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Evaluating Methodological Issues in the Tourism Literature: UK outgoing tourism and trade links

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ABSTRACT

This paper evaluates the importance of trade in goods when modelling demand for tourism. It is argued that the limited literature testing causality between trade in goods and tourism does not consider the appropriate variables. This study utilises bilateral data for 16 UK tourist destinations in order to test for Granger causality between trade in goods and tourism expenditure. UK imports, exports and total trade are tested separately, whilst controlling for real GDP and real bilateral exchange rates. The novelty of this paper is the variable specification, as well as testing the causal relationship for the case of UK outgoing tourists. Our findings suggest a causal relationship between the tourism expenditure of UK residents and trade in goods. These results support the inclusion of a trade-in-goods variable when estimating tourism demand, as well as adopting appropriate methodologies to account for this causal relationship. Furthermore, there is strong evidence that the trade-tourism link is important for both the UK and host countries.

1. INTRODUCTION

RECENT LITERATURE HAS HIGHLIGHTED the uneven development of research in the area of tourism economics (Song *et al.*, 2012; Tugcu, 2014). Studies analysing the demand for tourism have traditionally estimated single log-linear equations, where estimating demand systems and dynamic modelling is a recent development within this body of literature (Li *et al.*, 2013). Despite these important recent developments, trade in goods as a determinant for tourism demand still remains largely ignored. Furthermore, there are very few studies that evaluate whether a causal relationship exists between trade in

goods and tourism. In this paper, it will be argued that these causality studies have key deficiencies in terms of the variables deployed. Therefore, this paper proposes a revised variable specification for testing Granger causality between trade in goods and tourism. This novel specification will be applied to UK outgoing tourism data, thereby offering a significant contribution to the very limited literature examining the UK. It is important to establish whether these neglected links are empirically valid, and therefore whether there is evidence of simultaneity bias and omitted variables in the current tourism literature.

In 2011 UK residents were the fourth highest global spenders on tourism, and the second highest within the EU27 (UN World Tourism Organisation, 2013). Destinations for UK residents are intra-EU focused, although extra-EU countries such as the USA, Australia and India are also popular (UK Office of National Statistics, 2013). This paper will evaluate the causal relationship between trade in goods and tourism for 16 UK tourist destinations, including 11 intra-EU destinations. In the next section of this study, we review the key determinants of demand for tourism, as well as the studies that specifically consider trade in goods and the theoretical links. The third section will discuss the data and model. We will then turn, in section four, to the interpretation of the empirical results. Finally, we will outline our concluding remarks.

2. Review

There is an extensive body of literature examining tourism demand, as well as a significant number of reviews of this literature (Crouch, 1994; Johnson and Ashworth, 1990; Li *et al.*, 2005; Lim, 1997, 1999; Song and Li, 2008; Witt and Witt, 1995). Crouch (1994) and Lim (1997, 1999) identify the key determinants of the demand for tourism, namely: income, relative prices, exchange rates and transport costs. This literature also highlights a number of issues with respect to the specification of the variables. Firstly, the commonly used dependent variables are tourist arrivals/departures, or tourism expenditure/receipts (in both nominal and real terms; Lim, 1997). Johnson and Ashworth (1990) suggest that while tourist arrivals/departures are more frequently used, policy makers are more likely to be concerned with tourism expenditure/receipts.

In terms of explanatory variables, various measurement issues arise when modelling income. It would be preferential to measure income after spending on necessities, but data on GDP is more readily available and is thus a commonly-used proxy. There is also debate around tourist responsiveness to changes in exchange rates, compared to inflation. There is a significant body of literature (Artus, 1970; Gray, 1966; Lin and Sung, 1983; Little, 1980; Tremblay, 1989; Truett and Truett, 1987) suggesting that tourists tend to be better informed about changes in exchange rates. However, it has been shown by Edwards (1987) that tourists only react differently to these two variables in the short run. That said, given multicollinearity concerns it is questionable

whether both exchange rate and relative price variables should be included (Lim, 1997). Therefore, it is reasonable to include a relative price variable interacted with the exchange rate.

The literature makes little mention of the role of trade as a determinant for tourism demand, where recent studies focusing on the tourism demand of UK residents also fail to consider trade in goods as a driver. The UK studies focus on explanatory variables such as exchange rates, prices and expenditure (De Mello *et al.*, 2002; Seetaram *et al.*, 2014; Song *et al.*, 2000). There is no established theoretical framework explaining the link between tourism and trade in goods (Fischer and Gil-Alana, 2009). Nevertheless, economic theory suggests that the movement of people between countries will promote trade in goods by introducing domestically produced products to migrants as well as foreign tastes to the established local population (Brau and Pinna, 2013).

The migration literature also provides theory and evidence that can be applied to tourism. Migrants tend to have a preference towards products from their home country, alongside transmitting information regarding potential markets and distribution channels that may lower the costs for trade in goods (Gould, 1994). The importance of the information channel is dependent on the level of development of the host country, whereas more distinct varieties of goods produced across the home and host country suggest a stronger impact on trade via preferences (Head and Ries, 1998). Consumer preferences will also have a larger impact on host country imports of goods if tourism is relatively important within the economy.

Despite the lack of theoretical framework, the tourism literature provides intuitive explanations for a bilateral tourism - trade in goods link, which often mirror the theories proposed in the migration literature. For example, business travel may lead to future trade in goods as well as additional persons accompanying the business traveller for the purpose of a holiday. The development of trade links may also lead to increased awareness of a particular country and therefore, future holidays to this destination. On the other hand, holiday travel may lead to the import of goods to meet the demands of tourists, as well as the possibility that individuals may identify possible business opportunities (Kulendran and Wilson, 2000). Therefore, the current literature investigates the tourism and trade in goods link empirically, with mixed results.

Studies by Kadir and Jusoff (2010), Katircioglu (2009) and Massidda and Mattana (2013) investigate the trade-tourism link by using total trade/export/import data, on a unilateral basis, where each study focuses on a different country (Malaysia, Cyprus and Italy respectively). The exact specification varies between studies, with controls for GDP in the latter two studies, but the results of these time-series tests all indicate a uni-directional relationship from trade to tourism. By comparison, the results are much more mixed when time-series tests consider bilateral trade data (Khan *et al.*, 2005; Kulendran and Wilson, 2000; Santana-Gallego *et al.*, 2011b; Shan and Wilson, 2001). Each of these studies also has a country focus: Singapore (four

partners), Australia (four partners), Canary Islands (six partners) and China (four partners) respectively. It is noteworthy that only the Shan and Wilson (2001) study includes any control variables.

There are also two further studies that are of particular interest since they test Granger causality in a panel setting: Fry *et al.* (2010) and Santana-Gallego *et al.* (2011a). Fry *et al.* (2010) considers South African tourist arrivals, and whilst this study includes both time-series and panel tests, controls are only included in the time-series version. On the other hand, the study by Santana-Gallego *et al.* (2011a) takes a broader approach by considering OECD countries, but in doing so uses annual unilateral trade data and no control variables. Both panel test results provide evidence of a bi-directional trade-tourism link, although this result is more clearly identified in the Fry *et al.* (2010) study.

A VAR model will be utilised, similar to Shan and Wilson (2001), where we apply the causality method developed by Toda and Yamamoto (1995). The advantage of this methodology is that tests for unit roots and cointegration rank are not required, since they have proved to be problematic. Hence, this methodology is applicable whether the variables are stationary, integrated or cointegrated. However, all the independent variables in the model have identical lag lengths, which may not be valid for many economic time series and also may cause inefficiency in determining the maximum order of lags (Hsiao, 1981). Hsiao's (1981) version of causality test allows each independent variable to have a different number of lags, reducing the number of parameters to be estimated.

The novelty of this paper is that tests for Granger causality will be carried out applying both the methods of Toda and Yamamoto (1995) and of Hsiao (1981), using bilateral trade data with controls for real GDP and real bilateral exchange rates for 16 UK tourist destinations. The controls have been selected on the basis of the key variables found to be most consistently statistically significant in previous studies of tourism demand. These variables correspond to those utilised in other UK studies (De Mello *et al.*, 2002; Seetaram *et al.*, 2014; Song *et al.*, 2000).

3. Data and model

3.1 The Toda and Yamamoto (1995) Granger causality method

The following VAR model will be utilised:

$$Y_t = \mu_1 + \sum_{i=1}^{k+d} \alpha_{1i} Y_{t-i} + \sum_{i=1}^{k+d} \beta_{1i} X_{t-i} + \varepsilon_{1t} \quad (1)$$

$$X_t = \mu_2 + \sum_{i=1}^{k+d} \alpha_{2i} Y_{t-i} + \sum_{i=1}^{k+d} \beta_{2i} X_{t-i} + \varepsilon_{1t} \quad (2)$$

The model includes μ_1 and μ_2 to capture the deterministic component, which may include seasonal dummies, a trend and a constant term (Kulendran and

Wilson, 2000). k is the optimal lag order and d is the maximum order of integration of the variables. The optimal lag length (k) is determined and the VAR(p) model ($p=k+d$) is estimated with additional d-max lags, as long as d does not exceed k. Then the conventional Wald test is applied on the first k coefficient matrices, using the standard χ^2 statistic. It should be noted that the coefficient matrices of the last $d_{\max}$ lagged vectors in the model are ignored since they are assumed to be zero (Toda and Yamamoto, 1995).

Therefore, the causal relationships between the variables are determined by the joint significance of the lagged variables. For example, X only Granger-causes Y if the joint test of β_{1i} is statistically different from zero and the joint test of α_{2i} is zero ($i \le k$). Y only Granger-causes X if the joint test of is statistically different from zero and the joint test of β_{1i} is zero ($i \le k$). If both α_{2i} and β_{1i} ($i \le k$) are statistically different from zero, a two-way causal link exists. If both α_{2i} and β_{1i}($i \le k$) are zero, there is no causal link between the two variables.

3.2 The Hsiao (1981) Granger causality method

Hsiao's (1981) procedure of Granger causality method consists of two steps to determine the optimal lag length and the direction of causality, using Akaike's final prediction error (FPE). If both of the two variables (X and Y) have a unit root and no cointegration is found, the first step is to estimate equation (3) to compute FPE as shown in equation (4), where T is the total number of observations, SSE is the sum of squared errors and m is the order of lags varying from one to m. The lag order that has the smallest FPE is chosen as the optimal lag length m^*. Equation (5) is estimated in the second step with lag length m^* for ΔY, and with lag length varying from one to n for ΔX. The minimum value of FPE(m^*, n) in equation (6) determines the optimal lag length n^* for ΔX. If FPE(m) is greater than FPE(m^*, n), X Granger-causes Y, otherwise X does not Granger-cause Y. If one variable is I(1) and the other is I(0), the variable that is I(1) should be in first difference form and the variable that is I(0) should be in level form in equations (3) and (5). The hypothesis that Y Granger-causes X can be also tested by interchanging X and Y in the equations (3) to (6).

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + u_t \tag{3}$$

$$FPE(m) = \frac{T+m+1}{T-m-1}\frac{SSE}{T} \tag{4}$$

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^{m^*} \beta_i \Delta Y_{t-i} + \sum_{j=1}^{n} \lambda_i \Delta X_{t-j} + u_t \tag{5}$$

$$FPE(m^*,n)=\frac{T+m^*+n+1}{T-m^*-n-1}\frac{SSE(m^*,n)}{T} \quad (6)$$

However, if both of the two variables (X and Y) have a unit root and there is a cointegrating relationship, the error correction (EC) term should be included in the second step as shown in equation (7) to determine the optimal lag length n^* for ΔX (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). If one variable is found to be I(2) and the other is I(1) or I(2), cointegration is still tested by assuming that both variables are I(1) and the I(2) result is a statistical anomaly (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008).

$$\Delta Y_t=\alpha_1+\gamma_1 EC_{t-1}+\sum_{i=1}^{m^*}\beta_i\Delta Y_{t-i}+\sum_{j=1}^{n}\lambda_i\Delta X_{t-j}+u_t \quad (7)$$

3.3 Data

16 UK tourist destinations were selected on the basis of data availability: Australia, Czech Republic, Estonia, France, Germany, Hungary, Italy, Netherlands, New Zealand, Poland, Portugal, Slovakia, Slovenia, South Africa, Turkey, US. Quarterly data were collected for the period 1993-2011.[2] The data have been obtained from the *UK Office of National Statistics International Passenger Survey*, *IMF Direction of Trade Database*, *OECD Main Economic Indicators Database* and the *Bank of England*. Exchange rates for Australia, France, Germany, Italy, Netherlands, New Zealand, Portugal, South Africa and US are from the Bank of England. On the other hand, exchange rates for Czech Republic, Estonia, Hungary, Poland, Slovakia, Slovenia and Turkey are from the *OECD Main Economic Indicators Database*. UK GDP, Tourism, imports/exports/trade and exchange rate are real UK GDP, real tourist expenditure, real UK imports/exports/total trade from the tourist destination, and real bilateral exchange rate, respectively.

4. Empirical results

4.1 Unit root test

The Augmented Dickey-Fuller (ADF) test has been carried out for each variable to establish the order of integration. The optimum lag length (k) is selected by the Modified Akaike Information Criterion (MAIC). According to Ng and Perron (2001), the Bayesian Information Criterion (BIC) and Akaike Information Criteria (AIC) tend to select small lag lengths (k) and therefore suffer from severe small size distortions. The MAIC, however, is shown to yield substantial size improvements and power gains. The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is also reported to check the robustness of the ADF results, as Kwiatkowski *et al.* (1992) argue that most economic time series are not very informative about unit roots, and the standard unit root tests have low power. The KPSS test examines the null hypothesis of stationarity against the alternative hypothesis of non-stationarity, which is the opposite of the ADF test. The inclusion of constant/constant-and-trend in the ADF and KPSS tests

is based on the significance level of constant and trend in the unit root test equation. Details of ADF and KPSS tests are reported in Appendices A and B.

4.2 The Toda and Yamamoto (1995) Granger causality method

Table 1 and Table 2 show the maximum number of integration (d) for each VAR based on the ADF test and the KPSS test. The likelihood ratio (LR) test is used to determine the optimal number of lags (k) for each VAR model, as shown in Table 3. The size of the VAR is the optimum number of lags plus the maximum number of integration used in the model ($k+d$).

Table 1: Maximum number of integration order for the VAR model based on the Toda and Yamamoto (1995) methodology and the ADF unit root test

Country	*Trade equation*	*Exports equation*	*Imports equation*
Australia	2	2	2
Czech Republic	1	1	1
Estonia	1	1	1
France	2	2	2
Germany	2	2	2
Hungary	2	2	2
Italy	2	2	2
Netherlands	2	2	2
New Zealand	2	2	2
Poland	2	2	2
Portugal	2	2	2
Slovakia	2	2	2
Slovenia	1	1	1
South Africa	2	2	2
Turkey	1	1	1
US	2	2	2

Tables 4, 6 and 8 show the causality test results, whereas Tables 5, 7 and 9 summarise the causal relationship between tourism and total trade/exports/imports. As a result of the different results of the ADF and KPSS unit root tests, Hungary shows both bi-directional causality between tourism and trade and uni-directional causality from trade to tourism. Similarly, New Zealand falls into both a two-way link, and a one way link from tourism to trade. France demonstrates both one-way causality from Tourism to exports and two-way causality, Portugal shows one-way causality from exports to tourism and two-way causality. For the causal relationship between tourism and imports, New Zealand and Slovakia fall into two categories: uni-directional causality from tourism to imports and bi-directional causality. However, for the majority of countries there is evidence of two-way causality between the expenditure of outbound UK tourists and UK total trade/exports/imports.

Table 2: Maximum number of integration order for the VAR model based on the Toda and Yamamoto (1995) methodology and the KPSS unit root test

Country	*Trade equation*	*Exports equation*	*Imports equation*
Australia	1	1	1
Czech Republic	2	2	2
Estonia	1	1	1
France	2	1	1
Germany	1	1	1
Hungary	1	1	2
Italy	1	1	1
Netherlands	1	1	1
New Zealand	1	1	1
Poland	1	1	2
Portugal	1	1	1
Slovakia	1	1	1
Slovenia	1	1	1
South Africa	1	1	1
Turkey	2	1	2
US	1	2	1

Table 3: Optimum number of lags based on the Toda and Yamamoto (1995) methodology

Country	*LR (Trade)*	*LR(Exports)*	*LR(Imports)*
Australia	11	11	11
Czech Republic	9	9	9
Estonia	7	7	7
France	10	11	11
Germany	11	11	11
Hungary	10	10	10
Italy	11	11	11
Netherlands	11	11	11
New Zealand	11	11	11
Poland	10	10	10
Portugal	10	10	10
Slovakia	9	9	9
Slovenia	9	9	9
South Africa	11	11	11
Turkey	8	8	8
US	11	11	11

Note: Duttaray *et al.* (2008) set the maximum lag length at 4 using 27 observations; and Qi (2007) sets the maximum lag length at 5, using 34 observations. The maximum number of lags is set at 11 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 10 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 9 for the Czech Republic (64 observations), Slovakia (60 observations) and Slovenia (64 observations). It is set at 8 for Turkey (56 observations) and at 7 for Estonia (48 observations).

Table 4: Trade-tourism causality results based on the Toda and Yamamoto (1995) methodology

Country	*Tourism → Trade*	*Trade → Tourism*
Australia	38.07***	48.32***
(k=11, d=1)	(0.0000)	(0.0000)
Australia	56.88***	96.58***
(k=11, d=2)	(0.0000)	(0.0000)
Czech Republic	18.52**	63.63***
(k=9, d=1)	(0.0296)	(0.0000)
Czech Republic	118.00***	77.45***
(k=9, d=2)	(0.0000)	(0.0000)
Estonia	86.32***	96.03***
(k=7, d=1)	(0.0000)	(0.0000)
France	59.28***	11.12
(k=10, d=2)	(0.0000)	(0.3486)
Germany	51.03***	77.30***
(k=11, d=1)	(0.0000)	(0.0000)
Germany	71.02***	197.06***
(k=11, d=2)	(0.0000)	(0.0000)
Hungary	17.00*	45.44***
(k=10, d=1)	(0.0744)	(0.0000)
Hungary	12.07	140.57***
(k=10, d=2)	(0.2806)	(0.0000)
Italy	93.97***	176.96***
(k=11, d=1)	(0.0000)	(0.0000)
Italy	133.99***	351.98***
(k=11, d=2)	(0.0000)	(0.0000)
Netherlands	54.37***	68.45***
(k=11, d=1)	(0.0000)	(0.0000)
Netherlands	91.83***	160.29***
(k=11, d=2)	(0.0000)	(0.0000)
New Zealand	24.50**	4.02
(k=11, d=1)	(0.0108)	(0.9694)
New Zealand	61.82***	20.26**
(k=11, d=2)	(0.0000)	(0.0419)
Poland	80.70***	296.18***
(k=10, d=1)	(0.0000)	(0.0000)
Poland	56.83***	209.29***
(k=10, d=2)	(0.0000)	(0.0000)
Portugal	18.76**	66.92***
(k=10, d=1)	(0.0435)	(0.0000)
Portugal	53.86***	59.57***
(k=10, d=2)	(0.0000)	(0.0000)

...cont.

Slovakia	281.40***	43.40***
(k=9, d=1)	(0.0000)	(0.0000)
Slovakia	282.53***	31.72***
(k=9, d=2)	(0.0000)	(0.0002)
Slovenia	183.33***	37.30***
(k=9, d=1)	(0.0000)	(0.0000)
South Africa	26.96***	283.69***
(k=11, d=1)	(0.0047)	(0.0000)
South Africa	47.08***	244.52***
(k=11, d=2)	(0.0000)	(0.0000)
Turkey	41.10***	60.90***
(k=8, d=1)	(0.0000)	(0.0000)
Turkey	53.98***	154.52***
(k=8, d=2)	(0.0000)	(0.0000)
US	85.28***	39.15***
(k=11, d=1)	(0.0000)	(0.0000)
US	111.07***	46.32***
(k=11, d=2)	(0.0000)	(0.0000)

Notes: (1) ***, ** and * mean significant at 1%, 5% and 10% respectively. (2) The numbers in brackets are chi-square probabilities.

Table 5: Summary of trade-tourism causality results based on the Toda and Yamamoto (1995) methodology

	Country
Tourism → Trade	France, New Zealand
Tourism ← Trade	Hungary
Tourism ↔ Trade	Australia, Czech Republic, Estonia, Germany, Hungary, Italy, Netherlands, New Zealand, Poland, Portugal, Slovakia, Slovenia, South Africa, Turkey, US
No Causality	

Table 6: Exports-tourism causality results based on the Toda and Yamamoto (1995) methodology

Country	*Tourism → Exports*	*Exports → Tourism*
Australia	60.79***	38.17***
(*k*=11, *d*=1)	(0.0000)	(0.0001)
Australia	63.33***	92.80***
(*k*=11, *d*=2)	(0.0000)	(0.0000)
Czech Republic	101.95***	13.85[a]
(*k*=9, *d*=1)	(0.0000)	(0.1277)
Czech Republic	240.71***	18.79**
(*k*=9, *d*=2)	(0.0000)	(0.0270)
Estonia	138.12***	181.12***
(*k*=7, *d*=1)	(0.0000)	(0.0000)
France	87.41***	13.80
(*k*=10, *d*=1)	(0.0000)	(0.2443)
France	120.73***	32.36***
(*k*=10, *d*=2)	(0.0000)	(0.0007)
Germany	48.16***	35.67***
(*k*=11, *d*=1)	(0.0000)	(0.0002)
Germany	138.31***	75.63***
(*k*=11, *d*=2)	(0.0000)	(0.0000)
Hungary	52.33***	23.01**
(*k*=10, *d*=1)	(0.0000)	(0.0107)
Hungary	743.68***	17.21*
(*k*=10, *d*=2)	(0.0000)	(0.0698)
Italy	49.60***	84.89***
(*k*=11, *d*=1)	(0.0000)	(0.0000)
Italy	53.41***	164.01***
(*k*=11, *d*=2)	(0.0000)	(0.0000)
Netherlands	26.06***	64.15***
(*k*=11, *d*=1)	(0.0064)	(0.0000)
Netherlands	64.95***	174.64***
(*k*=11, *d*=2)	(0.0000)	(0.0000)
New Zealand	38.41***	66.28***
(*k*=11, *d*=1)	(0.0001)	(0.0000)
New Zealand	29.54***	78.81***
(*k*=11, *d*=2)	(0.0019)	(0.0000)
Poland	85.55***	140.38***
(*k*=10, *d*=1)	(0.0000)	(0.0000)
Poland	149.03***	103.02***
(*k*=10, *d*=2)	(0.0000)	(0.0000)
Portugal	14.17	39.36***
(*k*=10, *d*=1)	(0.1653)	(0.0000)
Portugal	34.74***	87.20***
(*k*=10, *d*=2)	(0.0001)	(0.0000)

...cont.

Slovakia	82.24***	98.42***
(k=9, d=1)	(0.0000)	(0.0000)
Slovakia	140.39***	95.39***
(k=9, d=2)	(0.0000)	(0.0000)
Slovenia	105.92***	35.28***
(k=9, d=1)	(0.0000)	(0.0001)
South Africa	86.05***	33.48***
(k=11, d=1)	(0.0000)	(0.0004)
South Africa	130.59***	44.92***
(k=11, d=2)	(0.0000)	(0.0000)
Turkey	41.68***	17.20**
(k=8, d=1)	(0.0000)	(0.0280)
US	316.04***	87.91***
(k=11, d=2)	(0.0000)	(0.0000)

Notes: (1) ***, ** and * mean significant at 1%, 5% and 10% respectively. (2) [a] means marginally significant at 10% level. (3) The numbers in brackets are chi-square probabilities.

Table 7: Summary of exports-tourism causality results based on the Toda and Yamamoto (1995) methodology

	Country
Tourism → Exports	France
Tourism ← Exports	Portugal
Tourism ↔ Exports	Australia, Czech Republic, Estonia, France, Germany, Hungary, Italy, Netherlands, New Zealand, Poland, Portugal, Slovakia, Slovenia, South Africa, Turkey, US
No Causality	

Table 8: Imports-tourism causality results based on the Toda and Yamamoto (1995) methodology

Country	*Tourism → Imports*	*Imports → Tourism*
Australia	85.65***	96.16***
(k=11, d=1)	(0.0000)	(0.0000)
Australia	61.36***	269.31***
(k=11, d=2)	(0.0000)	(0.0000)
Czech Republic	29.62***	63.40***
(k=9, d=1)	(0.0005)	(0.0000)
Czech Republic	161.37***	91.63***
(k=9, d=2)	(0.0000)	(0.0000)
Estonia	11.86[a]	48.60***
(k=7, d=1)	(0.1054)	(0.0000)
France	26.57***	51.88***
(k=10, d=1)	(0.0053)	(0.0000)

...cont

France	26.41***	133.84***
(k=10, d=2)	(0.0056)	(0.0000)
Germany	31.05***	49.93***
(k=11, d=1)	(0.0011)	(0.0000)
Germany	33.75***	81.63***
(k=11, d=2)	(0.0004)	(0.0000)
Hungary	10.78	265.71***
(k=10, d=2)	(0.3748)	(0.0000)
Italy	60.10***	88.46***
(k=11, d=1)	(0.0000)	(0.0000)
Italy	82.27***	157.32***
(k=11, d=2)	(0.0000)	(0.0000)
Netherlands	44.19***	74.43***
(k=11, d=1)	(0.0000)	(0.0000)
Netherlands	71.16***	92.19***
(k=11, d=2)	(0.0000)	(0.0000)
New Zealand	32.26***	15.07
(k=11, d=1)	(0.0007)	(0.1793)
New Zealand	46.52***	41.36***
(k=11, d=2)	(0.0000)	(0.0000)
Poland	44.74***	125.36***
(k=10, d=2)	(0.0000)	(0.0000)
Portugal	22.46**	82.22***
(k=10, d=1)	(0.0129)	(0.0000)
Portugal	71.74***	52.24***
(k=10, d=2)	(0.0000)	(0.0000)
Slovakia	186.01***	19.39**
(k=9, d=1)	(0.0000)	(0.0221)
Slovakia	860.80***	7.77
(k=9, d=2)	(0.0000)	(0.5576)
Slovenia	241.69***	29.00***
(k=9, d=1)	(0.0000)	(0.0006)
South Africa	57.04***	440.21***
(k=11, d=1)	(0.0000)	(0.0000)
South Africa	77.56***	295.00***
(k=11, d=2)	(0.0000)	(0.0000)
Turkey	82.19***	42.19***
(k=8, d=1)	(0.0000)	(0.0000)
Turkey	111.52***	42.26***
(k=8, d=2)	(0.0000)	(0.0000)
US	56.93***	32.60***
(k=11, d=1)	(0.0000)	(0.0006)
US	53.67***	66.27***
(k=11, d=2)	(0.0000)	(0.0000)

Notes: (1) ***, ** and * mean significant at 1%, 5% and 10% respectively (2) [a] means marginally significant at 10% level. (3) The numbers in brackets are chi-square probabilities.

Table 9: Summary of imports-tourism causality results based on the Toda and Yamamoto (1995) methodology

	Country
Tourism → Imports	New Zealand, Slovakia
Tourism ← Imports	Hungary
Tourism ↔ Imports	Australia, Czech Republic, Estonia, France, Germany, Italy, Netherlands, New Zealand, Poland, Portugal, Slovakia, Slovenia, South Africa, Turkey, US
No Causality	

4.3 The Hsiao (1981) Granger causality method

The trade-tourism, exports-tourism and imports-tourism causality test results are presented in Tables 10, 12, 14, 16, 18 and 20 with the summaries shown in Tables 11, 13, 15, 17, 19 and 21, based on ADF and KPSS unit root tests. The maximum lag length is set as 20 per cent of total observations as suggested by Chontanawat *et al.* (2006) and Chontanawat *et al.* (2008). Details of the Johansen cointegration test are reported in Appendix C to Appendix H, with optimum lag selected using the Schwarz criterion (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The results are different depending on the unit root test. However, in general, most countries experience uni-directional causality running from tourism to trade, a one way causal link from tourism to exports, and bi-directional causality between tourism and imports.

The results for exports suggest that UK outbound tourism in most cases leads to exports of goods. Migration theory offers an explanation for this result, in that the countries in this sample are likely to have similar varieties of products to those in the UK already available for sale. By contrast, the results for imports provide significant evidence that business links concerning UK goods imports lead to an increased awareness of the exporting country and therefore tourism. In the majority of cases, there is also evidence tourism has developed business links, resulting in UK goods imports. This may be via the information channel as well as the exposure to new tastes, where tourists change their preferences and patterns of demand after returning to the UK. Overall, these results provide evidence of more opportunities for foreign countries, rather than the UK, to develop their export sector. Nevertheless, consumers in the UK are likely to experience a welfare improvement, as a result of access to a larger variety of products. Therefore, these results provide strong evidence that the trade-tourism link is important for both the UK and host countries.

Table 10: Trade-tourism causality results based on the Hsiao(1981) methodology and the ADF unit root test

Country	*Direction of causality*	*Cointegration*	*m**	*n**	*FPE (m*)*	*FPE (M*,n*)*	*Causality result*
Australia	Tourism=f(Trade)	NA	8	1	9.5049E+14	9.7989E+14	Tourism → Trade
	Trade=f(Tourism)		5	4	8.3591E+15	7.3126E+15	
Czech Republic	Tourism=f(Trade)	NO	3	7	1.1200E+14	1.1273E+14	No Causality
	Trade=f(Tourism)		1	1	4.6968E+15	4.7266E+15	
Estonia	Tourism=f(Trade)	NO	3	2	9.6273E+12	9.8684E+12	Tourism → Trade
	Trade=f(Tourism)		3	1	3.4091E+15	3.3124E+15	
France	Tourism=f(Trade)	NA	8	1	5.1827E+15	5.1212E+15	Tourism ↔ Trade
	Trade=f(Tourism)		3	4	6.4969E+17	6.0579E+17	
Germany	Tourism=f(Trade)	NO	7	13	7.1343E+14	5.6814E+14	Tourism ↔ Trade
	Trade=f(Tourism)		1	1	4.3791E+17	4.2941E+17	
Hungary	Tourism=f(Trade)	YES	4	14	5.5457E+13	4.6349E+13	Trade → Tourism
	Trade=f(Tourism)		7	2	2.9859E+15	2.9867E+15	
Italy	Tourism=f(Trade)	NA	7	3	3.5578E+15	3.5261E+15	Tourism ↔ Trade
	Trade=f(Tourism)		10	3	7.2758E+16	6.6434E+16	
Netherlands	Tourism=f(Trade)	NO	5	3	5.5304E+14	5.5133E+14	Tourism ↔ Trade
	Trade=f(Tourism)		1	2	2.8243E+17	2.6599E+17	
New Zealand	Tourism=f(Trade)	NO	7	2	3.8559E+14	3.8565E+14	Tourism → Trade
	Trade=f(Tourism)		13	4	6.5887E+14	6.0411E+14	
Poland	Tourism=f(Trade)	NO	4	12	5.1363E+14	4.8919E+14	Trade → Tourism
	Trade=f(Tourism)		2	1	2.0754E+16	2.1405E+16	
Portugal	Tourism=f(Trade)	NA	7	9	1.6128E+15	1.6286E+15	No Causality
	Trade=f(Tourism)		1	1	2.3449E+16	2.4062E+16	
Slovakia	Tourism=f(Trade)	NO	1	2	1.3097E+13	1.3145E+13	Tourism → Trade
	Trade=f(Tourism)		11	7	1.9444E+15	1.5258E+15	

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Slovenia	Tourism=f(Trade)	NA	10	1	1.0235E+13	1.0649E+13	Tourism → Trade
	Trade=f(Tourism)		11	9	1.2653E+14	8.8573E+13	
South Africa	Tourism=f(Trade)	NO	12	11	1.2160E+15	1.1933E+15	Tourism ↔ Trade
	Trade=f(Tourism)		2	3	3.3018E+16	3.1843E+16	
Turkey	Tourism=f(Trade)	NA	11	7	1.1438E+15	1.0831E+15	Tourism ↔ Trade
	Trade=f(Tourism)		11	9	1.1822E+16	7.5167E+15	
US	Tourism=f(Trade)	NO	8	1	7.8425E+15	8.0448E+15	Tourism → Trade
	Trade=f(Tourism)		7	8	8.9412E+17	7.8458E+17	

Note: (1) NA means not applicable. (2) The maximum lag length is set at 20 per cent of total observations (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The maximum number of lags is set at 15 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 14 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 13 for the Czech Republic (64 observations) and Slovenia (64 observations). It is set at 12 for Slovakia (60 observations), at 11 for Turkey (56 observations) and at 10 for Estonia (48 observations).

Table 11: Summary of trade-tourism causality test results based on the Hsiao (1981) methodology and the ADF unit root test

	Countries
Tourism → Trade	Australia, Estonia, New Zealand, Slovakia, Slovenia, US
Tourism ← Trade	Hungary, Poland
Tourism ↔ Trade	France, Germany, Italy, Netherlands, South Africa, Turkey
No causality	Czech Republic, Portugal

Table 12: Trade-tourism causality results based on the Hsiao(1981) methodology and theKPSS unit root test

Country	*Direction of causality*	*Cointegration*	*m**	*n**	*FPE (m*)*	*FPE (M*,n*)*	*Causality result*
Australia	Tourism=f(Trade)	NA	8	1	9.5049E+14	9.7989E+14	Tourism → Trade
	Trade=f(Tourism)		5	4	8.3591E+15	7.3126E+15	
Czech Republic	Tourism=f(Trade)	NO	3	7	1.1200E+14	1.1273E+14	No Causality
	Trade=f(Tourism)		1	1	4.6968E+15	4.7266E+15	
Estonia	Tourism=f(Trade)	NA	3	1	9.6273E+12	9.7086E+12	Tourism → Trade
	Trade=f(Tourism)		1	1	2.7801E+15	2.7002E+15	
France	Tourism=f(Trade)	NO	8	2	5.1827E+15	5.2804E+15	Tourism → Trade
	Trade=f(Tourism)		2	3	7.3620E+17	6.9104E+17	
Germany	Tourism=f(Trade)	NA	7	14	7.1343E+14	4.5048E+14	Tourism ↔ Trade
	Trade=f(Tourism)		2	1	4.4113E+17	4.3216E+17	
Hungary	Tourism=f(Trade)	NA	4	14	5.3724E+13	4.9545E+13	Trade ↔ Tourism
	Trade=f(Tourism)		7	1	2.9859E+15	2.9765E+15	
Italy	Tourism=f(Trade)	NA	7	3	3.5578E+15	3.5261E+15	Tourism ↔ Trade
	Trade=f(Tourism)		10	3	7.2758E+16	6.6434E+16	
Netherlands	Tourism=f(Trade)	NO	5	3	5.5304E+14	5.5133E+14	Tourism ↔ Trade
	Trade=f(Tourism)		1	2	2.8243E+17	2.6599E+17	
New Zealand	Tourism=f(Trade)	NO	7	2	3.8559E+14	3.8565E+14	Tourism → Trade
	Trade=f(Tourism)		13	4	6.5887E+14	6.0411E+14	
Poland	Tourism=f(Trade)	NO	4	12	5.1363E+14	4.8919E+14	Trade → Tourism
	Trade=f(Tourism)		2	1	2.0754E+16	2.1405E+16	
Portugal	Tourism=f(Trade)	NA	7	9	1.6128E+15	1.6286E+15	No Causality
	Trade=f(Tourism)		1	1	2.3449E+16	2.4062E+16	
Slovakia	Tourism=f(Trade)	NA	2	4	1.2850E+13	1.3034E+13	Tourism → Trade
	Trade=f(Tourism)		11	8	1.9444E+15	1.4470E+15	

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Slovenia	Tourism=f(Trade)	NA	10	1	1.0235E+13	1.0649E+13	Tourism → Trade
	Trade=f(Tourism)		11	9	1.2653E+14	8.8573E+13	
South Africa	Tourism=f(Trade)	NA	11	11	1.1913E+15	1.1207E+15	Tourism ↔ Trade
	Trade=f(Tourism)		2	4	3.3018E+16	3.2579E+16	
Turkey	Tourism=f(Trade)	NO	11	4	1.2290E+15	1.2419E+15	Tourism → Trade
	Trade=f(Tourism)		4	10	1.3344E+16	9.6000E+15	
US	Tourism=f(Trade)	NO	8	1	7.8425E+15	7.9641E+15	Tourism → Trade
	Trade=f(Tourism)		8	8	8.9053E+17	7.5976E+17	

Note: (1) NA means not applicable. (2) The maximum lag length is set at 20 per cent of total observations (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The maximum number of lags is set at 15 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 14 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 13 for the Czech Republic (64 observations) and Slovenia (64 observations). It is set at 12 for Slovakia (60 observations), at 11 for Turkey (56 observations) and at 10 for Estonia (48 observations).

Table 13: Summary of trade-tourism causality test results based on the Hsiao (1981) methodology and the KPSS unit root test

	Countries
Tourism → Trade	Australia, Estonia, France, New Zealand, Slovakia, Slovenia, Turkey, US
Tourism ← Trade	Poland
Tourism ↔ Trade	Germany, Hungary, Italy, Netherlands, South Africa
No causality	Czech Republic, Portugal

Table 14: Export-tourism causality results based on the Hsiao (1981) methodology and the ADF unit root test

Country	*Direction of causality*	*Cointegration*	*m**	*n**	*FPE (m*)*	*FPE (M*,n*)*	*Causality result*
Australia	Tourism=f(Exports)	NA	8	1	9.5049E+14	9.6174E+14	Tourism → Exports
	Exports=f(Tourism)		5	3	4.8886E+15	4.5434E+15	
Czech Republic	Tourism=f(Exports)	NA	3	3	1.1200E+14	1.0956E+14	Exports → Tourism
	Exports=f(Tourism)		1	1	1.7421E+15	1.8125E+15	
Estonia	Tourism=f(Exports)	NA	3	1	9.6273E+12	1.0051E+13	Tourism → Exports
	Exports=f(Tourism)		1	1	1.3692E+15	1.3402E+15	
France	Tourism=f(Exports)	NA	8	1	5.1827E+15	5.0809E+15	Tourism ↔ Exports
	Exports=f(Tourism)		2	3	4.5579E+17	4.3662E+17	
Germany	Tourism=f(Exports)	NO	7	4	7.1343E+14	6.3866E+14	Tourism ↔ Exports
	Exports=f(Tourism)		2	2	1.3192E+17	1.2775E+17	
Hungary	Tourism=f(Exports)	YES	4	1	5.5457E+13	5.3225E+13	Tourism ↔ Exports
	Exports=f(Tourism)		3	1	3.0813E+14	3.0699E+14	
Italy	Tourism=f(Exports)	NO	7	2	3.5578E+15	3.4807E+15	Exports → Tourism
	Exports=f(Tourism)		12	1	2.1666E+16	2.2299E+16	
Netherlands	Tourism=f(Exports)	NO	5	2	5.5304E+14	5.3737E+14	Tourism ↔ Exports
	Exports=f(Tourism)		3	1	1.7075E+17	1.6441E+17	
New Zealand	Tourism=f(Exports)	NO	7	1	3.8559E+14	3.9536E+14	Tourism → Exports
	Exports=f(Tourism)		5	3	1.8491E+14	1.6244E+14	
Poland	Tourism=f(Exports)	NO	4	1	5.1363E+14	5.3033E+14	No Causality
	Exports=f(Tourism)		2	1	1.3296E+16	1.3661E+16	
Portugal	Tourism=f(Exports)	NA	7	1	1.6128E+15	1.6619E+15	No Causality
	Exports=f(Tourism)		5	1	3.9198E+15	4.0476E+15	
Slovakia	Tourism=f(Exports)	NA	1	1	1.3097E+13	1.3500E+13	No Causality
	Exports=f(Tourism)		2	3	1.2200E+14	1.2422E+14	

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Slovenia	Tourism=f(Exports)	NA	10	1	1.0235E+13	1.0499E+13	Tourism → Exports
	Exports=f(Tourism)		1	8	3.7549E+13	3.6505E+13	
South Africa	Tourism=f(Exports)	NO	12	1	1.2160E+15	1.2522E+15	Tourism → Exports
	Exports=f(Tourism)		3	11	3.5858E+15	3.3756E+15	
Turkey	Tourism=f(Exports)	NA	11	2	1.1438E+15	1.1208E+15	Tourism ↔ Exports
	Exports=f(Tourism)		5	11	5.0145E+15	3.7151E+15	
US	Tourism=f(Exports)	NO	8	1	7.8425E+15	7.9843E+15	Tourism → Exports
	Exports=f(Tourism)		7	8	2.9804E+17	2.2541E+17	

Note: (1) NA means not applicable. (2) The maximum lag length is set at 20 per cent of total observations (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The maximum number of lags is set at 15 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 14 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 13 for the Czech Republic (64 observations) and Slovenia (64 observations). It is set at 12 for Slovakia (60 observations), at 11 for Turkey (56 observations) and at 10 for Estonia (48 observations).

Table 15: Summary of exports-tourism causality test results based on the Hsiao (1981) methodology and the ADF unit root test

	Countries
Tourism → Exports	Australia, Estonia, New Zealand, Slovenia, South Africa, US
Tourism ← Exports	Czech Republic, Italy
Tourism ↔ Exports	France, Germany, Hungary, Netherlands, Turkey
No causality	Poland, Portugal, Slovakia

Table 16: Export-tourism causality results based on the Hsiao (1981) methodology and the KPSS unit root test

Country	*Direction of causality*	*Cointegration*	*m**	*n**	*FPE (m*)*	*FPE (M*,n*)*	*Causality result*
Australia	Tourism=f(Exports)	NA	8	1	9.5049E+14	9.6174E+14	Tourism → Exports
	Exports=f(Tourism)		5	3	4.8886E+15	4.5434E+15	
Czech Republic	Tourism=f(Exports)	NA	5	10	1.4520E+14	1.4635E+14	No Causality
	Exports=f(Tourism)		1	1	1.7421E+15	1.8270E+15	
Estonia	Tourism=f(Exports)	NA	3	1	9.6273E+12	1.0051E+13	Tourism → Exports
	Exports=f(Tourism)		1	1	1.3692E+15	1.3402E+15	
France	Tourism=f(Exports)	NA	8	1	5.1827E+15	5.0809E+15	Tourism ↔ Exports
	Exports=f(Tourism)		2	3	4.5579E+17	4.3662E+17	
Germany	Tourism=f(Exports)	NA	7	4	7.1343E+14	6.4866E+14	Tourism ↔ Exports
	Exports=f(Tourism)		2	2	1.1593E+17	1.1093E+17	
Hungary	Tourism=f(Exports)	NA	4	1	5.3724E+13	5.5253E+13	No Causality
	Exports=f(Tourism)		3	1	3.0813E+14	3.1304E+14	
Italy	Tourism=f(Exports)	NA	7	2	3.5578E+15	3.2627E+15	Exports → Tourism
	Exports=f(Tourism)		13	1	2.0952E+16	2.1324E+16	
Netherlands	Tourism=f(Exports)	NO	5	2	5.5304E+14	5.3737E+14	Tourism ↔ Exports
	Exports=f(Tourism)		3	1	1.7075E+17	1.6441E+17	
New Zealand	Tourism=f(Exports)	NA	7	1	3.8559E+14	3.8577E+14	Tourism → Exports
	Exports=f(Tourism)		14	3	1.6621E+14	1.4226E+14	
Poland	Tourism=f(Exports)	NO	4	1	5.1363E+14	5.3033E+14	No Causality
	Exports=f(Tourism)		2	1	1.3296E+16	1.3661E+16	
Portugal	Tourism=f(Exports)	NA	7	1	1.6128E+15	1.6619E+15	No Causality
	Exports=f(Tourism)		5	1	3.9198E+15	4.0476E+15	
Slovakia	Tourism=f(Exports)	NA	2	1	1.2850E+13	1.2333E+13	Exports → Tourism
	Exports=f(Tourism)		2	3	1.2200E+14	1.2211E+14	

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Slovenia	Tourism=f(Exports)	NA	10	1	1.0235E+13	1.0499E+13	Tourism → Exports
	Exports=f(Tourism)		1	8	3.7549E+13	3.6505E+13	
South Africa	Tourism=f(Exports)	NA	11	1	1.1913E+15	1.2185E+15	Tourism → Exports
	Exports=f(Tourism)		1	3	3.3050E+15	3.2055E+15	
Turkey	Tourism=f(Exports)	NA	11	2	1.2290E+15	1.2871E+15	Tourism → Exports
	Exports=f(Tourism)		6	10	5.1167E+15	4.1629E+15	
US	Tourism=f(Exports)	NO	8	1	7.8425E+15	7.9843E+15	Tourism → Exports
	Exports=f(Tourism)		7	8	2.9804E+17	2.2541E+17	

Note: (1) NA means not applicable. (2) The maximum lag length is set at 20 per cent of total observations (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The maximum number of lags is set at 15 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 14 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 13 for the Czech Republic (64 observations) and Slovenia (64 observations). It is set at 12 for Slovakia (60 observations), at 11 for Turkey (56 observations) and at 10 for Estonia (48 observations).

Table 17: Summary of exports-tourism causality test results based on the Hsiao (1981) methodology and the KPSS unit root test

	Countries
Tourism → Exports	Australia, Estonia, New Zealand, Slovenia, South Africa, Turkey US
Tourism ← Exports	Italy, Slovakia
Tourism ↔ Exports	France, Germany, Netherlands
No causality	Czech Republic, Hungary, Poland, Portugal

Table 18: Imports-tourism causality results based on the Hsiao (1981) methodology and the ADF unit root test

Country	*Direction of causality*	*Cointegration*	*m**	*n**	*FPE (m*)*	*FPE (M*,n*)*	*Causality result*
Australia	Tourism=f(Imports)	YES	8	4	9.5049E+14	8.6899E+14	Tourism ↔ Imports
	Imports=f(Tourism)		3	2	2.4216E+15	1.6578E+15	
Czech Republic	Tourism=f(Imports)	NO	3	7	1.1200E+14	9.3321E+13	Imports → Tourism
	Imports=f(Tourism)		4	1	2.6315E+15	2.6607E+15	
Estonia	Tourism=f(Imports)	NA	3	1	9.6273E+12	9.3945E+12	Imports → Tourism
	Imports=f(Tourism)		2	3	7.1097E+14	7.2368E+14	
France	Tourism=f(Imports)	NA	8	1	5.1827E+15	5.3430E+15	Tourism → Imports
	Imports=f(Tourism)		5	3	6.4069E+16	6.3607E+16	
Germany	Tourism=f(Imports)	NA	7	14	7.1343E+14	7.0452E+14	Tourism ↔ Imports
	Imports=f(Tourism)		1	1	2.1377E+17	2.0957E+17	
Hungary	Tourism=f(Imports)	YES	4	14	5.5457E+13	4.5949E+13	Tourism ↔ Imports
	Imports=f(Tourism)		1	1	2.7528E+15	2.5722E+15	
Italy	Tourism=f(Imports)	NA	7	7	3.5578E+15	3.5006E+15	Tourism ↔ Imports
	Imports=f(Tourism)		2	2	2.8725E+16	2.5278E+16	
Netherlands	Tourism=f(Imports)	NO	5	1	5.5304E+14	5.6921E+14	Tourism → Imports
	Imports=f(Tourism)		1	2	5.7770E+16	5.6103E+16	
New Zealand	Tourism=f(Imports)	NO	7	2	3.8559E+14	3.6192E+14	Tourism ↔ Imports
	Imports=f(Tourism)		13	11	2.9368E+14	2.3286E+14	
Poland	Tourism=f(Imports)	NO	4	2	5.1363E+14	5.0595E+14	Tourism ↔ Imports
	Imports=f(Tourism)		2	1	2.7504E+15	2.7148E+15	
Portugal	Tourism=f(Imports)	NA	7	9	1.6128E+15	1.5550E+15	Imports → Tourism
	Imports=f(Tourism)		1	1	1.0473E+16	1.0836E+16	
Slovakia	Tourism=f(Imports)	NO	1	2	1.3097E+13	1.3125E+13	Tourism → Imports
	Imports=f(Tourism)		11	7	1.4097E+15	1.0830E+15	

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Slovenia	Tourism=f(Imports)	YES	10	1	1.0235E+13	9.6019E+12	Tourism ↔ Imports
	Imports=f(Tourism)		1	5	6.5720E+13	5.4716E+13	
South Africa	Tourism=f(Imports)	NO	12	11	1.2160E+15	1.1118E+15	Tourism ↔ Imports
	Imports=f(Tourism)		2	3	2.4986E+16	2.4293E+16	
Turkey	Tourism=f(Imports)	NA	11	1	1.1438E+15	1.1882E+15	Tourism → Imports
	Imports=f(Tourism)		5	11	5.1163E+15	3.3608E+15	
US	Tourism=f(Imports)	NO	8	1	7.8425E+15	8.0851E+15	Tourism → Imports
	Imports=f(Tourism)		4	4	3.3086E+17	2.9623E+17	

Note: (1) NA means not applicable. (2) The maximum lag length is set at 20 per cent of total observations (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The maximum number of lags is set at 15 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 14 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 13 for the Czech Republic (64 observations) and Slovenia (64 observations). It is set at 12 for Slovakia (60 observations), at 11 for Turkey (56 observations) and at 10 for Estonia (48 observations).

Table 19: Summary of imports-tourism causality test results based on the Hsiao (1981) methodology and the ADF unit root test

	Countries
Tourism → Exports	France, Netherlands, Slovakia, Turkey, US
Tourism ← Exports	Czech Republic, Estonia, Portugal
Tourism ↔ Exports	France, Germany, Netherlands
No causality	Australia, Germany, Hungary, Italy, New Zealand, Poland, Slovenia, South Africa

Table 20: Imports-tourism causality results based on the Hsiao (1981) methodology and the KPSS unit root test

Country	*Direction of causality*	*Cointegration*	*m**	*n**	*FPE (m*)*	*FPE (M*,n*)*	*Causality result*
Australia	Tourism=f(Imports)	YES	8	4	9.5049E+14	8.6899E+14	Tourism ↔ Imports
	Imports=f(Tourism)		3	2	2.4216E+15	1.6578E+15	
Czech Republic	Tourism=f(Imports)	NO	3	7	1.1200E+14	9.3321E+13	Imports → Tourism
	Imports=f(Tourism)		4	1	2.6315E+15	2.6607E+15	
Estonia	Tourism=f(Imports)	NO	3	1	9.6273E+12	9.7488E+12	No Causality
	Imports=f(Tourism)		3	3	7.0636E+14	7.2365E+14	
France	Tourism=f(Imports)	NO	8	1	5.1827E+15	5.3430E+15	No Causality
	Imports=f(Tourism)		7	3	6.9294E+16	6.9298E+16	
Germany	Tourism=f(Imports)	NO	7	14	7.1343E+14	7.0406E+14	Imports → Tourism
	Imports=f(Tourism)		9	1	2.0768E+17	2.1148E+17	
Hungary	Tourism=f(Imports)	NA	4	14	5.3724E+13	5.1482E+13	Imports → Tourism
	Imports=f(Tourism)		11	1	3.3712E+15	3.4736E+15	
Italy	Tourism=f(Imports)	NA	7	7	3.5578E+15	3.5006E+15	Tourism ↔ Imports
	Imports=f(Tourism)		2	2	2.8725E+16	2.5278E+16	
Netherlands	Tourism=f(Imports)	NO	5	1	5.5304E+14	5.6921E+14	Tourism → Imports
	Imports=f(Tourism)		1	2	5.7770E+16	5.6103E+16	
New Zealand	Tourism=f(Imports)	NA	7	2	3.8559E+14	3.7095E+14	Tourism ↔ Imports
	Imports=f(Tourism)		15	11	2.7434E+14	2.1708E+14	
Poland	Tourism=f(Imports)	NO	4	2	5.1363E+14	5.0595E+14	Tourism ↔ Imports
	Imports=f(Tourism)		2	1	2.7504E+15	2.7148E+15	
Portugal	Tourism=f(Imports)	NA	7	7	1.6128E+15	1.5550E+15	Imports → Tourism
	Imports=f(Tourism)		1	1	1.0473E+16	1.0836E+16	
Slovakia	Tourism=f(Imports)	NA	1	2	1.2850E+13	1.3178E+13	Tourism → Imports
	Imports=f(Tourism)		11	11	1.4097E+15	9.8155E+14	

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Slovenia	Tourism=f(Imports)	YES	10	1	1.0235E+13	9.6019E+12	Tourism ⟷ Imports
	Imports=f(Tourism)		1	5	6.5720E+13	5.4716E+13	
South Africa	Tourism=f(Imports)	NA	11	12	1.1913E+15	1.0516E+15	Tourism ⟷ Imports
	Imports=f(Tourism)		2	4	2.4986E+16	2.4645E+16	
Turkey	Tourism=f(Imports)	NO	11	1	1.2290E+15	1.2913E+15	Tourism → Imports
	Imports=f(Tourism)		4	8	5.7050E+15	3.0488E+15	
US	Tourism=f(Imports)	NO	8	1	7.8425E+15	8.0851E+15	Tourism → Imports
	Imports=f(Tourism)		4	4	3.3086E+17	2.9623E+17	

Note: (1) NA means not applicable. (2) The maximum lag length is set at 20 per cent of total observations (Chontanawat *et al.*, 2006; Chontanawat *et al.*, 2008). The maximum number of lags is set at 15 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). It is set at 14 for Hungary (68 observations), Poland (68 observations) and Portugal (68 observations). It is set at 13 for the Czech Republic (64 observations) and Slovenia (64 observations). It is set at 12 for Slovakia (60 observations), at 11 for Turkey (56 observations) and at 10 for Estonia (48 observations).

Table 21: Summary of imports-tourism causality test results based on the Hsiao (1981) methodology and the KPSS unit root test

	Countries
Tourism → Imports	Netherlands, Slovakia, Turkey, US
Tourism ← Imports	Czech Republic, Germany, Hungary, Portugal
Tourism ⟷ Imports	Australia, Italy, New Zealand, Poland, Slovenia, South Africa
No causality	Estonia, France

5. Concluding remarks

The previous literature, testing the trade-tourism link, has found mixed results. However, the results presented in this paper suggest a unidirectional/bidirectional causal relationship in the significant majority of cases considered. Therefore, by utilising a novel variable specification, including the use of bilateral data, this paper has provided evidence of a causal relationship between tourism expenditure of UK residents and trade in goods. Given the lack of literature that examines the causal relationship for UK data, this paper provides important new evidence on the importance of the trade-tourism link, in terms of attracting UK tourists and the expansion of host country export industries. Policy makers in the UK should also be mindful of the potential of welfare gains from increased product variety.

These results also call into question the findings of the tourism demand modelling literature, given the evidence of simultaneity bias and omitted variables. Therefore, further research should adopt an appropriate modelling approach, such as structural equation modelling, to avoid simultaneity bias (Nunkoo *et al.*, 2013).

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Appendix A: ADF unit root tests

	Level		*First difference*		*Second difference*		*Order of integ'n.*
	k	*Test statistic*	*k*	*Test statistic*	*k*	*Test statistic*	
Australia							
Exchange rate	9	-0.835 (0.9567) (CT)	11	-1.628* (0.0971) (N)			I(1)
Tourism	8	-0.347 (0.9876) (CT)	0	-0.732***(0.0000)(N)			I(1)
Trade	3	-3.167** (0.0261) (C)					I(0)
Exports	3	-2.709* (0.0774) (C)					I(0)
Imports	11	0.012 (0.9956) (CT)	0	-11.842***(0.0000)(N)			I(1)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657)(CT)	1	-5.145***(0.0000)(N)	I(2)
Czech Republic							
Exchange rate	0	-3.404*(0.0599) (CT)					I(0)
Tourism	3	-0.105 (0.6434) (N)	0	-11.241***(0.0000) (N)			I(1)
Trade	0	-2.621(0.2727) (CT)	0	-7.266***(0.0000) (C)			I(1)
Exports	0	-4.369***(0.0048) (CT)					I(0)
Imports	4	-1.679 (0.7481) (CT)	0	-7.744***(0.0000) (C)			I(1)
UK GDP	3	-2.270 (0.1848)(C)	0	-3.111[a] (0.1130) (CT)			I(1)
Estonia							
Exchange rate	0	-2.383 (0.3831)(CT)	0	-7.278***(0.0000) (C)			I(1)
Tourism	3	-0.621 (0.4426)(N)	0	-8.414***(0.0000) (N)			I(1)
Trade	3	-2.194 (0.2112)(C)	0	-10.251***(0.0000) (N)			I(1)
Exports	3	-2.557[a](0.1096)(C)					I(0)
Imports	0	-4.958***(0.0011)(CT)					I(0)
UK GDP	3	-2.290(0.1795) (C)	0	-2.326** (0.0209) (N)			I(1)

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France							
Exchange rate	1	-0.166 (0.6228) (N)					I(1)
Tourism	3	0.615 (0.9994) (CT)	2	-3.446*** (0.0008) (N)			I(1)
Trade	0	-3.668*** (0.0065) (C)	0	12.721*** (0.0000) (N)			I(0)
Exports	0	-3.841*** (0.0039) (C)					I(0)
Imports	0	-4.711*** (0.0015) (CT)					I(0)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657) (CT)	1	-5.145***(0.0000) (N)	I(2)
Germany							
Exchange rate	1	-0.140 (0.6321) (N)	3	-3.167*** (0.0019) (N)			I(1)
Tourism	7	-1.759 (0.3974) (C)	0	-9.746*** (0.0000) (N)			I(1)
Trade	0	-2.758 (0.2174) (CT)	0	-7.146*** (0.0000) (N)			I(1)
Exports	0	-2.988 (0.1425) (CT)	0	-7.811*** (0.0000) (N)			I(1)
Imports	0	3.063[a] (0.1228) (CT)					I(0)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657) (CT)	1	-5.145*** (0.0000) (N)	I(2)
Hungary							
Exchange rate	1	-2.053 (0.5619) (CT)	10	-1.520[a](0.1195) (N)			I(1)
Tourism	3	0.056 (0.6972) (N)	0	-12.483***(0.0000) (N)			I(1)
Trade	7	-2.133 (0.5174) (CT)	0	-12.995***(0.0000) (C)			I(1)
Exports	3	-1.461 (0.5469) (C)	1	-5.776*** (0.0000) (N)			I(1)
Imports	7	-2.171 (0.4963) (CT)	11	-0.965 (0.2951) (N)	0	-17.516*** (0.0000)	I(2)
UK GDP	3	-2.238 (0.1952) (C)	11	-0.999 (0.2813) (N)	1	-4.713*** (0.0000) (N)	I(2)
Italy							
Exchange rate	0	-1.780 (0.7044) (CT)	2	-4.218***(0.0001)(N)			I(1)
Tourism	7	-1.615 (0.4697) (C)	0	-10.016***(0.0000)(N)			I(1)
Trade	3	-2.824* (0.0599) (C)					I(0)
Exports	3	-2.976 (0.1460) (CT)	0	-10.157***(0.0000)(N)			I(1)
Imports	1	-3.426* (0.0557) (CT)					I(0)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657) (CT)	1	-5.145*** (0.0000) (N)	I(2)
Netherlands							
Exchange rate	1	-0.373 (0.5468) (N)	2	-3.297*** (0.0013) (N)			I(1)
Tourism	3	-2.307 (0.1728) (C)	0	-10.570***(0.0000)(N)			I(1)
Trade	0	1.291 (0.9491) (N)	0	-8.010*** (0.0000) (N)			I(1)
Exports	6	-1.501 (0.5272) (C)	0	-9.104*** (0.0000) (N)			I(1)
Imports	0	-1.918 (0.6355) (CT)	0	-7.676*** (0.0000) (C)			I(1)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657) (CT)	1	-5.145*** (0.0000) (N)	I(2)
New Zealand							
Exchange rate	1	-0.855 (0.3425) (N)	7	-2.300**(0.0217) (N)			I(1)
Tourism	7	-1.658 (0.4476) (C)	0	-12.168***(0.0000) (N)			I(1)
Trade	8	-0.751 (0.3875) (N)	0	-12.288***(0.0000) (N)			I(1)
Exports	3	-0.635 (0.4388) (N)	0	-11.034***(0.0000) (N)			I(1)
Imports	8	-0.141 (0.6313) (N)	0	-11.427***(0.0000) (N)			I(1)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733(0.9657) (CT)	1	-5.145*** (0.0000)(N)	I(2)
Poland							
Exchange rate	0	-2.635 (0.2668) (CT)	1	-5.136*** (0.0000) (N)			I(1)
Tourism	4	-1.820 (0.6831) (CT)	8	-1.266 (0.1870) (N)	0	-18.971*** (0.0000)(N)	I(2)
Trade	8	-0.383 (0.9860) (CT)	11	-0.379 (0.5433) (N)	0	-10.880*** (0.0000)(N)	I(2)
Exports	9	-0.845 (0.9550) (CT)	0	-9.175*** (0.0000) (N)			I(1)
Imports	11	-0.230 (0.9908) (CT)	0	-6.861***(0.0000) (CT)			I(1)
UK GDP	3	-2.238 (0.1952) (C)	11	-0.999 (0.2813) (N)	1	-4.713*** (0.0000)(N)	I(2)

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Portugal							
Exchange rate	0	-1.966 (0.6088) (CT)	2	-3.254***(0.0015) (N)			I(1)
Tourism	7	0.311 (0.7724) (N)	0	-8.648***(0.0000) (N)			I(1)
Trade	0	-4.465***(0.0035) (CT)					I(0)
Exports	0	-4.330***(0.0052) (CT)					I(0)
Imports	0	-5.052***(0.0005) (CT)					I(0)
UK GDP	3	-2.238 (0.1952) (C)	11	-0.999 (0.2813) (N)	1	-4.713***(0.0000)(N)	I(2)
Slovakia							
Exchange rate	0	-2.402 (0.3747) (CT)	6	-2.356 (0.1592) (C)	0	-12.090***(0.0000)(N)	I(2)
Tourism	1	-2.429 (0.3612) (CT)	1	-6.548*** (0.0000) (N)			I(1)
Trade	2	-1.779 (0.7017) (CT)	7	-1.192 (0.2106) (N)	0	-17.796***(0.0000)(N)	I(2)
Exports	1	-3.574**(0.0410) (CT)					I(0)
Imports	1	-1.913 (0.6348) (CT)	7	-1.038 (0.2657) (N)	0	-18.141***(0.0000)(N)	I(2)
UK GDP	3	-2.281 (0.1814) (C)	0	-2.339** (0.0199) (N)			I(1)
Slovenia							
Exchange rate	0	-3.111[a] (0.1129) (CT)					I(0)
Tourism	10	-0.444 (0.5178) (N)	0	-12.054***(0.0000) (N)			I(1)
Trade	1	-3.045[a] (0.1288) (CT)					I(0)
Exports	2	-4.093**(0.0106) (CT)					I(0)
Imports	1	-2.750 (0.2211) (CT)	1	-5.736***(0.0000) (N)			I(1)
UK GDP	3	-2.270 (0.1848) (C)	0	-3.111[a] (0.1130) (CT)			I(1)
South Africa							
Exchange rate	0	-1.923 (0.3203) (C)	2	-4.055 (0.0001)(N)			I(1)
Tourism	7	-1.184 (0.9057) (CT)	0	-11.322*** (0.0000)(N)			I(1)
Trade	2	-2.362 (0.1561) (C)	0	-11.845*** (0.0000)(N)			I(1)
Exports	3	-2.159 (0.2229) (C)	0	-11.662*** (0.0000)(N)			I(1)
Imports	2	-1.724 (0.4150) (C)	0	-12.471*** (0.0000)(N)			I(1)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657)(CT)	1	-5.145*** (0.0000) (N)	I(2)
Turkey							
Exchange rate	0	-3.624** (0.0368)(CT)					I(0)
Tourism	0	-6.627***(0.0000)(CT)					I(0)
Trade	3	-4.692*** (0.0003) (C)					I(0)
Exports	1	-3.037 (0.1321) (CT)	1	-5.423***(0.0000) (N)			I(1)
Imports	4	-2.694* (0.0820) (C)					I(0)
UK GDP	3	-2.214 (0.2041) (C)	0	-2.286**(0.0228) (N)			I(1)
US							
Exchange rate	2	-2.236 (0.1957) (C)	0	-5.970***(0.0000) (N)			I(1)
Tourism	7	-1.141 (0.9140) (CT)	0	-9.444***(0.0000) (N)			I(1)
Trade	7	-1.714 (0.7342) (CT)	5	-2.814***(0.0055) (N)			I(1)
Exports	10	-0.557 (0.9781) (CT)	0	-14.725***(0.0000) (N)			I(1)
Imports	7	-2.484 (0.3347) (CT)	0	-10.828***(0.0000) (N)			I(1)
UK GDP	3	-2.049 (0.2658) (C)	13	-0.733 (0.9657) (CT)	1	-5.145*** (0.0000) (N)	I(2)

Notes: (1) The optimum lag length (k) is selected by MAIC. Hsiao and Hsiao (2006) choose maximum lags as 3 for a sample of 19 observations. The maximum lags are chosen as 13 for Australia (76 observations), France (76 observations), Germany (76 observations), Italy (76 observations), Netherlands (76 observations), New Zealand (76 observations), South Africa (76 observations) and US (76 observations). They are chosen as 11 for the Czech Republic (64 observations), Hungary (68 observations), Poland (68 observations), Portugal (68 observations) and Slovenia (64 observations). They are chosen as 10 for Slovakia (60 observations), as 9 for Turkey (56 observations) and as 8 for Estonia (48 observations). (2) ***, **, * denote rejection of the null hypothesis at the 1 per cent, 5 per cent and 10 per cent levels of significance respectively. Superscript 'a' means marginally significant at the 10 per cent level of significance. (3) The numbers in the brackets are MacKinnon (1996) one-sided p-values. (4) C: the equation includes only the constant, CT: the equation includes constant and trend, N: the equation does not include constant or trend. C, CT and N are determined based on the significance level of constant and trend in the unit root test equation.

APPENDIX B: KPSS UNIT ROOT TESTS

	Level		*First difference*		*Second difference*		*Order of*
	k	*LM statistic*	*k*	*LM statistic*	*k*	*LM statistic*	*integ'n.*
Australia							
Exchange rate	6	0.262*** (CT)	0	0.060 (CT)			I(1)
Tourism	5	0.319*** (CT)	13	0.180 (C)			I(1)
Trade	5	0.212 (C)					I(0)
Exports	5	0.158 (C)					I(0)
Imports	6	0.262*** (CT)	23	0.315 (C)			I(1)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)
Czech Republic							
Exchange rate	5	0.130* (CT)	3	0.138 (C)			I(1)
Tourism	6	0.199** (CT)	46	0.397* (C)	22	0.174 (C)	I(2)
Trade	5	0.197** (CT)	8	0.170 (C)			I(1)
Exports	4	0.052 (CT)					I(0)
Imports	5	0.233*** (CT)	3	0.136 (C)			I(1)
UK GDP	6	0.221*** (CT)	4	0.068 (CT)			I(1)
Estonia							
Exchange rate	5	0.063 (CT)	15	0.187 (C)			I(0)
Tourism	4	0.200** (CT)					I(1)
Trade	3	0.111 (CT)					I(0)
Exports	2	0.102 (CT)	21	0.255 (C)			I(0)
Imports	3	0.127* (CT)	4	0.055 (CT)			I(1)
UK GDP	5	0.202** (CT)					I(1)
France							
Exchange rate	6	0.261 (C)					I(0)
Tourism	32	0.151** (CT)	12	0.192 (C)			I(1)
Trade	5	0.156** (CT)	57	0.351* (C)	17	0.128 (C)	I(2)
Exports	5	0.171 (C)					I(0)
Imports	5	0.167** (CT)	31	0.272 (C)			I(1)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)
Germany							
Exchange rate	6	0.251 (C)	13	0.138 (C)			I(0)
Tourism	3	0.152** (CT)					I(1)
Trade	5	0.070 (CT)					I(0)
Exports	5	0.061 (CT)	14	0.113 (C)			I(0)
Imports	5	0.124* (CT)	4	0.095 (CT)			I(1)
UK GDP	6	0.228*** (CT)					I(1)
Hungary							
Exchange rate	6	0.125* (CT)	3	0.143 (C)			I(1)
Tourism	2	0.116 (CT)					I(0)
Trade	5	0.157** (CT)	39	0.331 (C)			I(1)
Exports	5	0.228*** (CT)	25	0.186 (C)			I(1)
Imports	5	0.213** (CT)	66	0.500**	15	0.169 (C)	I(2)
UK GDP	6	0.225*** (CT)	(C)				I(1)
			4	0.079 (CT)			
Italy							
Exchange rate	6	0.251*** (CT)					I(1)
Tourism	36	0.174** (CT)	3	0.229 (C)			I(1)
Trade	5	0.115 (CT)	12	0.195 (C)			I(0)

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Exports	4	0.267 (C)					I(0)
Imports	5	0.063 (CT)					I(0)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)
Netherlands							
Exchange rate	6	0.232*** (CT)	5	0.170 (C)			I(1)
Tourism	3	0.368*** (CT)	13	0.170 (C)			I(1)
Trade	5	0.155** (CT)	7	0.114 (C)			I(1)
Exports	5	0.136* (CT)	24	0.150 (C)			I(1)
Imports	6	0.156** (CT)	0	0.117 (C)			I(1)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)
New Zealand							
Exchange rate	6	0.215** (CT)	3	0.180 (C)			I(1)
Tourism	7	0.180** (CT)	12	0.076 (C)			I(1)
Trade	1	0.181** (CT)	13	0.090 (C)			I(1)
Exports	5	0.111 (CT)					I(0)
Imports	25	0.232 (C)					I(0)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)
Poland							
Exchange rate	5	0.130* (CT)	4	0.058 (C)			I(1)
Tourism	5	0.182** (CT)	13	0.112 (C)			I(1)
Trade	6	0.256*** (CT)	11	0.345 (C)			I(1)
Exports	5	0.225*** (CT)	13	0.107 (C)			I(1)
Imports	6	0.269*** (CT)	35	0.250*** (CT)	18	0.146 (C)	I(2)
UK GDP	6	0.225*** (CT)	4	0.079 (CT)			I(1)
Portugal							
Exchange rate	6	0.196** (CT)	4	0.239 (C)			I(1)
Tourism	15	0.150** (CT)	12	0.175 (C)			I(1)
Trade	3	0.067 (CT)					I(0)
Exports	3	0.056 (CT)					I(0)
Imports	3	0.078 (CT)					I(0)
UK GDP	6	0.225*** (CT)	4	0.079 (CT)			I(1)
Slovakia							
Exchange rate	5	0.104 (CT)					I(0)
Tourism	4	0.110 (CT)					I(0)
Trade	6	0.171** (CT)	6	0.162 (C)			I(1)
Exports	3	0.079 (CT)					I(0)
Imports	6	0.173** (CT)	12	0.168 (C)			I(1)
UK GDP	6	0.214** (CT)	4	0.056 (CT)			I(1)
Slovenia							
Exchange rate	5	0.215** (CT)	3	0.103 (CT)			I(1)
Tourism	4	0.133* (CT)	12	0.166 (C)			I(1)
Trade	5	0.094 (CT)					I(0)
Exports	1	0.046 (CT)					I(0)
Imports	5	0.119* (CT)	18	0.316 (C)			I(1)
UK GDP	6	0.221*** (CT)	4	0.068 (CT)			I(1)

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South Africa							
Exchange rate	6	0.224*** (CT)	3	0.149 (C)			I(1)
Tourism	1	0.332 (C)					I(0)
Trade	5	0.181** (CT)	9	0.216 (C)			I(1)
Exports	5	0.106 (CT)					I(0)
Imports	6	0.205** (CT)	4	0.138 (C)			I(1)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)
Turkey							
Exchange rate	3	0.088 (CT)					I(0)
Tourism	15	0.144* (CT)	12	0.136 (C)			I(1)
Trade	5	0.178** (CT)	15	0.135* (CT)	12	0.192 (C)	I(2)
Exports	4	0.074 (CT)					I(0)
Imports	5	0.191** (CT)	2	0.239*** (CT)	12	0.244 (C)	I(2)
UK GDP	5	0.229*** (CT)	4	0.052 (CT)			I(1)
US							
Exchange rate	6	0.084 (C)					I(0)
Tourism	5	0.285*** (CT)	13	0.208 (C)			I(1)
Trade	6	0.262 (C)					I(0)
Exports	6	0.266*** (CT)	17	0.351* (C)	13	0.179 (C)	I(2)
Imports	6	0.228*** (CT)	44	0.291 (C)			I(1)
UK GDP	6	0.228*** (CT)	4	0.095 (CT)			I(1)

Notes: (1) The optimum lag length (k) is selected by Newey-West Bandwidth using the Bartlett Kernel estimation method. (2) ***, **, * denote rejection of the null hypothesis at the 1 per cent, 5 per cent and 10 per cent significance levels respectively. (3) C: the equation includes only the constant, CT: the equation includes constant and trend. C or CT is determined based on the significance level of constant and trend in the unit root test equation. (4) If the equation includes both constant and trend, the critical values are 0.215, 0.146 and 0.119 at the 1 per cent, 5 per cent and 10 per cent significance levels respectively. If the equation includes only constant, the critical values are 0.739, 0.463 and 0.347 at the 1 per cent, 5 per cent and 10 per cent significance levels respectively.

APPENDIX C: THE JOHANSEN COINTEGRATION TEST BETWEEN TRADE AND TOURISM, BASED ON THE ADF unit root test

Country	*Lags*	H_0	H_1	*Trace test*	*5% CV*	*Max Eigenvalue*	*5% CV*	*Cointe-gration*	*Results*	*Note*
Czech Republic	2	r = 0 r ≤ 1	r>0 r>1	5.011 0.475	15.495 3.841	4.536 0.475	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
Estonia	1	r = 0 r ≤ 1	r>0 r>1	23.069 7.695	20.262 9.165	15.374 7.695	15.892 9.165	No	Trace test indicates 1 cointegrating equation and Max-eigenvalue test indicates no cointegrating equation	Intercept in the data and CE
Germany	2	r = 0 r ≤ 1	r>0 r>1	14.787 0.774	15.495 3.841	14.013 0.774	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
Hungary	2	r = 0 r ≤ 1	r>0 r>1	25.114 0.213	15.495 3.841	24.901 0.213	14.265 3.841	Yes	Both tests indicate 1 cointegrating equation	Intercept and linear trend in the data, intercept in the CE
Netherlands	4	r = 0 r ≤ 1	r>0 r>1	10.535 2.113	20.262 9.165	8.423 2.113	15.892 9.165	No	Both tests indicate no cointegration	Intercept in the data and CE
New Zealand	4	r = 0 r ≤ 1	r>0 r>1	8.139 2.091	20.262 9.165	6.048 2.091	15.892 9.165	No	Both tests indicate no cointegration	Intercept in the data and CE
Poland	4	r = 0 r ≤ 1	r>0 r>1	4.789 0.208	15.495 3.841	4.581 0.208	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
Slovakia	2	r = 0 r ≤ 1	r>0 r>1	9.556 0.0002	15.495 3.841	9.556 0.0002	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
South Africa	4	r = 0 r ≤ 1	r>0 r>1	11.893 2.914	15.495 3.841	8.980 2.914	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
US	5	r = 0 r ≤ 1	r>0 r>1	14.870 4.303	15.495 3.841	10.567 4.303	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE

Notes: (1) CV is critical value. (2)The optimum lag is selected using the Schwarz criterion (Chontanawat *et al*, 2006; Chontanawat *et al*, 2008).

APPENDIX D: THE JOHANSEN COINTEGRATION TEST BETWEEN TRADE AND TOURISM, BASED ON THE KPSS UNIT ROOT TEST

Country	*Lags*	H_0	H_1	*Trace test*	*5% CV*	*Max Eigenvalue*	*5% CV*	*Cointe-gration*	*Results*	*Note*
Czech Republic	2	r = 0 r ≤ 1	r > 0 r > 1	5.011 0.475	15.495 3.841	4.536 0.475	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
France	4	r = 0 r ≤ 1	r > 0 r > 1	16.552 3.897	15.495 3.841	12.655 3.897	14.265 3.841	No	Trace test indicates 2 cointegrating equations and Max-Eigenvalue test indicates no cointegration	Intercept and linear trend in the data, intercept in the CE
Netherlands	4	r = 0 r ≤ 1	r > 0 r > 1	6.055 0.015	15.495 3.841	6.040 0.015	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
New Zealand	4	r = 0 r ≤ 1	r > 0 r > 1	7.942 1.925	15.495 3.841	6.017 1.925	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
Poland	4	r = 0 r ≤ 1	r > 0 r > 1	4.789 0.208	15.495 3.841	4.581 0.208	14.265 3.841	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
Turkey	4	r = 0 r ≤ 1	r > 0 r > 1	36.367 4.244	15.495 3.841	32.124 4.244	14.265 3.841	No	Both tests indicate 2 cointegrating equations	Intercept and linear trend in the data, intercept in the CE

Notes: (1) CV is critical value. (2)The optimum lag is selected using the Schwarz criterion (Chontanawat *et al*, 2006; Chontanawat *et al*, 2008).

APPENDIX E: THE JOHANSEN COINTEGRATION TEST BETWEEN EXPORTS AND TOURISM, BASED ON THE ADF UNIT ROOT TEST

Country	*Lags*	H_0	H_1	*Trace test*	*5% CV*	*Max Eigenvalue*	*5% CV*	*Cointe-gration*	*Results*	*Note*
Germany	4	r = 0	r > 0	12.099	15.495	10.284	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	1.816	3.841	1.816	3.841			
Hungary	1	r = 0	r > 0	36.713	20.262	31.796	15.892	Yes	Both tests indicate 1 cointegrating equation	Intercept in the data and CE
		r ≤ 1	r > 1	4.917	9.165	4.917	9.165			
Italy	5	r = 0	r > 0	18.384	15.495	13.057	14.265	No	Trace test indicates 2 cointegrating equations and Max-Eigenvalue test indicates no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	5.327	3.841	5.327	3.841			
Netherlands	4	r = 0	r > 0	11.706	20.262	9.481	15.892	No	Both tests indicate no cointegration	Intercept in the data and CE
		r ≤ 1	r > 1	2.225	9.165	2.225	9.165			
New Zealand	4	r = 0	r > 0	8.583	20.262	6.234	15.892	No	Both tests indicate no cointegration	Intercept in the data and CE
		r ≤ 1	r > 1	2.349	9.165	2.349	9.165			
Poland	4	r = 0	r > 0	9.898	15.495	9.625	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.274	3.841	0.274	3.841			
South Africa	4	r = 0	r > 0	9.829	15.495	7.801	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	2.028	3.841	2.028	3.841			
US	4	r = 0	r > 0	19.194	15.495	15.221	14.265	No	Both tests indicate 2 cointegrating equations	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	3.974	3.841	3.974	3.841			

Notes: (1) CV is critical value. (2)The optimum lag is selected using the Schwarz criterion (Chontanawat *et al*, 2006; Chontanawat *et al*, 2008).

APPENDIX F: THE JOHANSEN COINTEGRATION TEST BETWEEN EXPORT AND TOURISM, BASED ON THE KPSS UNIT ROOT TEST

Country	*Lags*	H_0	H_1	*Trace test*	*5% CV*	*Max Eigenvalue*	*5% CV*	*Cointe-gration*	*Results*	*Note*
Netherlands	4	r = 0	r > 0	9.700	15.495	7.657	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	2.043	3.841	2.043	3.841			
Poland	4	r = 0	r > 0	9.898	15.495	9.625	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.274	3.841	0.274	3.841			
US	4	r = 0	r > 0	19.194	15.495	15.221	14.265	No	Both tests indicate 2 cointegrating equations	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	3.974	3.841	3.974	3.841			

Notes: (1) CV is critical value. (2)The optimum lag is selected using the Schwarz criterion (Chontanawat *et al*, 2006; Chontanawat *et al*, 2008).

APPENDIX G: THE JOHANSEN COINTEGRATION TEST BETWEEN IMPORTS AND TOURISM, BASED ON THE ADF UNIT ROOT TEST

Country	*Lags*	H_0	H_1	*Trace test*	*5% CV*	*Max Eigenvalue*	*5% CV*	*Cointe-gration*	*Results*	*Note*
Australia	4	r = 0	r > 0	17.385	15.495	15.400	14.265	Yes	Both tests indicate 1 cointegrating equation	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	1.986	3.841	1.986	3.841			
Czech Republic	1	r = 0	r > 0	6.292	15.495	6.006	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.287	3.841	0.287	3.841			
Hungary	2	r = 0	r > 0	25.214	15.495	24.949	14.265	Yes	Both tests indicate 1 cointegrating equation	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.264	3.841	0.264	3.841			

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Netherlands	4	r = 0	r > 0	6.049	15.495	5.622	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.428	3.841	0.428	3.841			
New Zealand	4	r = 0	r > 0	13.526	20.262	11.186	15.892	No	Both tests indicate no cointegration	Intercept in the data and CE
		r ≤ 1	r > 1	2.340	9.165	2.340	9.165			
Poland	4	r = 0	r > 0	11.035	15.495	10.643	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.392	3.841	0.392	3.841			
Slovakia	2	r = 0	r > 0	11.015	15.495	10.953	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.062	3.841	0.062	3.841			
Slovenia	1	r = 0	r > 0	36.360	15.495	35.437	14.265	Yes	Both tests indicate 1 cointegrating equation	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.923	3.841	0.923	3.841			
South Africa	4	r = 0	r > 0	10.454	15.495	7.221	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	3.232	3.841	3.232	3.841			
US	5	r = 0	r > 0	13.021	15.495	8.873	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 0	r > 1	4.148	3.841	4.148	3.841			

Notes: (1) CV is critical value. (2)The optimum lag is selected using the Schwarz criterion (Chontanawat *et al*, 2006; Chontanawat *et al*, 2008).

APPENDIX H: THE JOHANSEN COINTEGRATION TEST BETWEEN IMPORTS AND TOURISM, BASED ON THE KPSS UNIT ROOT TEST

Country	*Lags*	H_0	H_1	*Trace test*	*5% CV*	*Max Eigenvalue*	*5% CV*	*Cointe-gration*	*Results*	*Note*
Australia	4	r = 0	r > 0	17.385	15.495	15.400	14.265	Yes	Both tests indicate 1 cointegrating equation	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	1.986	3.841	1.986	3.841			
Czech Republic	1	r = 0	r > 0	6.292	15.495	6.006	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.287	3.841	0.287	3.841			
Estonia	1	r = 0	r > 0	17.099	15.495	11.601	14.265	No	Trace test indicates 2 cointegrating equations and Max-Eigenvalue test indicates no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	5.498	3.841	5.498	3.841			
France	4	r = 0	r > 0	15.607	15.495	12.445	14.265	No	Trace test indicates 1 cointegrating equation and Max-Eigenvalue test indicates no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	3.162	3.841	3.162	3.841			
Germany	4	r = 0	r > 0	7.988	15.495	7.359	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.629	3.841	0.629	3.841			
Netherlands	4	r = 0	r > 0	6.049	15.495	5.622	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.428	3.841	0.428	3.841			
Poland	4	r = 0	r > 0	11.035	15.495	10.643	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.392	3.841	0.392	3.841			
Slovenia	1	r = 0	r > 0	36.360	15.495	35.437	14.265	Yes	Both tests indicate 1 cointegrating equation	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	0.923	3.841	0.923	3.841			
Turkey	4	r = 0	r > 0	33.928	15.495	28.683	14.265	No	Both tests indicate 2 cointegrating equations	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	5.245	3.841	5.245	3.841			
US	5	r = 0	r > 0	13.021	15.495	8.873	14.265	No	Both tests indicate no cointegration	Intercept and linear trend in the data, intercept in the CE
		r ≤ 1	r > 1	4.148	3.841	4.148	3.841			

Notes: (1) CV is critical value. (2)The optimum lag is selected using the Schwarz criterion (Chontanawat *et al*, 2006; Chontanawat *et al*, 2008).

ENDNOTES

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2. Tourist expenditure data were only available from 1996q1-2011q4 for the Czech Republic, 2000q1-2011q4 for Estonia, 1995q1-2011q4 for Hungary, 1995q1-2011q4 for Poland, 1995q1-2011q4 for Portugal, 1997q1-2011q4 for Slovakia, 1996q1-2011q4 for Slovenia, 1998q1-2011q4 for Turkey.

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