5. THE INFLUENCE OF INFORMATION TECHNOLOGIES AND INTERNATIONAL TOURISM ON TRADE

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Abstract

This study investigates the influence of international tourism on trade activities in the context of the information technology age. In particular, the effects of international (arrival) and outbound tourists on trade, exports, imports, and sub-sectors (goods, manufacturing, merchandise, and total goods and services) and, notably, the catalytic role of the Internet (and mobile usage) are analysed. The study applies a robust twostep system generalized method of moments (GMM) estimate for panel data on 81 economies from 2002 to 2017 show interesting findings. First, the positive effects of international tourism on trade activities are reaffirmed. Second, the development of information technology appears to reduce these positive effects. The results may imply that information technology changes the demand components in international travel: decrease in business trips and increase in non-business trips consistent with the reduction in communication and transaction costs.

Keywords*: Tourism; demand; trade; Internet; mobile phone.*

JEL code*: Z32, F14, L86.*

1. Introduction

The influence of international tourism on trade activities has been extensively studied in the literature (*e.g.*, see Ongan and Gocer (2020) among others). Santana-Gallego, Ledesma-Rodríguez *et al.* (2016) summarise three basic channels[4] in which international tourism can enhance trade relationships between countries; namely, the preference of travellers (see Brau

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[4] *These basic channels are based on the theory of the effects of immigration on trade activities (see more detail in Santana-Gallego, Ledesma-Rodríguez et al. (2016)).*

and Maria Pinna , 2013), the reduction in transaction costs (see Kulendran and Wilson, 2000), and the promotion of market size (see Khan, Toh *et al.*, 2005).

This article contributes to the literature by (*i*) revisiting the influence of international tourism on different trade activities; and (*ii*) analysing the catalytic role of information technology in this relationship. In particular, this study focuses on the second channel in the influence of international tourism on trade activities, namely, the reduction in transaction costs (Kulendran and Wilson, 2000) to explain the catalytic role of information technology.

According to Sinclair (1998), international travel helps reduce information deficiency (or information asymmetry) in aspects of contracts and production that then mitigate market failures in trade activities. Kulendran and Wilson (2000) add that international trips can be business trips or non-business trips (*i.e.*, leisure, visiting relatives and friends, education, and others), whereas business trips are the main component in stimulating trade activities. This study argues that information technology may change the components of international trips, since information technology, especially the Internet, improves the effectiveness of communications and transactions (Suvankulov, Chi Keung Lau *et al.*, 2012). Furthermore, the development of information technology reduces both the time and cost of economic and human activities (Cappelli, 2001). As a result, information technology may have an important moderation effect on the influence of international tourism on trade activities.

Empirically, the study carries out a comprehensive analysis for a global sample of 81 economies in the period 2002–2017, as per data availability. The influence of international tourism (including international arrivals and outbound departures) on trade activities is estimated, including total trade, total exports, total imports, exports/imports of goods. Internet usage and its interaction term with international tourism are then added to the model to examine the role of information technology in the influence of international tourism on trade. The number of mobile phone subscriptions is used as an alternative proxy for information technology for the purpose of robustness checks.

The remainder of the study is structured as follows. The next section is the literature review. The methodology and data are in Section 3. Section 4 is the empirical results and discussion. The final section presents the conclusion.

2. Literature review

2.1. International tourism and trade activities: a summary

According to Santana-Gallego, Ledesma-Rodríguez *et al.* (2016), the theoretical background of the influence of international tourism on international trade is derived from the theory explaining the effects of immigration on trade activities. [5] Specifically, Santana-Gallego, Ledesma-Rodríguez *et al.* (2016) explain three basic channels in which tourism may promote trade activities, as follows.

The first channel is the preferences of travellers. Marrocu and Paci (2011) explain that inflows of international tourists bring more information about external consumer preferences to local businesses. *The second channel* is the reduction of transaction costs. Sinclair (1998) explains that travel can help to reduce information deficiency (information asymmetry) in aspects of contracts and production, which then mitigates market failures in trade activities. *The third channel* is the promotion of market size. Khan, Toh *et al.* (2005) explain that international travellers may

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[5] *In fact, international tourism is similar to immigration in term of people movement from one country to a destination.*

consume not only the products of destination countries but also may want to consume these products in their home countries.

Several empirical studies support the positive impacts of tourism on trade activities. For instance, Wong and Tang (2010) document that increases in tourism activities to Malaysia, China, the US, Korea, and Japan, would increase the trade openness of these countries with Singapore. Keum (2011) reveals a positive impact of international tourism on trade activities between Korea and its 21 trading partners. Other empirical evidence is documented in several areas, regions, and countries, such as OECD countries (Santana-Gallego, Ledesma-Rodríguez *et al.*, 2011a), and the Canary Islands (Santana-Gallego, Ledesma-Rodríguez *et al.*, 2011b), in a global sample of 195 countries (Santana-Gallego, Ledesma-Rodríguez *et al.*, 2016). Recent studies provide similar conclusions in Africa (Manyara and Naliaka, 2021), BRICS countries (Garidzirai, 2022), Thailand (Chaisumpunsakul and Pholphirul, 2018), Malaysia (Shahbaz, Kumar *et al.*, 2017), and Central and South American countries (Ben Jebli, Ben Youssef *et al.*, 2019).

The study adheres to this literature to propose the first hypothesis as follows:

H1: International tourism increases international trade

2.2. The development of information technology and the influence of international tourism on trade activities

The development of technology, especially information technology such as the Internet and mobile phones, is amongst the most important roots of the '*new economy*' (Atkinson and Correa, 2007, Nguyen and Doytch, 2022, Nguyen, Schinckus *et al.*, 2022b). The development of information technology has created several benefits for international trade (Freund and Weinhold, 2004). Information technology helps reduce communication and transaction costs to a very low level (the marginal cost is actually likely zero) (Suvankulov, Chi Keung Lau *et al.*, 2012). This efficiency in communication and transaction can reduce the issue of information asymmetry (Gajewski and Li, 2015) and also trade costs (Bojnec and Fertö, 2009). Aside from the associated risks in trading in the online environment (Roberts, Indermaur *et al.*, 2013), the literature mostly agrees that information technology could generally increase international trade (Lin, 2015). For instance, Fernandes, Mattoo *et al.* (2019) or Mu, Chen *et al.* (2020) document that the use of the Internet increases exports by Chinese firms. Recently, Nguyen, Doytch *et al.* (2023) document that Internet development improved intra-trade balance of African countries from 2003 to 2017.

Against this background, this study suggests a further role of information technology in its moderating effect on traditional relationships. In particular, this study proposes that the development of information technology may be an important catalyst in the influence of international tourism on international trade due to changes from both sides: travel purpose and the process of exporting/importing.

In fact, the Internet and mobile phone have changed both economic and human activities through their basic role as tools of communication (Nguyen, Nguyen *et al.*, 2023, Nguyen, Schinckus *et al.*, 2022a). Information technology also helps reduce the time and cost of economic and human activities (Cappelli, 2001); recapping the positive influence of international tourism on international trade through the preference information of consumers (tourists), reduction in transaction costs (reduction of information deficiency), and increases in market size (see Santana-Gallego, Ledesma-Rodríguez *et al.* (2016)). These channels are effective when international tourists move from their home country to a host country (travel destination), especially for business travel to find new markets or new products for imports when little information is available. However, the development of information technology may solve these issues with less need or indeed without any need for physical travel.

Concerning international trade, information technology and the World Wide Web have helped individuals and businesses, including exporters or importers, to establish information about potential customers or potential imported products at far lower cost and, more importantly, much quicker than it is possible with physical travel (Berners-Lee, Cailliau *et al.,* 2010). With *international tourism, information technology makes travel planning easier (Xiang, Magnini et al., 2015)* and reduces communication and transaction costs (Cappelli, 2001). The development of information technology has also contributed to the boom in inform*ation about hotspot travel destinations through social media (da Costa Liberato, Alén-González et al., 2018).* Anser, Adeleye *et al.* (2022) find that development of information technologies promoted tourism in a sample of 44 East Asia and Pacific and South Asian countries over the period of 2010–2019.

As a result, information technology has stimulated international travel for non-business purposes such as leisure travel, visiting friends and relatives, travelling for education, and other reasons. Overall, there may be a change in the composition of international travel as the proportion of non-business trips increase and the proportion of business trips decrease. That is, information technology may reduce the influence of international tourism on trade activities. Thus, the second hypothesis is formed as follows:

H2: The development of information technology may reduce the influence of international tourism on international trade.

3. Methodology and data

3.1. Empirical model

The study first builds the baseline model of international trade (*Trade*). In the baseline model, three main control variables are used: economic size (*Esize*), real effective exchange rate (*ER*), and FDI inflows (*FDI*), as suggested by the literature (Liargovas and Skandalis, 2012).

$$Trade_{it} = \beta_0 + \beta_1 Esize_{it} + \beta_2 ER_{it} + \beta_3 FDI_{it} + \varepsilon_{it} \qquad [1]$$

in which: *i, t* are country *i* at year *t*; β is coefficient; ε is residual term.

International tourism (*Tour*) is then added as an augmented driver of international trade, following the previous extensive literature (*e.g.*, Santana-Gallego, Ledesma-Rodríguez *et al.* (2011a), Santana-Gallego, Ledesma-Rodríguez *et al.* (2016), Suresh and Tiwari (2018), among others):

$$Trade_{it} = \beta_0 + \beta_1 Esize_{it} + \beta_2 ER_{it} + \beta_3 FDI_{it} + \beta_4 Tour_{it} + \varepsilon_{it} \qquad [2]$$

Then, the role of information technology in the influence of international tourism on international trade is investigated. Information technology (*IT*) is firstly added into *Eq.* [2] as an independent variable to control the direct effects on international trade. The interaction term of information technology with international tourism variable is added to investigate its role in the influence of international tourism on international trade.

$$Trade_{it} = \beta_0 + \beta_1 Esize_{it} + \beta_2 ER_{it} + \beta_3 FDI_{it} + \beta_4 Tour_{it} + \beta_5 IT_{it} + + \\ \beta_6 IT_{it} * Tour_{it} + \varepsilon_{it} \qquad [3]$$

3.2. Data

This study uses different proxies of trade and international tourism to aim at a comprehensive investigation.

The trade activities are investigated through three dimensions: total trade, exports, and imports (values in USD). Furthermore, the export and import of goods were also analysed. The investigation of trade and exports and imports helps not only to provide a full picture of the

influence of tourism on trade activities but also aligns with the literature. The literature suggests that international (*arrivals) tourists are usually exporters, thus imports are subsequently increased (Khan, Toh et al., 2005).* Accordingly, international tourism may have different impacts on exports and imports. All data of the above trade activities is collected from the World Development Indicators database of the World Bank (WDI - last version in 2020).

International tourism is investigated through two directions: international (arrivals) tourists, and outbound (departure) tourists, representing two different flows of international tourists in and out of a country, respectively. Again, as suggested by Khan, Toh *et al.* (2005), the inflows of international tourists may be mostly foreign sellers and thus may have a strong impact on imports; while outbound tourists can be domestic exporters and so exports may increase. The data of international tourists (including tourist arrivals and departure numbers) is also collected from the WDI.

In terms of information technology, previous studies utilize Internet and mobile phone usage as the two most important and most used proxies (Yin and Choi, 2021). The percentage of the population using the Internet and mobile phone subscriptions per 100 people are collected from the WDI.

In terms of control variables, the total population is collected to proxy for economic size. The population is identified as a good proxy of economic size in previous literature (Guttmann and Richards, 2006).[6] The real effective exchange rate and FDI net inflows (as percentage of GDP) are collected from the WDI to proxy for exchange rate and FDI flows.

In data transformation, except for FDI (as percentage of GDP) and Internet usage (as percentage of population), all variables are taken in logarithm form. This transformation is aimed at (i) normalising the data and avoiding extreme outliers; and (ii) explaining the estimated coefficients as the elasticity of trade activities to explanatory variables.

There is also the number of UNESCO Heritage sites, manually collected from the United Nations Educational Scientific and Cultural Organization (UNESCO). This variable is used as an external instrumental variable in estimation, and will be explained in the next sub-section.

After collecting all variables, countries with missing data in important variables such as trade activities, tourism or Internet usage, are dropped. There are several milestone years in information technology development, such as the birth year of the Internet (1983); or the birth year of the first mobile phone (1973), or that of the icon of mobile phones, the iPhone (2007). The study has chosen the period from 2002 for the following reasons. Firstly, 2002 is mostly agreed as the year of a new stage of the world economy or the year of the digital information age when total digital information was larger than traditional analogue information.[7] Meanwhile, international tourism was relatively low in the 1990s, while international tourism was negatively impacted by the September 11 attacks in the US in 2001, thus it is necessary to avoid the inclusion of 2001. Lastly, global trade openness (% GDP) passed 50% in 2003 from around 49% in 2002, recording an important point in world trade activities.[8] Since the availability of Internet usage is mostly to 2017, while data of international tourists are mostly available to 2018, 2017 is chosen as the best end-

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[6] *It is worth noting that the literature also suggests real GDP as a proxy of economic size. This study has also recruited this variable, but its correlations with tourism variables (>0.8 and statistical significance) cause the issue of multicollinearity in estimates. Therefore, we also use population as proxy of economic size.*

[7] *See https://www.computerhope.com/history/2002.htm*

[8] *Data from the World Development Indicators (WDI) database, World Bank, see https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=1W*

year for empirical analysis. All variables, data, definitions, calculations, source, and data descriptions are presented in *Table 1* (see *Table A1*, Appendix, for the list of countries).

Table 1. Variables, definitions, calculations, source, and data descriptions

Variables	Definition	Calculation	Sources	Obs	Mean	S.D.	Min	Max
Trade	Trade	Logarithm of total trade values	WDI	1,296	29.73	1.96	23.61	33.90
Export	Exports of goods and services	Logarithm of goods and services exports	WDI	1,296	28.99	2.05	22.08	33.14
ExGoods	Goods exports	Logarithm of goods exports	WDI	1,296	23.98	2.20	17.01	28.44
ImGoods	Goods imports	Logarithm of goods imports	WDI	1,296	24.20	1.92	18.47	28.50
IntTour	International tourist arrivals	Logarithm of total international tourist arrivals	WDI	1,296	15.18	1.48	11.14	18.28
OutTour	Outbound tourist departures	Logarithm of total outbound tourist departures	WDI	1,003	15.20	1.53	10.71	18.78
Internet	Internet development	Individuals using the Internet (% of population)	WDI	1,296	44.28	29.23	0.12	98.26
Mobile	Mobile development	Logarithms of Mobile subscriptions (per 100 people)	WDI	1,296	4.31	0.86	-0.31	5.53
Esize	Economic size	Logarithms of total population	WDI	1,296	16.36	1.78	10.72	21.05
ER	Exchange rate	Logarithms of real effective exchange rate index (2010 = 100)	WDI	944	4.59	0.12	4.05	5.06
FDI	FDI inflows	Foreign direct investment, net inflows (% of GDP)	WDI	1,294	7.32	25.33	-58.32	451.64
UNESCO	UNESCO Heritages	Number of UNESCO Heritage sites	UNESCO	1,248	9.05	10.47	0.00	53.00

Notes: WDI is the World Development Indicators database, World Bank; UNESCO is the United Nations Educational Scientific and Cultural Organisation.

3.3. Econometric estimates

According to the recent literature, there are not just simple unidirectional effects of international tourism on trade activities. For instance, Suresh and Tiwari (2018) show a positive bidirectional Granger-causality nexus of trade and tourism in India from April 1991 to July 2012. Thus, the estimate for the influence of international tourism on trade activities following the equations in sub-section 3.1 may face the issue of endogeneity due to the feedback effects of the dependent variable (trade activities) to the independent variable (international tourism) (Roodman, 2009b).

The study overcomes this issue by applying standard approaches from the econometrics literature. Anderson and Hsiao (1982) developed the first-difference method to solve the issue of endogeneity in panel data estimates. In the first-difference method, the first-difference and lags of endogenous variables are used as instrumental variables. Arellano and Bond (1991) extended to the GMM estimate and suggested that this is more efficient. The Arellano-Bond GMM estimate

is used in several empirical studies, but it may face asymptotic and considerable bias when used for unbalanced panel data (Roodman, 2009a). Arellano and Bover (1995) then developed the system GMM estimator to deal with this bias.

In applying the two-step system GMM, the most important issue is to choose the instrumental variable (Roodman, 2009b). This study uses two approaches in this process. *First*, we follow the approach in Anderson and Hsiao (1982) by using the internal instrumental variables, the difference and the lag of endogenous variables. In this case, the international tourism variables are potential endogenous variables. *Second*, we consider the external instrumental variables. The econometrics literature suggests that external instrumental variables are much better than internal instruments when they meet the conditions of choosing instrumental variables (Donald, Imbens *et al.*, 2009).[9]

This study follows previous literature in choosing the external instrumental variable for international tourism (see, for example, Santana-Gallego, Ledesma-Rodríguez *et al.* (2016)) as the number of UNESCO Heritage sites. In fact, recognition of a new UNESCO Heritage site would stimulate tourism demand (from the demand side) and also tourism investment (the supply side) (Nguyen, Binh *et al.,* 2023), and thus leads to more international (arrivals) tourists, while it may also retain the domestic tourist who wants to travel abroad, also to travel at home. Meanwhile, there is likely no theory or empirical evidence on the link between a new UNESCO Heritage site and trade activities. Lastly, we checked for the year-fixed effects in estimates to reduce any potential bias due to fixed effects.[10]

4. Empirical results and discussion

4.1. Empirical results

The main results of the influence of international tourism and the role of Internet development on trade activities are presented in Tables 2 and 3, for total trade values, export and import activities, respectively. It is worth noting that the robustness checks using mobile phone usage show consistent findings in line with Internet usage, and are reported in detail in *Tables A2* and *A3* in the Appendix, respectively.[11]

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[9] *Three common conditions are that an instrumental variable must have causal effect on the endogenous variable (in this case, international tourism), and have effect on Y (in this case, trade activities) only through the endogenous variable (tourism), and there is no confounding for the effect of instrumental variable on Y.*

[10] *It is worth noting that if the number of cross-sections (countries) is below 20, the GMM estimation is not advised (see Roodman (2009)). Therefore, we do not divide our full sample into subsamples.*

[11] *The results are also checked for robustness by adding control variables one by one. The detailed results are robust and provided upon request.*

Table 2. Travel, Internet development and Trade activities: Total trade values

Dep. var: *Trade*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
IntTour	0.7426*** [0.1320]	0.8808*** [0.1282]	0.7049*** [0.1366]	0.7049* [0.2671]	0.5557*** [0.1154]	0.7981*** [0.1122]						
OutTour							0.7930*** [0.1175]	0.9668*** [0.1010]	0.9597*** [0.0989]	0.9597*** [0.1926]	0.7446*** [0.1456]	0.8289*** [0.0763]
Internet	0.0293*** [0.0038]	0.0301*** [0.0039]	0.0341*** [0.0040]	0.0341*** [0.0059]	0.0386*** [0.0034]	0.1001*** [0.0211]	0.0167*** [0.0046]	0.0118*** [0.0037]	0.0125*** [0.0038]	0.0125 [0.0094]	0.0231*** [0.0058]	0.0766*** [0.0131]
IntTour*Internet						-0.0041*** [0.0014]						
OutTour*Internet												-0.0033*** [0.0009]
Esize	0.4185*** [0.0912]	0.3217*** [0.1020]	0.4546*** [0.1017]	0.4546** [0.1887]	0.5317*** [0.0877]	0.5386*** [0.0574]	0.2416*** [0.0858]	0.1079 [0.0828]	0.1255 [0.0769]	0.1255 [0.1692]	0.2784** [0.1148]	0.3953*** [0.0340]
ER		-0.2629 [0.3105]	-0.2004 [0.2816]	-0.2004 [0.4233]	0.1369 [0.3062]	-0.3195 [0.2952]		-0.6520* [0.3567]	-0.5921 [0.3579]	-0.5921 [0.4697]	-0.5321 [0.3770]	-0.1399 [0.1591]
FDI			0.0032 [0.0025]	0.0032 [0.0034]	0.0045** [0.0022]	0.0034 [0.0024]			0.0026* [0.0014]	0.0026* [0.0027]	0.0015* [0.0009]	0.0046*** [0.0010]
Constant	10.59*** [0.7109]	0.0000 [0.0000]	11.27*** [1.453]	11.27*** [1.8100]	10.62*** [1.5315]	0.0000 [0.0000]	13.39*** [0.7380]	15.88*** [1.828]	0.0000 [0.0000]	0.0000 [0.0000]	0.0000 [0.0000]	10.55*** [0.834]
Year-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Robust estimation												
Alternative IVs				Yes[a]	UNESCO[b]					Yes[a]	UNESCO[b]	
Obs.	1,215	885	883	883	883	883	946	716	716	716	716	702
No. of countries	81	59	59	59	59	59	69	52	52	52	52	52
No. of IVs	32	33	34	34	34	35	32	33	33	34	34	49
AR(2) test-p-value	0.280	0.146	0.272	0.282	0.235	0.178	0.113	0.034	0.034	0.320	0.039	0.395
Hansen test-p-value	0.094	0.170	0.424	0.424	0.773	0.301	0.304	0.198	0.202	0.202	0.491	0.135

Notes: Results are estimated by the two-step system GMM estimators; [a]: the robust estimation for two-step system GMM estimate with finite-sample correction follows Windmeijer (2005); [b]: the number of UNESCO Heritage sites is used as the instrumental variable for number of tourists rather than its lags; Standard errors are in brackets; *, **, *** with significance levels at 10%, 5%, and 1%, respectively.

Table 2 presents the influence of international tourism and the role of Internet usage on total trade values. All estimates show statistical insignificance of AR(2) tests and Hansen tests, which means that the two-step system GMM estimates are unbiased and consistent (Roodman, 2009a). Furthermore, the results are properly robust and consistent when using the internal instrumental variable (models 1, 2, 3, 6, 7, 8, 9, 12) or external instrumental variable (UNESCO Heritage site, models 5 and 10). The results are also consistent with the robust two-step system GMM estimator (models 4 and 10) as suggested by Windmeijer (2005).

The results for the influence of international tourist arrivals (*IntTour*) on total trade values and the role of Internet usage (*Internet*) in models (1) to (6) show that (*i*) international tourist arrivals have a significant positive impact; (*ii*) Internet usage also has a significant positive impact; and (*iii*) notably, the interaction term between international tourist arrivals and Internet usage (model 6) has a significant negative impact. The results for the influence of outbound tourist departures (*OutTour*) and the role of Internet usage on total trade values are in models (7) to (12).

It is important to note that all results are consistent with the results for international tourist arrivals. Specifically, outbound tourist departures and Internet usage have significant positive impacts on total trade values. The interaction term between outbound tourist departures with Internet usage has a significant negative impact. International tourism and total trade values are calculated in logarithm form, and the coefficients of the impact of international tourism range from 0.5 to 0.9 (for international tourist arrivals) and from 0.7 to 0.96 (for outbound tourist departures). Thus, the results mean that a 1% increase in tourist flows may increase total trade value by about 0.5% to 0.96%, whereas the effects of outbound tourists may be stronger than international tourist arrivals. In terms of Internet usage, this effect is somewhat weaker, with the coefficients of Internet usage ranging from 0.01 to 0.1.

Table 3. Travel, Internet development and Trade activities: Export activities

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep.var:	Goods exports (*ExGoods*)				Goods imports (*ImGoods*)			
IntTour	0.5726***	0.7348***			0.7049***	0.8026***		
	[0.1749]	[0.1712]			[0.1318]	[0.0876]		
OutTour			1.0597***	0.9687***			0.8166***	0.7662***
			[0.1462]	[0.0880]			[0.0838]	[0.0678]
Internet	0.0405***	0.1028***	0.0117*	0.0859***	0.0308***	0.0943***	0.0164***	0.0518***
	[0.0050]	[0.0323]	[0.0062]	[0.0139]	[0.0038]	[0.0178]	[0.0028]	[0.0088]
IntTour*Internet		-0.0040*				-0.0040***		
		[0.0022]				[0.0012]		
OutTour*Internet				-0.0040***				-0.0019***
				[0.0009]				[0.0006]
Esize	0.6558***	0.6894***	0.1275	0.3829***	0.4373***	0.5095***	0.2745***	0.4077***
	[0.1274]	[0.0725]	[0.1061]	[0.0455]	[0.0948]	[0.0515]	[0.0623]	[0.0391]
ER	-0.4394	-0.6702*	-0.7749	-0.6250***	0.0607	-0.0786	-0.3991*	0.0399
	[0.3474]	[0.3518]	[0.5106]	[0.1865]	[0.2691]	[0.3012]	[0.2227]	[0.1575]
FDI	0.0015	0.0017	-0.0006	0.0014	0.0009	0.0010	0.0018*	0.0029***

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep.var:		Goods exports (*ExGoods*)				Goods imports (*ImGoods*)		
	[0.0020]	[0.0019]	[0.0037]	[0.0009]	[0.0021]	[0.0020]	[0.0011]	[0.0007]
Constant	0.0000	3.1373	8.9422***	4.6835***	0.0000	0.0000	8.3151***	5.0009***
	[0.0000]	[2.0939]	[2.2176]	[1.1014]	[0.0000]	[0.0000]	[1.1324]	[0.8317]
Year-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	883	883	716	702	883	883	716	702
No. of countries	59	59	52	52	59	59	52	52
No. of IVs	34	35	34	48	34	35	34	48
AR(2) test-p-value	0.171	0.129	0.343	0.112	0.348	0.168	0.151	0.144
Hansen test-p-value	0.779	0.697	0.153	0.106	0.470	0.393	0.109	0.112

Notes: Results are estimated by the two-step system GMM estimators; Standard errors are in brackets; *, **, *** with significance levels at 10%, 5%, and 1%, respectively.

Next, the estimates for export and import activities are presented in *Table 3*. Interestingly, the results in Table 4 show consistent findings for the influence of international tourism and the role of the Internet on export and import activities as for total trade values. In particular, the results in *Table 3* show that (*i*) international tourist flows (arrivals and departures) have a significant positive impact on goods exports (models 1 to 4) and goods imports (models 5 to 5); (*ii*) Internet development also appears to have a significant positive impact on both export and import activities; and (*iii*) the interaction term between the Internet and international tourist flows has a significant negative impact on both export and import of goods.

4.2. Discussion

It is important to note that all empirical results for the influence of international tourism flows and the role of information technology on trade activities support our hypotheses. Hypothesis 1 is that international tourism increases international trade. The empirical results show a significant positive impact of international tourist flows, including both arrivals and departures, on total trade values and export and import activities.

Hypothesis 2 is that the development of information technology could reduce the positive impact of international tourism on trade activities. The empirical results show that the interaction terms between information technologies (*i.e.*, the Internet or mobile phone) and international flows (arrivals or departures) have a significant negative impact on all trade activities. This means that increases in Internet usage or mobile phone usage reduce the positive impact of international tourism on international trade activities. From these findings, it is worth discussing the findings and contribution of this study to the literature.

First, the finding on the positive effects of international tourism on trade activities is consistent with the theory and previous literature. That is, international tourist flows (arrivals or departures) provide producers from both the home country and host country with many benefits, including information on the preferences of potential customers, reduction of transaction costs, and increase in market size (Santana-Gallego, Ledesma-Rodríguez *et al.*, 2016). Hence, international

tourism promotes international trade activities. This empirical evidence aligns with several previous empirical studies (*e.g.*, Santana-Gallego, Ledesma-Rodríguez *et al.* (2016), Manyara and Naliaka (2021), Garidzirai (2022)). Hence, this study has provided a global evidence to reaffirm positive effect of tourism on trade activities, which has been found in regional samples (see Manyara and Naliaka (2021), Garidzirai (2022)) or country context (see Chaisumpunsakul and Pholphirul (2018), Shahbaz, Kumar *et al.* (2017)). This study re-emphasises the importance of the tourism industry in the interaction with other economic activities, especially trade activities. This also calls for serious consideration to incorporating international tourism into trade theory, as previously suggested (*e.g.*, Suresh and Tiwari (2018)). More importantly, it is essential to raise the importance of an appropriate policy for sustainable tourism development (Min, Kung *et al.*, 2019), especially in the post-Pandemic era (Ma, Khurshid *et al.*, 2022).

Second, in line with the key aim of this study, it provides empirical evidence that the development of information technology may change the nature of international tourism demand. Specifically, the study shows that the development of the Internet and mobile phone usage reduces the positive impact of international tourism on international trade activities. This implies that there may be import changes in the components of international tourism demand, with an increasing proportion of non-business trips and decreasing proportion of business trips. This evidence is in the same vein as previous evidences that information technology might change with structure of trade and tourism (Anser, Adeleye *et al.*, 2022). Interestingly, this finding of the literature has noticed the important benefits of information technology for economic and human activities, which can then change the way of life and activities (Yin and Choi, 2021). Several recent studies (Nguyen, Nguyen *et al.*, 2023, Nguyen, Schinckus *et al.*, 2022b, Nguyen, Su *et al.*, 2020, Zhang and Haiqing, 2019) emphasize that information technology is changing several economic sectors' activities and their behaviours. For instance, the development of information technology and the World Wide Web helps exporters or importers acquire information about consumer preferences or potential markets at less cost (even zero marginal cost) without the need for certain physical requirements e.g., travel (Suvankulov, Chi Keung Lau *et al.*, 2012). In other words, in the digital information age, exporters and importers (business individuals) may require fewer international business trips, but can still do business as well or even better than before.

Conclusion

This study endeavours to contribute to the literature by revisiting the influence of international tourism on trade activities. Notably, this study incorporates the role of information technology in the influence of international tourism, and the important role of information technology in the ways of economic and human activities (Atkinson and Correa, 2007), including both tourism (Tavakoli and Wijesinghe, 2019) and trade activities (Fernandes, Mattoo *et al.*, 2019).

The robust twostep system GMM estimate is applied to a global sample of 82 countries from 2002 to 2017 showing three main findings. *First*, international tourist flows including arrivals and departures appear to have the effect of increasing all kinds of trade activities. *Second*, the development of information technology, such as Internet usage and mobile phone usage, also has a direct positive impact on trade activities. *Third*, information technology is found to have negative moderating effects on the influence of international tourism on trade activities; that is, the positive impact of international tourism on trade activities is reduced with the development of information technology – the digital information age.

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Appendix

Table A1. List of countries

Country	Country code	Country	Country code	Country	Country code
Argentina	ARG	Greece	GRC	Paraguay	PRY
Armenia	ARM	Hong Kong SAR, China	HKG	Peru	PER
Bahrain	BHR	Iceland	ISL	Philippines	PHL
Belgium	BEL	India	IND	Poland	POL
Benin	BEN	Indonesia	IDN	Portugal	PRT
Bolivia	BOL	Israel	ISR	Romania	ROU
Brazil	BRA	Italy	ITA	Russian Federation	RUS
Bulgaria	BGR	Jamaica	JAM	Saudi Arabia	SAU
Burundi	BDI	Japan	JPN	Singapore	SGP
Cambodia	KHM	Jordan	JOR	Slovakia	SVK
Canada	CAN	Kazakhstan	KAZ	Slovenia	SVN
Chile	CHL	Latvia	LVA	South Africa	ZAF
China	CHN	Lebanon	LBN	South Korea	KOR
Colombia	COL	Lithuania	LTU	Spain	ESP
Costa Rica	CRI	Luxembourg	LUX	Sri Lanka	LKA
Croatia	HRV	Malawi	MWI	St Kitts and Nevis	KNA
Cyprus	CYP	Malaysia	MYS	Sweden	SWE
Czech Republic	CZE	Malta	MLT	Tanzania	TZA
Denmark	DNK	Mauritius	MUS	Thailand	THA
Dominican Republic	DOM	Mexico	MEX	Tunisia	TUN
Egypt	EGY	Morocco	MAR	Turkey	TUR
El Salvador	SLV	Namibia	NAM	Uganda	UGA
Estonia	EST	Netherlands	NLD	Ukraine	UKR
Eswatini	SWZ	New Zealand	NZL	United Kingdom	GBR
Finland	FIN	Nicaragua	NIC	United States	USA
France	FRA	North Macedonia	MKD	Uruguay	URY
Germany	DEU	Norway	NOR	Zambia	ZMB

Table A2. Travels, Mobile usage and Trade activities: Total trade values

Dep. var: **Trade**	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
IntTour	1.2284*** [0.1747]	1.4502*** [0.1602]	1.4141*** [0.1641]	1.4141*** [0.2033]	0.8876*** [0.1511]	1.7274*** [0.5594]						
OutTour							1.1318*** [0.1525]	1.0294*** [0.1455]	1.0194*** [0.1387]	1.0194*** [0.1491]	1.0615*** [0.1428]	2.5467*** [0.4500]
Mobile	0.2855 [0.1976]	0.1573 [0.1895]	0.2343 [0.2074]	0.2343 [0.2693]	0.7338*** [0.1567]	3.6521** [1.6118]	-0.0288 [0.1977]	0.2050 [0.2384]	0.2250 [0.2353]	0.2250 [0.2799]	0.3176 [0.2441]	5.2530*** [1.2428]
IntTour*Mobile						-0.2036* [0.1198]						
OutTour*Mobile												-0.3494*** [0.0927]
Esize	0.0805 [0.1081]	-0.1091 [0.1290]	-0.0904 [0.1370]	-0.0904 [0.1827]	0.2514** [0.1160]	0.3288*** [0.0807]	-0.0269 [0.1106]	0.0340 [0.1201]	0.0499 [0.1149]	0.0499 [0.1263]	0.0231 [0.1105]	0.0519 [0.0665]
ER		0.1406 [0.4714]	0.1699 [0.4550]	0.1699 [0.6417]	0.3200 [0.4765]	0.7164 [0.4483]		-0.8724** [0.3817]	-0.8614** [0.3594]	-0.8614 [0.5263]	-0.7401 [0.5554]	-0.3265 [0.4259]
FDI			-0.0022 [0.0023]	-0.0022 [0.0030]	0.0018 [0.0023]	0.0010 [0.0024]		0.0015 [0.0017]	0.0015 [0.0017]	0.0015 [0.0028]	0.0012 [0.0011]	0.0015 [0.0017]
Constant	8.2758*** [0.7805]	0.0000 [0.0000]	0.0000 [0.0000]	0.0000 [0.0000]	7.3544*** [2.2309]	0.0000 [0.0000]	13.5723*** [1.1044]	0.0000 [0.0000]	0.0000 [0.0000]	0.0000 [0.0000]	0.0000 [0.0000]	-7.4299 [5.5440]
Year-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Robust estimation				Yes^a						Yes^a		
Alternative IVs					UNESCO^b						UNESCO^b	
Obs.	1,215	885	883	883	883	883	946	716	716	716	716	702
No. of countries	81	59	59	59	59	59	69	52	52	52	52	52
No. of IVs	32	33	34	34	34	35	32	33	34	34	34	49
AR(2) test-p-value	0.434	0.803	0.872	0.877	0.148	0.005	0.302	0.169	0.437	0.458	0.393	0.034
Hansen test-p-value	0.434	0.154	0.116	0.116	0.246	0.133	0.443	0.252	0.241	0.241	0.638	0.200

Notes: results are estimated by the two-step system GMM estimators; ^{a}: the robust estimation for two-step system GMM estimate with finite-sample correction followed Windmeijer (2005); ^{b}: the number of UNESCO Heritage sites is used as instrument variable for number of tourists rather than its lags; Standard errors are in brackets; *, **, *** are significance levels at 10%, 5%,, and 1%, respectively.

Table A3. Travels, Mobile usage and Trade activities: Export and import activities

Model: Dep.var:	(5)	(6)	(7) Goods exports (ExGoods)	(8)	(5)	(6) Goods Imports (ImGoods)	(7)	(8)
IntTour	1.4096*** [0.2005]	2.1733*** [0.6638]			1.4051*** [0.1603]	1.4941*** [0.4790]		
OutTour			0.9194*** [0.1749]	2.0025*** [0.6214]			1.0119*** [0.1373]	3.1860*** [0.5364]
Mobile	0.3863 [0.2475]	5.2185*** [1.8633]	0.5447* [0.2808]	3.8028** [1.6930]	0.1388 [0.1992]	3.0737** [1.3862]	0.1402 [0.1920]	6.9021*** [1.5952]
IntTour*Mobile		-0.3073** [0.1407]				-0.1643 [0.1025]		
OutTour*Mobile				-0.2317* [0.1258]				-0.4776*** [0.1131]
Esize	0.0511 [0.1599]	0.4285*** [0.0899]	0.1918 [0.1238]	0.1598** [0.0791]	-0.1067 [0.1309]	0.3674*** [0.0711]	0.0970 [0.0963]	0.0323 [0.0511]
ER	0.0895 [0.5016]	0.8666 [0.5360]	-0.8972** [0.4069]	-0.4315 [0.4265]	0.2430 [0.3814]	0.9673** [0.4092]	-0.7300** [0.3578]	-0.0356 [0.5263]
FDI	-0.0022 [0.0030]	-0.0004 [0.0027]	-0.0015 [0.0034]	-0.0023 [0.0032]	-0.0041* [0.0021]	-0.0007 [0.0020]	0.0005 [0.0021]	-0.0009 [0.0019]
Constant	-0.5625 [2.8014]	-21.9369*** [7.9597]	0.0000 [0.0000]	-7.6873 [7.4419]	0.0000 [0.0000]	0.0000 [0.0000]	0.0000 [0.0000]	-22.823*** [6.9587]
Year-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	883	883	716	702	883	883	716	702
No. of countries	59	59	52	52	59	59	52	52
No. of IVs	34	35	34	35	34	35	34	34
AR(2) test-p-value	0.849	0.012	0.642	0.220	0.357	0.012	0.461	0.006
Hansen test-p-value	0.125	0.128	0.233	0.367	0.104	0.127	0.321	0.270

Notes: results are estimated by the twostep system GMM estimators; Standard errors are in brackets; *, **, *** are significance levels at 10%, 5%,, and 1%, respectively.