfi, et al., 2021). *UP* accounts for the

number of persons living in urban areas as defined by national statistical offices, while the *E.G.*, accounts for the growing interdependence of the global market since the increasing scale of cross-border import and export of goods, the availability of foreign funds as well as the diffusion of technologies. Equation (1) presents the functional form of the variables.

$$Y_{i,t} = f(AT_{i,t}, EG_{i,t}, UP_{i,t}, REC_{i,t}, FF_{i,t}) \quad (1)$$

Second, equation (1) is expressed in its natural logarithmic form to ensure homoscedasticity of coefficients representing elasticities of TLG relationship as:

$$lnY_{i,t} = \delta_0 + \delta_1 lnAT_{i,t} + \delta_2 lnEG_{i,t} + \delta_3 lnUP_{i,t} + \delta_4 lnREC_{i,t} + \delta_5 lnFF_{i,t} + \Theta_{i,t} \quad (2)$$

As previously stated, t and i stand for the time components and the cross-sectional aspects of the investigation (1995–2016), respectively, while θ indicates the error term. The explanation for individual variables has been provided in Table 1.

3.1. Estimation techniques

This study utilized Chudik and Pesaran's (2015) cross-sectional ARDL (CS-ARDL) model to test the influence of regressors on the dependent variable. CS-ARDL approach was selected as a feasible choice for our smaller sample size data. Besides, it provides long- and short-term balance relations while simultaneously correcting the connected prediction errors. For this analysis, it is rational to use CS-ARDL because the findings of the cross-sectional analysis are suitable for estimating long-term correlations in a panel with heterogeneous effects. Moreover, vis-a-vis the ARDL process, the CS-ARDL approach provides a structured form of approximation that makes it possible to recognize models that are not defined but also errors and elements that are serially associated. CS-ARDL technique is used where T is not too large, and parameters have mixed order of integration characteristics at I(0) or [I(1)] —a situation observed in this study (Chudik et al. 2016). Thus, useful for evaluating cointegration among dependent and independent variables. To confirm the results presented in Wang et al. (2020), we used the CIPS technique developed by Pesaran (2007) and Im et al. (2003) to test the unit root properties of the variables. Second, through a cointegration experiment in Westerlund (2007), including the presence of cross-dependence, a probability for long-run stability interactions was established.

3.2. Pre-estimation properties tests

In contrast to the frequently utilized classical econometric approach, this study is predicated on a robust analytical framework. Before conducting unit root examinations, cointegration techniques, or long-run assessments, it is vital to consider all inherent problems. As a basis, this investigation produced a regression equation to check for homogeneity in cross-sectional observations before checking for a homogenous slope. As noted by Bekun et al. (2021), disregarding these two methods during long-term panel estimations can result in inadequate and misleading results from the examination. That is precisely the aim we examined the CD test using the Pesaran (2015) L.M. approach, Pesaran (2007) CD approach, the Breusch, and Pagan (1980) L.M. approach, as well as the slope homogeneity proposed by Pesaran and Yamagata, (2008). Following the observation in empirical studies (Hao et al., 2021; Gyamfi, Sarpong, et al., 2020; Su et al., 2020), cross-sectional reliance problems often trigger worrisome concerns in light of the increasing integration in the global economy, numerous countries, are less self-sufficient and so more susceptible to connected shocks. These nations have distinct economies as well as regulations, raising the possibility that homogeneity can provide deceptive results. Thus, the study tested the assumptions that cross-section dependency is present firstly and secondly, that slope heterogeneity is present.

3.3. The stationarity and cointegration tests

When it was established that the panel results were cross-based, the second-generation unit analysis failed to invalidate the null assumption as a result, unit root checks were required to address the cross-section reliance issues. The unit root attributes were then examined using the IPS and CIPS procedures. It was necessary to compare the inclusion of all elements using this technique. Since these techniques are suitable for detecting variation inside as well as within panels, the approach is critical for analyzing second-order generation in a panel study. The fundamental CIPS configuration is as follows:

$$\Delta CA_{i,t}=\Phi_i+\Phi_i Z_{i,t-1}+\Phi_i CA_{i\square t-1}+\sum_{1=0}^{p} \Phi il\Delta CA_{t-1}+\sum_{i=0}^{p} \Phi il\Delta CA_{i,t1}+\mu_{it} \quad (3)$$

Where $CA_{\bar{n}-1}$ and $\Delta CA_{i,t1}$ represent the CD average. The respective statistic for the CIPS is given in equation 4:

$$CIPS_{2007}=N^{-1}\sum_{i=0}^{n} CDFi \quad (4)$$

While CDF is CD augmented Dickey-Fuller (CADF) as shown in equation (4). These approaches are preferable to address the weakness in pseudo-stationary data collection and to take gain of the extra evidence delivered in the inspection result by a joint CD time series. Demonstrating that the second-generation long-run relationship analytical approach is more appropriate for this study requires the utilization of the suggested cointegration technique by Westerland (2007). This time series approach of the second-generation category can discover cointegration if there are cross-dependence assessment issues and consequently show if such a relationship exists as indicated by the null hypothesis.

3.4. Long-run and short-run estimations

The investigation outcomes for the ARDL (CS-ARDL) cross-sectional technique are given in Table 6 in section 4. The CS-ARDL expression is supplied in equation 5:

$$\Delta TI_{i,t}= \pi_i+\sum_{i=0}^{p} \pi_{il}\, \Delta TI_{i,t-1} + \sum_{i=0}^{p} \pi_{il} AEV_{i,t-1}+ \sum_{i=0}^{p} \pi_{il} Z_{i,t-1} + \mu_{it} \quad (5)$$

The cross-section averages are indicated by $Z_t=(\Delta TI_t, AEV_t)$, while AEV_t stands for the independent factors in the form of airline passengers, economic globalization, urban population, clean energy as well as fossil fuel. Furthermore, in addition to the ARDL (CS-ARDL) approach that was used to estimate the long-term relationship between the variables, the Augmented Mean Group (AMG) of (Eberhardt, 2012) was used to assess the sensitivity of the long-lasting balance relationship. The methodology absorbs estimation problems, including endogeneity, heterogeneity, cross-section dependence, and unequal periodicity. These methodologies are useful because cross-sectional measures and specified independent variables can be improved by a less-quadratic approach applied for auxiliary projections. This method demonstrates the attributes of a logarithmically distributed model (Pesaran, 2006).

4. Discussion of the empirical results

4.1. Descriptive statistics

The results in Table 2 show the descriptive statistics of variables studied in E7 Economies. From the result, it can be observed that the highest mean from the estimation was fossil fuel which is 76.963%, a minimum of 51.318%, and a maximum of 92.326%. All the variables show strong and healthy kurtosis and skewness figures from the analysis. Moreover, analysis from the correlation matrix presented in Table 2 indicates that economic growth has a significant association with all the variables. It has a positive and significant association with airline transport, clean energy, and fossil fuel but a negative and significant association with economic globalization and urban population.

Table 2
Descriptive statistics and correlation matrix

	Y	AT	EG	UP	REC	FF
Mean	64.862	60.1477	45.912	59.951	26.183	76.963
Median	77.245	32.640	48.099	68.145	21.866	83.434
Maximum	94.062	88.7808	96.186	86.042	54.484	92.326
Minimum	36.746	17.4900	15.635	26.607	3.227	51.318
Std. dev.	38.862	7.7765	14.168	19.165	17.003	13.608
Skewness	-0.095	1.302	-0.113	-0.410	-0.094	-0.414
Kurtosis	1.5774	15.057	3.143210	1.658	1.423	1.543
Jarque-Bera	13.219***	12.128***	0.4599	15.868***	16.174***	18.019***
Probability	(0.001)	(0.000)	(0.794)	(0.000)	(0.000)	(0.000)
Observations	154	154	154	154	154	154
lnY	1					
P-value	-					
lnAT	0.1387*	1				
P-value	(0.086)	-				
lnEG	-0.3278***	0.0742	1			
P-value	(0.000)	(0.360)	-			
lnUP	-0.1908**	-0.0439	0.4996***	1		
P-value	(0.018)	(0.588)	(0.000)	-		
lnREC	0.3990***	0.1880**	-0.4251***	-0.6932***	1	
P-value	(0.000)	(0.019)	(0.000)	(0.000)	-	
lnFF	0.3255***	0.3800***	-0.3960***	-0.5348***	(0.6597)	1
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-

****, ** and * are for the 1%, 5% and 10% significant level accordingly.*

4.2. Pre-estimation properties test results

Results in Table 3 from Pesaran (2015) L.M., coupled with the Pesaran (2007) CD and Breusch-Pagan LM (1980), show that the null assumption is truly valid. As a result, all variables are interdependent throughout time. Along with the identified cross-sectional dependency, the model also contains evidence of slope homogeneity. The CD and slope analyses provide the foundation for the panel regression approaches.

Table 3
Cross-sectional dependency and slope homogeneity test results

Model	CD Test	LM Test	Breusch-Pagan LM Test	Slope homogeneity test		*P-value*
LnY= f(LnAT, LnEG, LnUP, LnREC, LnFF)	-2.156**	-1.476*	1809.45***	Delta_tilde	6.584***	(0.000)
P-value	(0.0119)	(0.081)	(0.0000)	Adj. Delta_tilde	-6.368***	(0.000)

***, ** and * are for the 1%, 5% and 10% significant level accordingly.

4.3. The stationarity tests

Table 4 shows that the variables are series of order one, and the results are similar in the approaches used. It is also an indication of the non-stationarity of the distribution of the variables at the level positions but implies a differential stationarity situation. For instance, the variation at the level under the heterogeneity variance system is stationary at the first difference position I[1] for the variable LnY. As shown in Table 4, all parameters were not stationary at level but at the I[1], suggesting that the coefficients were acceptable for investigation and the outcomes could be utilized in decision evaluations

Table 4
Unit root estimation

Variables	CIPS				IPS			
	I(0)		I(1)		I(0)		I(1)	
	C	C&T	C	C&T	C	C&T	C	C&T
LnY	-0.806	-1.071	-2.582***	-3.008***	1.783	-1.239	-2.661***	-3.348***
LnAT	-1.882	-2.043	-4.192***	-4.229***	0.2683	-1.727	-5.383***	-5.637***
LnEG	-2.302	-2.095	-5.015*	-5.242*	-2.334	-2.357	-4.362*	-4.651*
LnUP	-1.090	-1.706	-3.116***	-4.579***	1.485	-0.351	-2.209***	-3.607***
LnREC	-0.592	-2.632	-5.034*	-4.958*	-2.657	-2.657	-4.672*	-4.794*
LnFF	-1.733	-2.197	-4.004***	-4.008***	-1.336	-2.620	-5.346***	-5.293***

***, ** and * are for the 1%, 5% and 10% significant level accordingly.

4.4. Cointegration test results

The analytical representations in Table 5 demonstrate that the assertion of the null must be rejected. The observed findings support cointegration as there is potential for variables to walk together in the long run. According to the study, the determinants are highly connected with portfolio production at the conventional level of significance (5%) and have a level relationship with portfolio innovation.

Table 5
Cointegration test (Westerlund, 2007)

Statistics	Value	p-value
Gτ	-2.120***	(0.001)
Gα	-1.651***	(0.000)
Pτ	-4.172**	(0.015)
Pα	-2.443**	(0.026)

*** and ** are for the 1% and 5% significant levels accordingly.

4.5. Long-run and short-run estimations results

As observed in Table 6, there is a positive and significant connection between airline passengers and economic enlargement. Indicating that a percent rise in airline passengers' arrivals enhances growth in the E7 economies by 0.77%. The finding affirms the study of Balsalobre-Lorente et al. (2020) for the Spanish economy. Thus, lending credence to the validity of the TLGH for the E7 economies. Therefore, this is evidence for the E7 authorities to strengthen their transportation industry as it is a tool for enhancing economic advancement for the various nations. Furthermore, economic globalization expands the economies of the E7 by 0.34%, which is also positive news for the countries under review to open their economy to foreign trade continuously. However, urbanization harms the economies of the countries under review by reducing their economies by 0.92% in the long run. This connotes that as the E7 economies expand with globalization over time, a higher level of urban population is undermining economic growth prospects due to its unwanted attendant impacts like the rising cost of living and undesirable pressure on social amenities, among others, which in the long run also have undesirable impacts on tourism enlargement of the countries under review. On the other hand, the usage of renewable energy has a desirable impact on economic growth from the analysis, thus affirming finding from some extant studies (Destek & Aslan, 2017; Wang & Wang, 2020; Onifade, Erdoğan, et al., 2021). However, fossil fuel usage, on the other hand, has an undesirable impact on economic growth for the E7 economies, thus affirming the finding of Gyamfi, Bein, et al. (2020). This could be explained by the trade-off of the ecological consequences of fossil energy supplies, which are marked by pollutants. In the short run, the error correction of the estimation (ECM) expectedly came out to be negative and significant. Globalization, on the other hand, has a negative and significant connection with

economic growth in the short run, while the use of fossil energy has a positive link with economic growth. Lastly, the results from the AMG test in Table 7 which is used as a sensitivity check, are reliable with the out of the CS-ARDL long-run result.

Table 6
CS-ARDL technique

Variables	Coefficient	Std. error	P-value
LnAT	0.7722*	[1.3380]	(0.068)
LnEG	0.3433**	[18.6818]	(0.012)
LnUP	-0.9235*	[32.6706]	(0.065)
LnREC	0.6953**	[10.3844]	(0.022)
LnFF	-1.8717**	[10.7866]	(0.027)
	Short-run		
ECM	-0.0172***	[0.0042]	(0.002)
LnAT	0.0094	[0.0906]	(0.917)
LnEG	-0.1391***	[0.0416]	(0.001)
LnUP	5.2850	[10.8434]	(0.628)
LnREC	0.1051	[0.2772]	(0.705)
LnFF	0.6652***	[0.2279]	(0.005)

***, ** and * are for the 1%, 5% and 10% significant level accordingly.

Table 7
Sensitivity checks with AMG

Variables	Coefficient	Std. error	P-value
LnAT	0.2416*	[0.1316]	(0.066)
LnEG	0.5390**	[0.2156]	(0.012)
LnUP	-0 .7137***	[0.2529]	(0.005)
LnREC	0 .3789***	[0.1090]	(0.001)
LnFF	-1.1214***	[0.6997]	(0.009)
Wald test	48.02***		(0.0000)

***, ** and * are for the 1%, 5% and 10% significant level accordingly.

4.6. Dumitrescu and Hurlin causality test

The Dumitrescu and Hurlin (2012) panel causality test is reported in Table 8. The panel causality test is necessitated by the need to assess the Granger non-causality movement from the explanatory variables to the explained variable given a heterogeneous panel dataset. Following the importance of testing for causality in empirical studies (Balsalobre-Lorente & Leitão, 2020; Onifade, Çevik, et al., 2020; Roudi et al., 2019; Çoban et al., 2020; Bekun et al., 2019; Taiwo et al., 2020; Onifade, Ay, et al., 2020), we report the causality test results for this study in Table 8. From the table, it can be observed that there is a feedback causality between three variables and the dependent variable, namely, airline transport and economic growth, globalization and growth, and also between urbanization and growth. Nevertheless, two variables were also found to have one-way causality with the dependent variable. The causality flow between fossil energy consumption and growth ideates that the former has a unidirectional relationship with economic growth while there is no flow of causality from renewable energy to economic growth. On the contrary, there is a unidirectional causality flow from the level of economic expansion to the levels of renewable energy consumption in the E7 economies. This scenario implies important consequences for the sustainability of the environment in the E7 countries since fossil energy consumption poses detrimental impacts on the quality of the environment by inducing carbon emission levels.

Table 8
Dumitrescu and Hurlin panel causality test

	W-stat.	Zbar-stat.	p-value	Causality flow
LnAT→LnY	4.889**	2.534	(0.0113)	LnAT↔LnY
LnY→ LnAT	7.30437***	4.905	(9.E-07)	LnY↔ LnEG
LnEG→LnY	4.568**	2.219	(0.0265)	
LnY→ LnEG	9.214***	6.780	(1.E-11)	LnUP↔LnY
LnUP→LnY	6.742***	4.354	(1.E-05)	
LnY → LnUP	4.075*	1.735	(0.0826)	LnY↔ LnREC
LnREC→LnY	2.336	0.028	(0.9774)	
LnY→ LnREC	4.226*	1.883	(0.0596)	LnFF↔LnY
LnFF→LnY	5.008***	2.651	(0.0080)	
LnY→ LnFF	2.939	0.620	(0.5352)	

***, ** and * are for the 1%, 5% and 10% significant level accordingly.

5. Conclusion and policy directions

In this study, the tourism-led growth hypothesis (TLGH) model was expanded to accommodate air transport as a major intermediate in the tourism sector, while effort was also made towards accounting for the impacts of energy consumption and urbanization, considering the level of economic globalization experience among the E7 economies. It was revealed that air transport exerts positive and significant impacts on the economic growth of the E7 countries, and considering the notable impacts of air transport activities in aiding the development of tourism in the literature, this finding lends credence to the validity of the TLGH among the E7 economies. This argument can further be strengthened from the point of the obtained two-way causality moving between air transport and economic growth for the panel of the E7 economies. The results, therefore, resonate with the argument for the validity of the TLGH, as seen in some extant studies (Tang & Tan, 2013; Ohlan, 2017; Roudi et al., 2019; Eyuboglu & Eyuboglu, 2020).

On the part of energy consumption, evidence of causality flow to economic growth in the E7 economies was only obtained from fossil energy consumption, urbanization, and economic globalization. On the other hand, while no causality flow from renewable energy use to economic growth, the latter was found to Granger cause the former among the E7. As such, detrimental implications to the environment can be deduced from the causality flow from fossil energy use.

Thus, based on the findings, it is recommended that more investments should be directed towards the advancement of the air transport infrastructures and clean energy infrastructures, considering the significant contribution of air transport to economic growth among the E7 countries. Currently, Turkey is executing the construction of air transport facilities which are notably among the largest in Europe and the world at large, and this is a step in the right direction. However, policymakers and environmental regulatory bodies must ensure that policy measures are put in place for environmental concerns during the planning and execution of projects for air transport advancement. This would be critical to enhancing environmental quality while boosting sustainable economic growth through air transportation. The need for more investments in air transport and clean energy infrastructures is applicable to all countries in the current study as the tourism sector is vital to boosting economic growth, revenues, and employment generation among the countries. Also, tourism revenues can help to cushion trade deficits among the emerging seven (E7) economies. For instance, in 2019, there was a travel surplus (difference between tourism expenditures and receipts) from the tourism sector in China (Macao), Turkey, Mexico, and India, amounting to the tune of about US$ 39 billion, US$ 26 billion, US$ 15 billion, and US$ 7 billion respectively (UNWTO, 2021). However, although tourism is among the world's largest and fastest-growing economic sectors (UNWTO, 2021), the tremendous economic benefits from the tourism sector cannot be properly harnessed if priority is not given to adequate investment

in air transport infrastructures among all the E7 countries. The UNWTO (2012) noted that the tremendous improvements in international tourism to about 990 million in 2011 from about 25 million tourists that it used to be in 1950 is mainly due to the improvements and developments in air transport over the last couple of decades. Hence, it is highly recommended that priority should be given to adequate investment in air transport infrastructures among all the E7 countries.

In addition, although there is an increasing pressure to cut down on fossil energy consumption in the wake of the growing quest for a sustainable environment, however, care must be taken while drawing out energy conservation policies in the case of the E7 economies considering that fossil energy use Granger causes economic expansion among these nations. Moreover, income level also Granger causes renewable energy consumption among these countries, and as such, steps should be taken to encourage a gradual transition toward cleaner energy use as these nations continue to witness economic expansion and globalization over time. Therefore, to reduce the negative impact of increasing urban population among the E7 economies, it is recommended that authorities and policymakers pursue strategic urban infrastructural investment plans to cut down on any undesirable pressure on social amenities. This action will encourage quality urban experience and also help to moderate the average cost of living that will be sustainable for both the locals and the tourists that are visiting the countries.

Finally, the main constraint in the current study relates to data limitations. As such, future studies can build on the existing framework that is developed in this study while exploring the importance of the validity of the tourism-led growth hypothesis in other emerging economies with a broader scope of the study. By so doing, an extension can be carried out to factor in the impacts of the Covid-19 pandemic when accessing the tourism-led growth hypothesis, especially among emerging economies.

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