Uğur Korkut Pata

Tourism and Economic Growth in G10 Countries: Evidence from an Asymmetric Panel Causality Test

Abstract

This study proposes an asymmetric panel causality test to analyze the relationship between tourist arrivals and economic growth. To this end, annual data over the period 1995–2017 are examined for the G10 countries. The findings demonstrate that the relationship between tourism and economic growth varies according to positive and negative shocks. In terms of positive shocks, tourism development causes economic growth. The study also finds a bidirectional causality relationship between the negative shocks of the variables. Therefore, positive developments in tourism contribute to economic growth, while negative events in tourism impede growth. In sum, tourism is strongly linked to economic activities in G10 countries, and thus policymakers should attach importance to the tourism sector in order to support sustainable development.

Keywords: asymmetric panel causality, economic growth, tourism development, tourism led-growth hypothesis, G10 countries

1. Introduction

The importance of tourism for economic development has been the subject of many studies since the 1960s. The technological development of air, land, and sea transportation has contributed significantly to the growth of the tourism sector. With these technological developments, tourism has gained a new dimension. In the 21st century, it ranks as the third most important service sector after telecommunications and information (Crouch & Ritchie, 1999). The increase in government expenditure, branding, and marketing campaigns for travel activities are indicators of how important the tourism sector is for countries throughout the world (Fahimi et al., 2018). With the tremendous support that it receives, this sector has become attractive for both private and individual investors. Exhibitions and national marketing campaigns are frequently organized to prioritize travel and tourism, and these initiatives play an important role in attracting tourists to host countries (Louca, 2006). There is a broad consensus that international tourism has many benefits and can affect economic development in many ways – both directly and indirectly. The impacts of this sector on economic growth have become a major research topic for policymakers, particularly government and private institutions.

Tourism can stimulate economic growth in providing foreign exchange inflows to the country, investing in infrastructure, human capital, and competition, and creating new business areas (Brida et al., 2015; Kožić et al., 2020). Moreover, in many countries, the tourism sector is an alternative export channel, as tourist spending contributes to an improved balance of payments through foreign exchange earnings (Balaguer & Cantavella-Jordá, 2002; Oh, 2005; Kim & Chen, 2006; Shahzad et al., 2017). The United Nations General Assembly declared 2017 the International Year of Sustainable Tourism.

Moreover, according to the United Nations World Tourism Organization (UNWTO, 2018a), the tourism sector benefits countries in many different ways. First, it enables the establishment of the right kind of activities, such as the development of plant infrastructure and the implementation of innovative business models all over the world. Second, this sector ensures equal distribution of income and benefits, offers jobs for women and young people, contributes to poverty reduction, and respects and supports the interests of local and national

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communities. Third, tourism activities facilitate the transition to sustainable consumption and production patterns. Tourism paves the way for the green economy, mitigates climate change, protects biodiversity and natural areas, and supports sustainable development. Fourth, it provides cultural development with the coming together of different societies, provides creative opportunities, social, educational, and economic benefits, and protects societal and cultural values. Fifth, the acceptance of the tourism sector as a means of change has enabled peace, understanding and reconciliation among societies and accelerated security activities.

In the past decade, significant changes have taken place in international tourism and national economies. The number of tourists increased from 1,239 million people in 2016 to 1,323 million in 2017, representing growth of 7% for one year, and tourism revenues were calculated as US$1.6 trillion worldwide. From 2010 to 2017, average annual international tourist arrivals increased by 4%. From 2008 to 2017, approximately 393 million more tourists travelled to countries. By 2030, the number of international tourists is expected to reach 1.8 billion (UNWTO, 2018a). Meanwhile, the tourism sector constituted 10.4% of gross domestic product (GDP), 10% of employment, 6.5% of total exports, and 27.2% of services exports on a global scale – approximately US$8.8 trillion – in 2018 (World Travel & Tourism Council [WTTC], 2019). Despite external shocks resulting from armed conflicts or terrorism, tourism continues to grow by 4% to 5% per year (Işik et al., 2017).

Table 1 presents the travel and tourism competitiveness index for the top ten countries in 2019. This index provides a comparison of tourism competitiveness levels for 140 countries by considering various factors such as infrastructure, environment, and natural and cultural characteristics (Calderwood & Soshkin, 2019). According to the table, eight of the top ten countries (France, Germany, Japan, the United States [US], the United Kingdom [UK], Italy, Canada, and Switzerland) are among the G10 countries. From 2017 to 2019, only the US and the UK were replaced in the country ranking; other countries continued to maintain their place in the top ten list. Besides, these countries are well above the global average of competitiveness index. This demonstrates that the tourism sector is of great importance in the relevant country group.

Table 1
Travel and tourism competitiveness index in the top ten countries

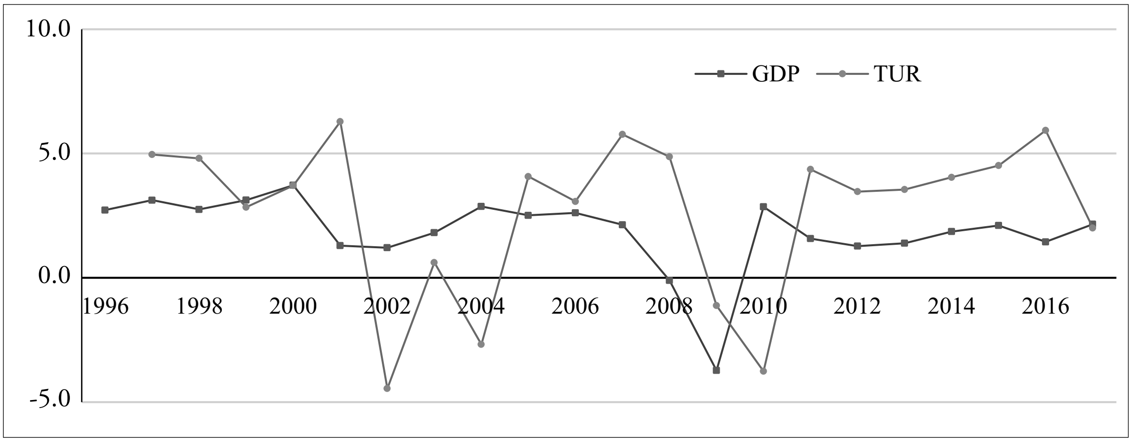
Rank	Country	Score[1]	Change since 2017		Diff. from global avg. (%)
			Rank	Score[2]	
1	Spain	5.4	0	0.3	41.4
2	**France**	5.4	0	1.5	40.4
3	**Germany**	5.4	0	2.0	40.0
4	**Japan**	5.4	0	2.1	39.6
5	**US**	5.3	1	2.6	36.6
6	**UK**	5.2	-1	-0.2	34.9
7	Australia	5.1	0	0.8	33.6
8	**Italy**	5.1	0	1.9	32.2
9	**Canada**	5.1	0	1.6	31.3
10	**Switzerland**	5.0	0	1.5	30.4

[1]Scores are between 1 and 7. 7 best, 1 worst. [2]Percentage change in score.
Bolds are G10 countries.

The G10 was established in 1962, when Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the UK and the US agreed to provide economic, financial and monetary support to the International Money Fund (IMF). Switzerland joined this group in 1964, but the group of 11 countries continued to be referred to as the G10. This study analyzes the 10 founding countries and does not include Switzerland. The 2008 financial crisis affected various macroeconomic indicators such as employment, inflation, economic growth, and tourism in these industrialized countries. The crisis resulted in a 4% decrease in international arrivals and a 6% decrease in revenues from the tourism sector, which grew by an average of 4% annually (UNWTO, 2013). Having survived the effects of the global crisis, the sector has recovered over the past few decades and is currently among the largest industries in both developing and developed countries (Paramati et al., 2017).

Figure 1 presents the growth rates of international tourist arrivals and GDP in G10 countries between 1995 and 2017. In terms of tourist arrivals, there was a sharp decline in the G10 countries after the September 11 terrorist attack in 2001 and the 2008-2009 financial crisis. After the crisis, the tourism sector in G10 countries grew by more than 3% every year between 2011-2016. It is also seen that the increase in tourism is more than economic growth in the relevant period. Tourist arrivals followed a parallel course with GDP value in this period. Moreover, these two variables exhibited similar movements, especially after the financial crisis. It is therefore clear that tourism and economic growth in G10 countries can affect each other.

Figure 1
GDP and international tourist arrivals growth rates in G10 countries (1995-2017).



The primary purpose of this study is to test whether there is a causal relationship between international tourist arrivals and GDP in G10 countries. We chose to analyze these particular countries because of their high tourism revenues, tourist arrivals, and travel and tourism competitiveness index. This study contributes to the literature from three perspectives. First, it is the first study to test the relationship between tourism and GDP in G10 countries. Second, we have used unit root and causality tests that take account of cross-section dependence and heterogeneity. Third, we used a new asymmetric panel causality test, with the inclusion of positive and negative components in the panel causality test of Emirmahmutoglu and Kose (2011). For all these reasons, we expect our study to bring a new dimension to the tourism-economic growth nexus.

2. Literature review

In recent years, many researchers have empirically tested the causal relationship between economic growth and tourism. Moreover, they obtained different results due to the differences in methods, variables, and time intervals. The causality relationships between tourism and economic growth can be examined on the basis of four different hypotheses.

I) Balaguer and Cantavella-Jordá (2002) suggested the tourism-led growth hypothesis (TLGH) based on the export-based growth model and stated that tourism is the driving force of economic growth. According to the TLGH, the increase in tourism revenues and international tourist arrivals provides foreign exchange inflow, new investment, and employment opportunities. Thus, tourism development will positively affect economic growth. However, the stagnation that may be experienced in the tourism sector due to various reasons such as terror attacks, epidemics and natural disasters may adversely affect economic growth. For the above reasons, the TLGH indicates that there is unidirectional causality from tourism to economic growth. The results of Gunduz and Hatemi-J (2004), Aslan, (2014), Al-mulali et al. (2014), Ertugrul and Mangir (2015), Tang and Tan (2015), Chiu and Yeh (2017), and Solarin (2018) are in line with the TLGH.

II) The economic-driven tourism growth hypothesis (EDTGH) – also known as the conservation hypothesis – suggests that growth contributes to the development of tourism and creates new business opportunities by increasing demand in the sector. People who increase their welfare through economic growth will spend more on tourism. On the one hand, increased expenditure and investments can contribute to the progress of the tourism sector. On the other hand, decreasing expenditure and other economic activities during an economic recession may adversely affect the sector. Therefore, the EDTGH demonstrates that there is a unidirectional causality from economic growth to tourism. Narayan (2004), Oh (2005), Payne and Mervar (2010) and Ghosh (2011) determined that the tourism sector developed as economic growth increased, and thus concluded that the EDTGH is valid.

III) Feedback hypothesis reveals a bidirectional causality between growth and tourism activities. According to this hypothesis, economic growth and tourism are complementary and mutually influenced. In other words, an increase in economic growth will enable the tourism sector to develop, while positive developments in the tourism sector constitute the driving force for economic growth. Kim and Chen (2006), Lee and Chang (2008), Lorde et al. (2011), Tugcu (2014), Bilen et al. (2017), and Dogru and Bulut (2018) concluded that the feedback hypothesis is valid.

IV) The neutrality hypothesis finds no relationship between the two variables. According to this hypothesis, increases or decreases in economic growth activities and the tourism sector are not affected by each other. Economic growth activities do not result in any acceleration in the tourism sector, and an increase in tourism investments and incentives has no impact on economic growth activity either. Katircioglu (2009), Ekanayake and Long (2012), and Wu et al. (2018) found that the neutrality hypothesis is valid.

Developed countries generally attract the most tourists in the world (UNWTO, 2018a). The relationship between tourism and GDP for developed countries has been examined in some studies employing time series and panel data analysis. Among the time series studies, Balaguer and Cantavella-Jordá (2002) utilized Johansen-Juselius (JJ) cointegration for Spain from 1975q1 to 1997q1 and found that the TLGH is valid. Cortes-Jimenez and Pulina (2006) performed a JJ cointegration test and vector autoregressive (VAR) model for Spain and Italy for 1964–2000 and 1954–2000, respectively. They found a unidirectional causality from GDP to tourism in Italy and bidirectional causality between the variables in Spain. Nowak et al. (2007) used a JJ cointegration test and a Granger causality test and argued that the TLGH is valid for Spain. Massidda and Mattana (2013) utilized a JJ cointegration test and error correction model for Italy from 1987q1 to 2009q4, confirming a bidirectional causality between tourism and GDP. Bento (2016) applied Gregory-Hansen cointegration and Toda-Yamamoto (TY) causality tests for Portugal over the period 1995–2015, and concluded that tourism causes economic growth. Perles-Ribes et al. (2017) utilized the ARDL bounds testing procedure and the TY causality test for Spain from 1957 to 2014. The results of their study supported the feedback hypothesis.

Among panel studies, Nissan et al. (2011) examined 11 developed countries between 2005 and 2015, and identified that tourism is an important factor that both creates new business opportunities and increases productivity. Antonakakis et al. (2015) used the spillover index approach for 10 European countries from 1995m1 to 2012m12, and found that the relationship between tourism and GDP is not stable in terms of either size or direction. They also found that the Great Recession in 2007 and the Eurozone debt crisis that commenced in 2010 and continued thereafter affected the tourism–GDP relationship. Shahzad et al. (2017) used a quantile-on-quantile approach for the top ten tourist destinations from 1990 to 2015 and found a positive relationship between the two variables. Shahbaz et al. (2018) investigated the same destinations over the period 1990–2015, and concluded that the 2008 financial crisis was keenly felt in a large number of countries. Their results pointed to a weak causal relationship in Germany, France and China, and a robust causal relationship in the UK, Italy, and Mexico.

Some studies have examined the tourism-growth nexus by adding positive and negative shocks to the bootstrap panel Granger causality test proposed by Kónya (2006). For example, Hatemi-J et al. (2014) investigated G7 countries from 1995–2012, and found that the TLGH is valid for Germany, France and the UK. These authors found no causal relationship between positive shocks of tourism and GDP in any country. They also argued that tourism causes economic growth for negative shocks in Germany. Hatemi-J et al. (2018) examined the same group of countries for the period 1995–2014 and concluded that the TLGH is valid for Germany, France, and the US. They also found that negative shocks of tourism in Germany, Italy and Japan, and positive shocks of tourism in the UK and the US cause economic growth. Eyuboglu andEyuboglu (2019) analyzed nine emerging countries over the period 1995–2016 and found that tourism causes economic growth for positive shocks in Argentina and Turkey. The authors also concluded that the negative shocks of tourism cause the positive shocks of economic growth in the Philippines.

In the literature, only three studies investigate the relationship between tourism and GDP using an asymmetric panel causality test. Although many studies have been carried out for developing countries, relatively few studies examine the tourism-growth nexus for developed country groups (see detailed literature; Pablo-Romero & Molina, 2013; Brida et al., 2016). Our study aims to contribute to the literature concerning these aspects.

3. Data set and methodology

3.1. Data set

In this study, we examined the tourism-growth nexus in G10 countries over the period 1995– 2017. The variables include the number of international tourist arrivals (TA) as an indicator of tourism development and real GDP in constant 2010 US dollars as a measure of economic growth. The annual data of TA and GDP are collected from World Development Indicators (WDI) (World Bank, 2020). We utilize natural logarithms of both variables to avoid problems with the data measurement. The data set covers ten developed countries, namely Canada, France, Germany, Italy, Japan, the UK, the US, Belgium, Sweden, and the Netherlands. Although Switzerland joined the G10 countries in 1964, international tourist arrivals data for this country in 2004 are not included in the WDI. Since this study involves a balanced panel data analysis, we have excluded Switzerland from the analyzed countries.

3.2. Cross-sectional dependence and homogeneity tests

Cross-sectional dependence refers to the fact that shocks and unobservable effects have a common effect between cross-section units. A positive or negative shock in one country can affect another country's economy. This dependence can be determined by four different tests. Breusch and Pagan (1980) proposed the Lagrange Multiplier (LM) test based on the pair-wise correlation of the residuals that can be obtained for a panel data model, as in equation (1).

$$y_{i,t}=\alpha_i+\beta_i^{'}x_{i,t}+\varepsilon_{i,t} \text{ for } i=1,2...,N;\ t=1,2,...,T \quad (1)$$

where α_i is the constant terms, $\beta_i^{'}$ is the slope coefficients, i cross section units, t time period, and u_{it} denotes error terms. The null hypothesis of no cross-sectional dependence $H_0:Cov(\varepsilon_{i,t},\varepsilon_{j,t})=0$, is tested against the alternative hypothesis $H_1:Cov(\varepsilon_{i,t},\varepsilon_{j,t})\neq 0$. To test the validity of these hypotheses, the LM test statistic is calculated by equation (2).

$$LM=T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2,\ \chi'^2_{N(N-1)/2}, \quad i\neq j \quad (2)$$

The LM test statistic is suitable for small cross section units (N) and large period (T). Pesaran (2004) developed CD_{LM} and CD tests for large N and T, and small T and large N, respectively. The two test statistics that scaled versions of LM are calculated with equations (3) and (4).

$$CD_{LM}=\left(\frac{1}{N(N-1)}\right)^{0.5}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T\hat{\rho}_{ij}^{2}-1),\quad N(0,1) \qquad (3)$$

$$CD=\sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right), N(0,1) \qquad (4)$$

However, these two test statistics are not useful when average pairwise correlations are zero, and underlying individual population pairwise correlations are non-zero. To solve this problem, Pesaran et al. (2008) applied the adjusted LM test statistic shown in equation (5).

$$LM_{adj}=\sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\frac{(T-k)\hat{\rho}_{ij}^{2}-\mu_{Tij}}{\upsilon_{Tij}^{2}},\quad N(0,1) \qquad (5)$$

As in the LM test, the null hypothesis of CD_{LM}, CD, and LM_{adj} tests indicated no cross-sectional dependence between the cross-section units. The rejection of the null hypothesis for all four test statistics supports cross-sectional dependence among countries or units.

Pesaran and Yamagata (2008) proposed $\widetilde{\Delta}$ and $\widetilde{\Delta}_{adj}$ test to analyze slope homogeneity. These two tests are based on the $\tilde{S}$ statistic developed by Swamy (1970). The $\tilde{S}$ statistic is obtained by equation (6).

$$\tilde{S}=\sum_{i=1}^{N}(\hat{\beta}_i-\tilde{\beta}_{WFE})'\frac{x_i'M_\tau x_i}{\tilde{\sigma}_i^2}(\hat{\beta}_i-\tilde{\beta}_{WFE}) \qquad (6)$$

In equation (7), Δ and $\widetilde{\Delta}_{adj}$ tests are the standardized version of $\tilde{S}$ statistics. For both tests, the null hypothesis states that all coefficients are the same, while the alternative hypothesis implies that at least one coefficient is different from the other variables. The rejection of the null hypothesis suggests that the slope coefficients are heterogeneous.

$$\widetilde{\Delta}=\sqrt{N}\left(\frac{N^{-1}\tilde{S}-k}{\sqrt{2k}}\right),\qquad \widetilde{\Delta}_{adj}=\sqrt{N}\left(\frac{N^{-1}\tilde{S}-E(\tilde{z}_{iT})}{\sqrt{var(\tilde{z}_{iT})}}\right) \qquad (7)$$

3.3. Unit root test

Pesaran (2007) developed the cross-sectionally augmented Dickey-Fuller (CADF) unit root test that deals with heterogeneity and cross-sectional dependence in panel data. The CADF test statistics for each cross-section are calculated by equation (8).

$$\Delta y_{i,t}=\delta_i+\beta_i y_{i,t-1}+\alpha_i\bar{y}_{i,t-1}+\sum_{j=0}^{l}\varphi_{ij}\Delta\bar{y}_{i,t-1}+\sum_{j=0}^{l}\varphi_{ij}y_{it-1}+z_{i,t} \qquad (8)$$

where Δ is the difference operator, y denotes the analyzed variable, $\bar{y}$ refers to cross-sectional mean, δ are individual intercepts, l refers to lag order, and z are the error terms. The null hypothesis H_0: $\beta_i=0$ for all cross sections is tested against the alternative hypothesis $H_{alternative}$:$\beta_i<0$, $i=1,2,\ldots.N_1$. If the null hypothesis is rejected, it is determined that the series is stationary for the corresponding cross-section unit.

$$\text{CIPS}=N^{-1}\sum_{i=1}^{n} t_i(N,T) \quad (9)$$

In addition, Pesaran (2007) developed the cross-sectionally augmented IPS (CIPS) statistics through the average of each CADF t-statistics, as in equation (9). If the null hypothesis is rejected by CIPS statistics, the series is determined to be stationary for the whole panel.

3.4. Asymmetric panel causality test

In Granger's (1969) causality, and Engle and Granger's (1987) cointegration tests, the effects of positive and negative components of the variables are assumed the same. This is also the case in many other causality and cointegration tests. However, policymakers and households may react differently to negative and positive shocks. Similarly, the relationship between variables may vary according to these shocks, and thus different causality findings can be obtained. Granger and Yoon (2002) first considered the positive and negative components of the variables in the hidden cointegration test. Hatemi-J (2012) included these components in the causality test of Toda and Yamamoto (1995) and obtained critical values by bootstrap simulation that eliminates heteroscedasticity and non-normality problems. This simulation has better power and size properties than asymptotic distribution.

Since panel data analysis is a combination of time series and cross-section units, it increases the degrees of freedom. In addition, panel data analysis considers the interaction between cross-section units (Hatemi-J, 2011). Kónya (2006), Emirmahmutoglu and Kose (2011) and Dumitrescu and Hurlin (2012) developed different panel causality tests. These panel causality tests do not take into account asymmetric effects.

Hatemi-J (2011, 2016) developed an asymmetric causality test based on the seemingly unrelated regressions (SUR) approach by including negative and positive components in the Kónya (2006) panel causality test. This causality test considers cross-sectional dependence and heterogeneity in the panel. Also, this test can be performed without the need for stationary information of the series.

We propose a new test by adding asymmetric components to the lag augmented vector autoregressive models (LA-VAR) panel causality test developed by Emirmahmutoglu and Kose (2011). The asymmetric Emirmahmutoglu-Kose (EK) panel causality test consists of three steps. In the first step, the error terms are divided into positive and negative shocks. In equation (10), x_1 and x_2 are two variables in which the causality relationship is examined.

$$x_{i1,t}=x_{i1,t-1}+u_{1i,t}=x_{i1,0}+\sum_{k=1}^{t} u_{1i,k}\,, \quad x_{i2,t}=x_{i2,t-1}+u_{2i,t}=x_{i2,0}+\sum_{k=1}^{t} u_{2i,k} \quad (10)$$

where x_1 and x_2 represent GDP and tourist arrivals respectively in this study. Moreover, i: 1,…10 denotes cross section units, t: time trend, $x_{i1,0}$ and $x_{i2,0}$ are the initial values of the series, and u_1 and u_2 are error terms. The error terms can be expressed as $u_{1it}=u^{+}_{1it}+u^{-}_{1it}$ and $u_{2it}=u^{+}_{2it}+u^{-}_{2it}$. These positive and negative shocks can be separated into $u^{+}_{1it}=\max(u_{1it},0)$ and $u^{+}_{2it}=\max(u_{2it},0)$.

In the second step, these shocks can be defined as the cumulative components. In the asymmetric causality test, series can be used whether stationary or not (Hatemi-J, 2012). When the series are stationary, positive and negative changes are employed directly instead of cumulative sums. The cumulative sums of the shocks of the variables are presented in equations (11) and (12).

$$x^{+}_{i1,t}=x^{+}_{i1,0}+u^{+}_{i1,t}=x_{i1,0}+\sum_{k=1}^{t} u^{+}_{1i,k}\,, \quad x^{-}_{i1,t}=x^{-}_{i1,0}+u^{-}_{i1,t}=x_{i1,0}+\sum_{k=1}^{t} u^{-}_{1i,k} \quad (11)$$

$$x^{+}_{i2,t}=x^{+}_{i2,0}+u^{+}_{i2,t}=x_{i2,0}+\sum_{k=1}^{t}u^{+}_{2i,k}\,,\qquad x^{-}_{i2,t}=x^{-}_{i2,0}+u^{-}_{i2,t}=x_{i2,0}+\sum_{k=1}^{t}u^{-}_{2i,k} \quad (12)$$

After the data are converted to positive and negative shocks, the EK panel causality tests of order $p + d_{max}$ can be estimated for each cross-section. The EK panel causality test is based on the Toda-Yamamoto (1995) causality test, which considers cross-sectional dependence and heterogeneity. In this test, the maximum degree of integration (d_{max}) is added to the optimal lag length (p) selected by Akaike information criteria (AIC). In the EK panel causality test, the series can have a different degree of integration as I(0) or I(1).

$$x^{+}_{i1,t}=\delta_{i0}+\sum_{r=1}^{p}\beta_{1,ir}\,x^{+}_{i1,t-r}+\sum_{r=p+1}^{p+d_{max}}\emptyset_{1,ir}\,x^{+}_{i1,t-r}+\sum_{r=1}^{p}\vartheta_{1,ir}\,x^{+}_{i2,t-r}+\sum_{r=p+1}^{p+d_{max}}\partial_{1,ir}\,x^{+}_{i2,t-r}+e^{+}_{1i,t} \quad (13)$$

$$x^{+}_{i2,t}=\sigma_{i0}+\sum_{r=1}^{p}\alpha_{2,ir}\,x^{+}_{i2,t-r}+\sum_{r=p+1}^{p+d_{max}}\theta_{2,ir}\,x^{+}_{i2,t-r}+\sum_{r=1}^{p}\mu_{2,ir}\,x^{+}_{i1,t-r}+\sum_{r=p+1}^{p+d_{max}}\omega_{2,ir}\,x^{+}_{i1,t-r}+e^{+}_{2i,t} \quad (14)$$

In the last step, the Wald test is applied to the lag length (p) for the original data. The MWald test used by Toda and Yamamoto (1995) does not have the correct size when the data set is not normally distributed. In addition, the Fisher (1932) test statistic ($\lambda=-2\sum_{i=1}^{N}\ln(p_i)$ i=1,2,…,N) (is ineffective when there is correlation between cross sections (Emirmahmutoglu & Kose, 2011). To solve both problems, we used the bootstrap method in the causality test. Asymmetric causality relationships from x_2 to x_1 and from x_1 to x_2 are tested with equations (13) and (14), respectively. A causality from positive components of x_2 to positive components of x_1 is determined when the null hypothesis $\sum_{r=1}^{p}\vartheta_{1,ir}=0$ is rejected. Meanwhile, if the null hypothesis $\sum_{r=1}^{p}\mu_{2,ir}=0$ that there is no causality from positive components of x_1 to positive components of x_2 is rejected, a bidirectional causality is determined between the positive components of the two variables. The same process can be repeated by replacing positive components with negative components. In this way, causality relationships between negative components of the variables can be determined. As a result, eight different relationships can be found for negative and positive components of two variables (none, bidirectional, unidirectional from x_1 to x_2, and from x_2 to x_1). Finally, the asymmetric EK panel causality test can be expressed in matrix form, as in the following equation.

$$\begin{bmatrix}x^{+}_{i1,t}\\ x^{+}_{i2,t}\end{bmatrix}=\begin{bmatrix}\delta_{i0}\\ \sigma_{i0}\end{bmatrix}+\sum_{r=1}^{p}\begin{bmatrix}\beta_{1,ir} & \vartheta_{1,ir}\\ \mu_{2,ir} & \alpha_{2,ir}\end{bmatrix}\begin{bmatrix}x^{+}_{i1,t-r}\\ x^{+}_{i2,t-r}\end{bmatrix}+\sum_{r=p+1}^{p+d_{max}}\begin{bmatrix}\emptyset_{1,ir} & \partial_{1,ir}\\ \omega_{2,ir} & \theta_{2,ir}\end{bmatrix}\begin{bmatrix}x^{+}_{i1,t-r}\\ x^{+}_{i2,t-r}\end{bmatrix}+\begin{bmatrix}e^{+}_{1i,t}\\ e^{+}_{2i,t}\end{bmatrix} \quad (15)$$

In equation (15), the Wald test is applied for the optimal lag length p, which minimizes the AIC criterion. For each cross section unit, the null hypothesis $\vartheta_{1,ir}=0,\forall r$ where r=1,…p stating that there is no causality from $x^{+}_{i2,t-r}$ to $x^{+}_{i1,t}$ is tested against the alternative hypothesis $\vartheta_{1,ir}\neq 0$, that there is a causality from $x^{+}_{i2,t-r}$ to $x^{+}_{i1,t}$. When the obtained test statistic is greater than the bootstrap critical value, the null hypothesis is rejected and a unidirectional causality from to is determined. Various causal relationships can be tested in the same way by replacing variables.

4. Results and discussion

Before conducting the panel data analyses, we divided the variables into positive and negative components. Then we used the cross-sectional dependence and homogeneity test for the six different models. The results of these tests are presented in Table 2.

The findings of the $\widehat{\Delta}$ and $\widehat{\Delta}_{adj}$ tests indicate that the slope coefficients are heterogeneous for the six models at a 1% significance level. Therefore, reliable policy decisions can be made by considering the country-specific findings for the tourism-growth relationship. In addition, the results of the four different cross-sectional dependence tests demonstrate that the null hypothesis is rejected. In other words, there is a cross-sectional dependence between countries. With globalization, developed countries have become more interconnected. Thus, changes in tourism and economic growth due to positive or negative shocks in one developed country may affect other countries. After determining the properties of the panel data, the stationarity of the series is examined with a second-generation panel unit root test.

Table 2
Cross sectional dependency and homogeneity tests results

Tests	TA≠GDP	TA^+≠GDP^+	TA^-≠GDP^-	GDP≠TA	GDP^-≠TA^-	GDP^+≠TA^+
$\widehat{\Delta}$	20.835***	21.238***	13.743***	20.362***	12.528***	23.697***
$\widehat{\Delta}_{adj}$	22.274***	22.776***	14.738***	21.768***	13.435***	25.412***
CD_{BP}	819.823***	263.811***	595.201***	95.059***	65.244***	121.305***
CD_{LM}	81.674***	23.065***	57.996***	5.277***	6.827***	8.043***
CD	28.508***	13.400***	21.275***	2.236**	-3.245***	2.933***
LM_{adj}	49.485***	49.486***	37.620***	35.412***	31.099***	32.210**

*** and ** show the 1% and 5% significance levels, respectively.

Table 3 presents the findings of the CADF unit root test. The results of the CIPS statistics demonstrate that negative GDP shocks are stationary at level I(0). The remaining five series contain a unit root at level values. All variables are integrated of order one I(1) except negative GDP shocks. Thus, the maximum order of integration for the six models is determined as 1.

Table 3
Pesaran CADF unit root test results

Variables	Level I(0)	First differences I(1)
GDP	-1.850	-2.804***
GDP^+	-2.030	-2.903***
GDP^-	-2.740***	-
TA	-1.804	-2.853***
TA^+	-1.605	-2.947***
TA^-	-1.778	-2.595**

*** and ** show the 1% and 5% significance levels, respectively.
Table critical values at %1: 2.60, %5: -2.34 for CIPS statistics.

Next, we investigated the relationship between tourism development and GDP using the EK panel causality test. We also included asymmetric effects by adding positive and negative components of the variables. Table 4 presents the results for the null hypothesis that there is no causality from tourism development to GDP.

Table 4
The panel causality test results (tourism development to GDP)

Models	TA $\nrightarrow$ GDP			$TA^+ \nrightarrow GDP^+$			$TA^- \nrightarrow GDP^-$		
Countries	W_i	p_i	k	W_i	pi	k	W_i	p_i	k
Canada	0.942	0.332	1	3.289*	0.070	1	0.565	0.452	1
France	0.018	0.893	1	0.744	0.388	1	2.424	0.120	1
Germany	3.677*	0.055	1	2.129	0.145	1	0.001	0.977	1
Italy	0.083	0.774	1	0.483	0.487	1	0.186	0.666	1

Table 4 ***(continued)***

Models	$TA \nrightarrow GDP$			$TA^{+} \nrightarrow GDP^{+}$			$TA^{-} \nrightarrow GDP^{-}$		
Countries	**W_i**	**p_i**	**k**	**W_i**	**pi**	**k**	**W_i**	**p_i**	**k**
Japan	0.124	0.725	1	0.008	0.931	1	118.559***	0.000	4
The UK	1.294	0.255	1	43.420***	0.000	4	0.322	0.571	1
The US	1.752	0.417	2	2.725*	0.099	1	0.409	0.522	1
Belgium	0.099	0.753	1	0.033	0.856	1	0.000	0.997	1
Sweden	0.790	0.374	1	1.918	0.751	4	30.358***	0.000	2
The Netherlands	10.843***	0.001	1	1.150	0.765	3	19.336***	0.000	1
Panel Fisher	30.230	0.108		55.891***	0.000		172.685***	0.000	

Notes: Optimal lag length selected by AIC. Max lag 4. ***, ** and * show the significance at 1%, 5% and 10% levels, respectively.

The findings of the country-specific symmetric causality test in Table 4 indicate that a unidirectional causality exists from tourism to GDP in Germany and the Netherlands only. For the panel, tourism is not a factor that causes economic growth. However, there may be a hidden causality for the variables. In the case of positive shocks, tourism causes economic growth in Canada, the UK and the US. Meanwhile, negative tourism shocks cause negative GDP shocks in Japan, Sweden, and the Netherlands. For the whole panel, both positive and negative tourism shocks cause the same shocks for GDP. Excluding positive and negative components of variables, tourism affects GDP in only two countries. When the asymmetric effects are considered, tourism causes economic growth in six out of ten countries. Clearly, it can be said that positive and negative shocks should be taken into consideration in order to determine the causal relationships more reliably.

Table 5 presents the results of the null hypothesis that there is no causality from GDP to tourism. According to the symmetric causality test results, tourism causes economic growth for Germany, the Netherlands and the panel as a whole. However, positive GDP shocks do not affect tourism. In terms of negative shocks, there is a unidirectional causality from GDP to tourism in Japan, Sweden and the panel as a whole.

Table 5
The panel causality test results (GDP to tourism development)

Models	$TA \nrightarrow GDP$			$TA^{+} \nrightarrow GDP^{+}$			$TA^{-} \nrightarrow GDP^{-}$		
Countries	**W_i**	**p_i**	**k**	**W_i**	**p_i**	**k**	**W_i**	**p_i**	**k**
Canada	0.048	0.826	1	0.255	0.613	1	1.163	0.281	1
France	2.415	0.120	1	2.033	0.154	1	0.699	0.403	1
Germany	4.447**	0.035	1	0.974	0.324	1	0.019	0.89	1
Italy	0.003	0.958	1	0.187	0.665	1	0.220	0.639	1
Japan	0.513	0.474	1	2.069	0.150	1	25.611***	0.000	3
The UK	0.668	0.414	1	7.334	0.119	4	0.022	0.882	1
The US	0.211	0.900	2	1.371	0.242	1	0.299	0.585	1
Belgium	0.267	0.605	1	0.018	0.893	1	0.002	0.961	1
Sweden	0.851	0.356	1	1.279	0.865	4	43.301***	0.000	2
The Netherlands	5.531**	0.019	1	3.171	0.366	3	0.872	0.350	1
Panel Fisher	25.910***	0.007		21.204	0.971		75.036**	0.049	

Note: See notes for table 4.

If we interpret both tables together, there is a bidirectional causality between the two variables for Germany and the Netherlands. For the panel as a whole, a unidirectional causality is found from GDP to tourism. These findings are obtained without considering positive and negative components. Considering these components, we determined that tourism has a significant impact on GDP. Positive tourism shocks affect the same GDP shocks for Canada, the UK, the US and the panel as a whole. There is no reverse causality for positive shocks. In terms of negative shocks, a bidirectional causality between the two variables is detected for

Japan, Sweden and the panel as a whole. In the Netherlands, there is unidirectional causality from negative tourism shocks to negative GDP shocks. Finally, these results are summarized in Table 6 for the validity of the four tourism hypotheses.

Table 6
The summary of the causality results

Countries	Raw data	Positive components	Negative components
Canada	-	TLGH	-
France	-	-	-
Germany	Feedback	-	-
Italy	-	-	-
Japan	-	-	Feedback
The UK	-	TLGH	TLGH
The US	-	TLGH	TLGH
Belgium	-	-	-
Sweden	-	-	Feedback
The Netherlands	Feedback	-	TLGH
Panel Fisher	EDTGH	TLGH	Feedback

According to the results presented in Table 6, there is no causal relationship between tourism and GDP in Belgium, France, and Italy. This finding supports the neutrality hypothesis and is in line with the results of Katircioglu (2009), Ekanayake and Long (2012), and Wu et al. (2018). It is not surprising that no causality is found in Belgium since the country is not among the countries with the highest tourism revenues and international tourist arrivals in the world. By contrast, France and Italy were among the top six countries in the world in terms of both tourism revenues and tourist arrivals in 2017 (UNWTO, 2018b). Although these two countries have high tourism levels, tourism expenditure and the areas in the economy where the revenues are used should be taken into consideration for sustainable growth. In addition to the tourism sector, other macroeconomic variables such as capital stock, labor, foreign trade, and research and development expenditure may affect GDP positively for France and Italy.

The EDTGH is valid for the panel, and this result is consistent with Narayan (2004), Oh (2004), Payne and Mervar (2010) and Ghosh (2011).

The feedback hypothesis is valid for the raw data in Germany and the Netherlands. In this case, tourism provides tax revenues, investments, and employment opportunities in Germany and the Netherlands, while economic growth enables the development of tourism. These results are consistent with Kim and Chen (2006), Lee and Chang (2008), Lorde et al. (2011), Massidda and Mattana (2013), Tugcu (2014), Bilen et al. (2017), and Dogru and Bulut (2018). In addition, this hypothesis is also confirmed in Japan and Sweden for the negative components. In other words, negative tourism and GDP shocks affect each other in these countries. Based on negative shocks, the feedback hypothesis also applies to the panel as a whole. Economic crises can adversely affect tourism, while problems in the tourism sector are detrimental to economic growth in Japan and Sweden. Therefore, governments are required to take measures to prevent problems in the tourism sector.

The TLGH is valid for the positive shocks in Canada, the UK, the US and the panel as a whole. Meanwhile, this hypothesis is also confirmed in the UK, the US, and the Netherlands for negative shocks. These findings for the UK and the US support the results of Hatemi-J et al. (2018). In contrast to the above-mentioned study, tourism positively affects GDP in Canada. In light of these results, we can say that tourism is an important sector for the development of G10 countries. In the case of Canada, the UK, and the US in particular, economic development can be supported by improving infrastructure, education and accommodation in the tourism sector. At this point, cultural, social, and economic gains contribute to development in these countries.

5. Conclusion

In this study, we used two different panel causality tests to analyze the tourism-growth nexus in G10 countries. First, we performed the symmetric Emirmahmutoglu and Kose (2011) panel causality test. We then added positive and negative components of the variables to this test. Thus, we propose a new asymmetric panel causality test based on the EK method. With this approach, hidden causality relationships between variables can be obtained. Also, different causal findings can be identified for positive and negative shocks.

We can summarize the findings of the study under two sub-headings. I) According to the symmetric causality test, bidirectional causality is found between tourism and GDP only in Germany and the Netherlands. For the panel, economic growth causes tourism. II) The findings obtained with the asymmetric causality test are quite different. In terms of positive shocks, tourism development causes economic growth in Canada, the UK, the US, and the panel. Moreover, negative tourism shocks cause negative GDP shocks in Japan and Sweden. In addition, the findings suggest a bidirectional causality relationship between the negative shocks of the two variables for Japan, Sweden, and the panel. For country-specific findings, the symmetric causality test demonstrates that there is a relationship between tourism and GDP only in Germany and the Netherlands. By contrast, the results of the asymmetric causality test indicate that in addition to these two countries, a causal relationship is found for five other countries. In Japan, the UK, the US, Canada, and Sweden, there is a hidden causality between tourism and GDP. This demonstrates that it is important to consider the positive and negative components of variables when examining the relationship between tourism development and GDP.

With respect to policy implications, tourism affects seven of the ten developed countries. Tourism problems adversely affect economic development in Japan, the UK, the US, Sweden, and the Netherlands. In order to ensure sustainable development, there should be no decrease in the number of tourists visiting these countries. Moreover, these countries need more investment in the tourism sector to overcome or minimize the impact of economic shocks. Furthermore, tourism enhances economic development in Germany, the Netherlands, Canada, the UK, and the US. In addition to providing foreign currency inflows, tourism reduces unemployment, enhances industrial activity, and consequently increases economic growth. Investing in tourism infrastructure and human capital can directly or indirectly affect economic growth in terms of creating new business areas. The governments and the private sector have an important role to play in contributing to the economic development of the tourism sector. Governments need to provide more financial resources to this sector by implementing policies to improve tourism activities. They should regulate the sector with active policies that can increase the demand for tourism and accelerate the growth in tourism supply. To this end, they should diversify the policies that promote the tourism sector and transfer more resources to the promotion of their countries as destinations. The private sector, on the other hand, should increase the quality of service in tourism and offer tourists as many economic options as possible. In addition, companies should provide their personnel with the necessary training and increase the employment of a qualified labor force that meets the needs of the sector. As the tourism sector develops, access to international markets becomes easier, business relations develop and trade opportunities emerge. Thus, tourism can contribute to sustainable development in G10 countries.

This study creates new research opportunities for further analyses. With the newly developed asymmetric panel causality test, the relationship between tourism and GDP can also be tested for developing country groups. In this study, we have only taken into account international tourism arrivals as a tourism development indicator. The effects of tourism revenues and tourism expenditure (see Tugcu, 2014) on economic growth can be analyzed with positive and negative components.

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