Causality between Business Travel and Trade Volume

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ABSTRACT

This study employs Taiwan data to examine the cointegration and causal relationships between business travel and trade volume. Analysis is performed with respect to Asian countries (i.e., Japan, Korea, Singapore, Indonesia, and Thailand), to North American countries (i.e., Canada and the United States), to United Kingdom, and to Australia from 2001Q1-2020Q4. This study finds evidence of a long-term equilibrium relationship (cointegration) between Taiwan and Japan, and between Taiwan and the United States. In addition, there is no bidirectional causality between business travel and trade volume in the study; however, in the cases of Canada, the United States, and the United Kingdom, the results indicate an unidirectional (one-way Granger causality) causal effect running from trade volume to business travel. The concept of a linkage between business travel and trade volume is demonstrated in this study. Significantly, this study is expected to benefit policymakers by enabling better strategic planning to integrate the resources and strengths of the public and private sectors to forge a new mutually beneficial model of cooperation and a sense of economic community in these trading countries.

Key words and phrases: Business Travelers, Trade Volumes, Cointegration, Granger Causality.

JEL classification: C51, F10.

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1. Introduction

Empirical studies have focused on the relationship between the development of tourism and economic growth (Chen & ChiouWei, 2009; Po & Huang, 2008). In addition, it is generally accepted international business travel may lead to increased international trade volume when they travel to other nations, and of course, countries with highly correlated relationships in terms of business may also have more opportunities for travel related to work or business.

The theme of World Tourism Day (WTD) 2022 is "Rethinking Tourism", which points to the rebuilding of tourism after the COVID-19 pandemic. In general, investments have a strategic importance for tourism and its proven contribution to wider economy recovery, which will still be underway after the COVID-19 pandemic. According to the World Tourism Organization (UNWTO), global tourism saw an upturn in Q3 2021, but the recovery remains fragile. The report shows the direct economic contribution of tourism is estimated at US$ 1.9 trillion (measured in tourism direct gross domestic product), well below the pre-pandemic value of US$ 3.5 trillion.

Taiwan is a small island with a trade-oriented economy. Figure 1 indicates there is a close relationship between the number of business travelers to Taiwan and the amount of trade volume, both of which show similar patterns (except in 2020 because lockdowns in numerous countries caused a decreased number of business travelers). In general, an island economy faces more challenges owing to geographical and natural resource limitations. A study conducted by Seetanah (2011) provides a possible solution for the growth of island economies. He utilizes panel data of 19 island economies for the period from 1990 to 2007 to investigate the impact of tourism on island economics. The results indicate tourism development is an essential determinant of economic performance in island economies. Data provided by the World Travel & Tourism Council (WTTC) show in 2019, the total contribution of travel and tourism to GDP was US$38.7 billion (about 6.0% of the total economy) in Taiwan, but it dropped to about 59.6% (about 3% real economy GDP changes) in 2020 because of the COVID-19 pandemic. These data appear to support the results of the study by Seetanah (2011).

The idea that international tourism and trade may be closely interlinked and
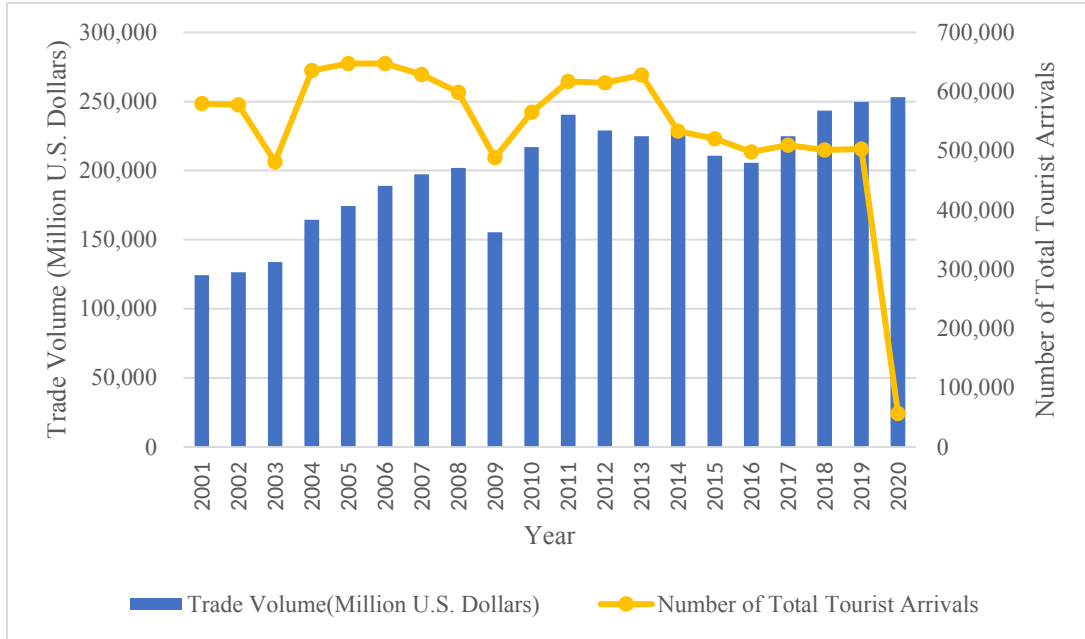
Figure 1: The pattern of the business travelers and trade volume in Taiwan (2001-2020).

causally related is not new. Our review of this topic reveals some published literature investigating this very issue. This study examines how international tourism (focusing only on business travelers) is cointegrated with the total international trade volume (i.e., the sum of exports and imports), and how each Granger causes the other. Our contribution to the literature emerges from a thorough investigation of the causal relationships between international business travel and the trade volumes of Taiwan and its nine key trading partners, including: Japan, Korea, Singapore, Indonesia, the Philippines, and Thailand in Asia, Canada and the United States in North America, and Australia in the Southern Hemisphere. It is generally accepted international tourism plays an important role in Taiwan's economic development, and only a few empirical studies and reports exist on Taiwan's business travel. Therefore, this study develops a model to examine whether the long-term relationships of international business travel with bilateral trade volumes exist between Taiwan and its nine major trading partners.

Another of our paper's meaningful contributions is in relation to increasing and promoting Taiwan's international business tourism and international trade volume. Regarding strategic planning and decision-making, it is important for policymakers

(i.e., the Government, Bureau of Tourism, etc.) to understand the fluctuations in the number of business travelers and trade volumes originating from key trading partners so they can reallocate resources effectively and develop appropriate policies to deal with this issue appropriately. This may enhance the competitiveness of Taiwan when nations are focusing on regional integration (e.g., Free Trade Agreement, FTA; Association of Southeast Asian Nations, ASEAN).

This paper is structured as follows. Section 2 provides an overview of international business travel to Taiwan, bilateral trade volumes and the effects of macroeconomic variables. Section 3 describes the methodology used to investigate the causal relationship between business travel and trade volume, and the empirical results of descriptive statistics and the above models. Section 4 addresses a discussion of the key findings and policy implications of this study. Section 5 summarizes the key findings.

2. Overview of tourism, trade volumes and economic growth

2.1 Tourism, economic growth, and trade volumes

Tourism has been one of the world's fastest-growing economic activities in recent decades. Competition for a share of the world tourism market has intensified significantly; therefore, there is a tremendous number of studies focusing on the relationship between tourism and economic growth. The tourism-led growth hypothesis (TLG), economic-led tourism growth hypothesis, and two-way causal hypothesis are the three major popular arguments attracting research attention. Indeed, researchers are not only trying to analyze whether a relationship between tourism and economic growth exists, but are also attempting to explore the causality of the relationship. The study results are mixed (Balaguer & Cantavella-Jordá, 2002; Shan & Wilson, 2001; Dritsakis, 2004; Oh, 2005). Balaguer and Cantavella-Jordá (2002) test the TLG hypothesis, and find a long-term stable relationship existed between economic growth and tourism expansion in Spain during 1975-1997. Dritsakis (2004) further proves a bidirectional causal relationship and concludes international tourism earnings and real exchange rate cause economic growth with a strong causal relationship, while economic growth and real exchange rate cause international tourism earnings with a simply causal re-

lationship (p.314), supporting tourism-led growth and economic-led tourism growth hypotheses. However, the results of examining the relationship between tourism and economic growth in Korea in a study by Oh (2005) show no long-term relationship between tourism and economic growth, but a short-term economic-driven tourism growth occurred in the country. In contrast, following Oh (2005), Kim, Chen and Jang (2006) took Taiwan as the destination country to study the same issue, and the empirical results were very different, showing tourism and economic development impact each other in Taiwan.

One of the ways in which tourism can significantly contribute to the destination economy by increasing trade volume. Initially, Gray (1970) explores the idea that international travel is a component of international trade, and then goes on to investigate the impact of international travel on the economy. Kulendran and Wilson (2000) examined both the correlations as well as the bidirectional causal relationships between international travel (business, holiday, and total) and international trade (i.e., between Australia and the United States, United Kingdom, New Zealand, and Japan), and the results show international tourism and trade are both cointegrated, as well as causally related. Turner and Witt (2001), working on New Zealand data, also find international trade plays a major role in influencing the demand for business travel[1]. Shan and Wilson (2001) take the case of China with three trading partners (the United States, Japan, and Australia) to explore the relationship between international tourism and trade, and the results confirm a two-way Granger causality (feedback effect) between international tourism and trade. Tsui and Fung (2016) use Hong Kong as a case to conduct a very similar study, and their results verify a long-term cointegration relationship exists between business travel and trade volume, and a bidirectional causal relationship (two-way between business travel and trade volume) in some cases.

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[1]According to Poole (2010) business travel, as defined by business, professional, convention, conference, or trade show, and leisure travel, as defined by leisure, recreation, holiday, sightseeing, visiting friends, or visiting relatives.

2.2 Tourism, trade volume, and the effects of macro economics

A great number of empirical studies have attempted to clarify the impact of tourism on the national economy. Tourist consumption can contribute to the balance of payments, production and employment through foreign exchange earnings and can also represent an important income source for the national economy (Balaguer & Cantavella-Jordá, 2002). Dritsakis (2004) found a cointegrated vector among GDP, the real effective exchange rate and tourism earnings. The empirical studies showed the impact of the exchange rate on tourism demand indicated the exchange rate significantly affected tourism demand (Uysal & Crompton, 1984; Crouch, 1994; Webber, 2001; Nowjee *et al.*, 2012). Webber (2001) concluded exchange rate volatility was causing tourists' abandonment of plans to travel to a particular country in 40% of the cases. Kuo, Wang, Hwang and Ye (2009) found the tourist arrivals were positively and significantly affected by the exchange rate. Akar (2012) concluded a high exchange rate might help Turkish tourism to attract more tourists from these countries. According to previous research findings, the results indicated if the currency of the destination country had depreciated relative to the currency of the origin country, it encouraged international tourism business in the destination country, and vice versa.

In addition, international tourism allows potential investors to experience first-hand the environment of the country being visited and to obtain information about available investment opportunities. Tourism improves on existing research into direct foreign investment (DFI) and as a result it can contribute to the expansion of new DFI in the host country (Sanford & Dong, 2000). In recent years, there has been a growing interest in analyzing the relationship between DFI and tourism (Craigwell & Moore, 2007; Kundu & Contractor, 1999; Sanford & Dong, 2000; Selvanathan, Selvanathan, & Viswanathan, 2012; Tang, Selvanathan, & Selvanathan, 2007). Moreover, business tourists are entrepreneurs and managers from other countries who, while looking for opportunities to invest in the host country as well as to promote and sustain business in the host country, visit several tourist destinations (Selvanathan *et al.*, 2012). In fact, more DFI inflow could generate a cyclical effect of investigative business and holiday

travel, resulting in greater tourism (Tang *et al., 2007*).
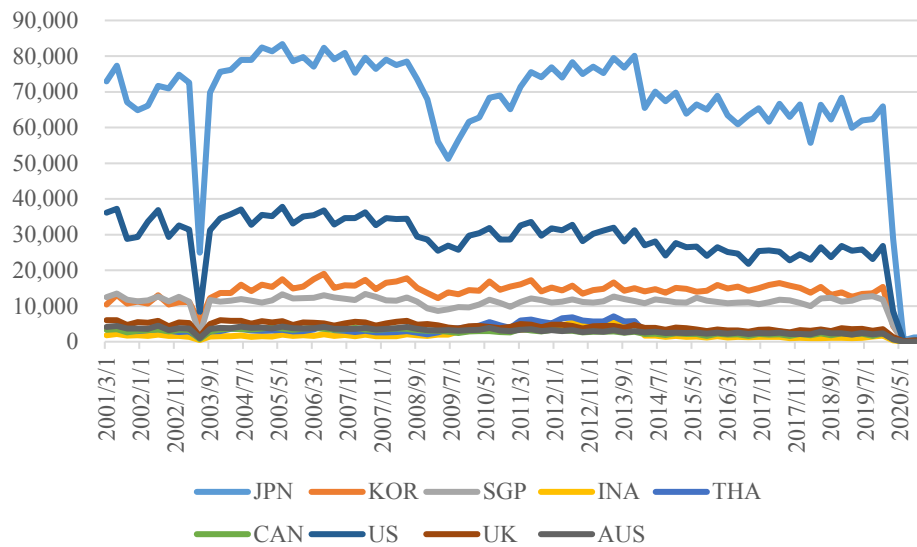
Figure 2: 2001-2020 International Business Travelers.
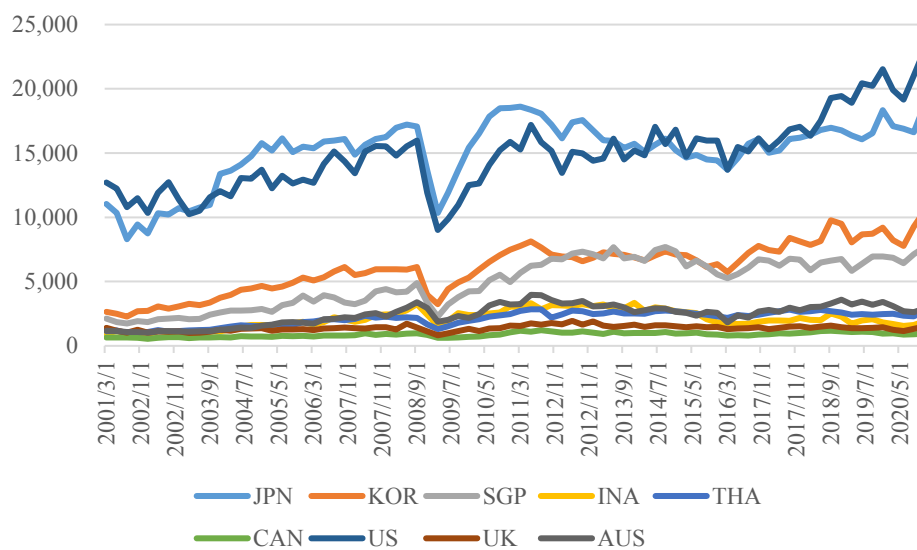
Figure 3: 2001-2020 International Trade Volume (million US dollars).

2.3 A brief outline of the relationship between business travel and trade volumes in Taiwan

Figures 2 and 3 display the time plots of business travelers and trade volumes for Taiwan's nine key trading partners, both in Asia, North America, and Australia during the period 2001-2020. Looking at the graphical analysis, the time series of the quarterly

trade business traveler and trade volume for Taiwan's nine key trading partners display a similar pattern (except a few trading partners in 2019-2020). However, the time series of the quarterly business traveler for Taiwan's nine key trading partners present different levels of fluctuation (volatility). These huge declines in business travel were due to the SARS outbreak that occurred during the period Nov. 2002-Jul. 2003, the subprime financial crisis that resulted in a global economic downturn beginning in 2008, and the lockdown announced by the host government to help prevent the spread of coronavirus in Jan. 2020. In addition, the sharp decline in business travel to Taiwan from Asian countries in 2013 was caused by the formation of the China-ASEAN Free Trade Area (CAFTA), integrating mainland China and ASEAN markets to become the third largest free trade area in the world.

Note, the time series of the quarterly trade volumes of Taiwan's nine key trading partners display upward trends during the study period, except for periods of huge decline because of the subprime crisis in 2008. Note, the subprime financial crisis caused a global economic downturn in 2008, which not only affected the numbers of business travelers, but also influenced the trade volumes between Taiwan and all its nine major trading partners. However, the trading volumes between Taiwan and U.S., Thailand, Korea, and Singapore substantially increased during the Covid-19 pandemic in 2020. Taiwan and U.S. have maintained stable trade volumes since the Trade and Investment Framework Agreement (TIFA) was signed in 2006 and the trade volume has been increasing due to close cooperation in the areas of agriculture, information communication, architecture, and public transportation. In Asia, the reason Taiwan enterprises cooperate closely with Asian countries is because of the free trade agreements signed among ASEAN countries, and the trend of regional economic integration further influencing the trading partnerships between Taiwan and southern Asian countries. In this regard, the government promulgates the "New Southbound Policy," which aims to strengthen Taiwan's trade and economic ties with members of the ASEAN and south Asian countries.

Briefly, the quarterly business travel of Taiwan's nine key trading partners shows a stable upward trend. The declining business travel between these nine key trading partners and Taiwan is caused by exogenous events, including the SARS outbreak in

2003, and the subprime financial crisis resulting in a global economic downturn in 2008. However, the lockdown restriction policy, announced in 2020 because of Covid-19, did not cause decreased trade volume. The reason is the emergence of the "zero-contact economy" (i.e., digital trade) of the epidemic led to the development of more trade and trade-related topics in various regions. Digital trade has become an important topic of recent economic growth, showing evidence that trade volumes between Taiwan and U.S. and few Asian countries were in an upward trend during the study period.

3. Methodology and findings

3.1 Data

This paper uses quarterly data across nine industrialized countries during the period from 2001Q1-2020Q4. The nine countries are, Japan (JPN), Korea (KOR), Singapore (SGP), Indonesia (INA), Thailand (THA), Canada (CAN), the United States (US), the United Kingdom (UK), and Australia (AUS). The arrival of tourists' data are obtained from the Tourism Statistics Database of the Taiwan Tourism Bureau. The quarterly trade volume and quarterly direct foreign investment (DFI) are collected from the Bureau of Statistics, Ministry of Finance, R.O.C. and Government Data platform, and the quarterly GDP growth rate and exchange rate are obtained from the Taiwan Economic Journal (TEJ). The announcement for SARS and COVID-19 are based on information from the Taiwan Center for Disease Control (CDC), and the Global Financial Crisis (GFC) is defined as 2007 subprime financial crisis.

3.2 Descriptive statistics

Table 1 shows some descriptive statistics of selected variables over the period 2001Q1-2020Q4. The summary of statistics contains the means, median standard deviation (Std. Dev.), maximum and minimum of each series. There was an average of 67,031, 13,793, 10,855, 2,114, and 3,344 business travelers from Japan, Korea, Singapore, Indonesia, and Thailand, respectively, and an average of 2,695, 28,404, 4,187 and 2,990 business travelers from Canada, United States, the United Kingdom, and Austra-

Table 1: Descriptive statistics for Taiwan's trading partners (2001Q1-2020Q4).

	JPN		KOR		SGP	
	Business Travelers	Trade volumes	Business Travelers	Trade volumes	Business Travelers	Trade volumes
Maximum	83,381	18,682,406	19,024	10,461,500	13,496	7,694,278
Minimum	399	8,298,022	154	2,277,333	39	1,739,965
Mean	67,031	15,108,501	13,793	6,117,490	10,855	4,929,601
S.D.	16,489	2,479,486	3,532	1,939,346	2,665	1,902,952
n	80	80	80	80	80	80

	INA		THA		CAN	
	Business Travelers	Trade volumes	Business Travelers	Trade volumes	Business Travelers	Trade volumes
Maximum	5,601	3,345,416	7,101	2,841,351	3,964	1,216,902
Minimum	10	814,066	17	977,046	14	547,228
Mean	2,114	2,100,039	3,344	2,124,057	2,695	876,365
S.D.	1,386	683,973	1,421	543,926	883	169,949
n	80	80	80	80	80	80

	US		UK		AUS	
	Business Travelers	Trade volumes	Business Travelers	Trade volumes	Business Travelers	Trade volumes
Maximum	37,803	22,968,583	6,019	1,942,972	4,493	3,970,177
Minimum	92	9,017,149	112	821,667	9	1,018,680
Mean	28,404	14,828,054	4,187	1,379,575	2,990	2,443,996
S.D.	7,732	2,850,934	1,295	210,248	945	800,834
n	80	80	80	80	80	80

lia, respectively, visiting Taiwan during the study period (see Table 1).

Further, it should be noted the time series of the quarterly trade volumes of Taiwan's nine key trading partners show upward trends during the study period, with the exception of periods of decline in 2008 and 2020. Note, the subprime financial crisis

caused a global economic downturn in 2008 and the COVID-19 pandemic caused a number of non-pharmaceutical interventions in numerous countries, which not only affected the numbers of business travelers, but also influenced the trade volumes between Taiwan and all of its nine major trading partners.

The quarterly trade volumes between Taiwan and Asian countries present steady growth over the study period (except Indonesia); the average quarterly growth rate (using 2001 Q1 as the base year) of the total bilateral trade volume reached 0.95%, 2.21%, 2.27%, 1.71%, and 1.42% in Japan, Korean, Singapore, Indonesia, and Thailand, respectively. The reason Taiwan cooperates closely with Asian countries is because of the Free Trade Agreements (FTA) signed with those trading countries, and the trend of regional economic integration further influences the trading partnerships between Taiwan and southern Asian countries. In this regard, the government promulgates the "New Southbound Policy," aiming to strengthen Taiwan's trade and economic ties with members of the ASEAN and south Asian countries. At the same time, via this policy, the government hopes to initiate wide-ranging negotiations and dialogues with the nations of ASEAN and South Asia, with an eye to establishing close cooperation and together achieving regional development and prosperity. In addition, Taiwan and the U.S. have maintained stable trade volumes since the Trade and Investment Framework Agreement (TIFA) was signed in 2006, and Taiwan is the fourth major trading partner in the Asia-Pacific zone with Canada. The average quarterly growth rate of the total bilateral trade volume reached 1.14% and 0.84% in United States and Canada. The trade volume has been increasing due to close cooperation in the areas of agriculture, information communication, architecture, and public transportation.

Briefly, the quarterly business travel of Taiwan's nine key trading partners presents a stable trend. The declining business travel between these nine key trading partners and Taiwan was caused by exogenous events, including the SARS outbreak in 2003, the subprime financial crisis resulting in global economic downturn in 2008, and the lockdowns due to Covid-19 in 2020. In addition, the trade volumes of these nine trading partners demonstrate the magnitude of the correlation with Taiwan's quarterly trade volume. Trade volumes between Taiwan and Asian countries show upward trends while the other trade volumes between Taiwan and Canada, United States, United

Kingdom,and Australia were stable during the study period.

3.3 Unit root tests

To estimate the cointegration of the time series variables, all of the time series need to be stationary in order to avoid spurious correlation problems. The Augmented Dickey-Fuller (ADF) unit root tests are used to examine the time series variables investigated in this study (Dickey & Fuller, 1979). Table 2 shows the results of the ADF unit root tests for the time series variables, which indicate not all the time series variables are stationary. Therefore, first-order differencing is applied to make the non-stationary time series variables stationary.

3.4 Cointegration test and Granger causality test

Cointegration between two time series variables implies a long-term equilibrium relationship exists (e.g., Granger, 1988; Khan *et al.*, 2005; Kulendran & Wilson, 2000; Oh, 2005). This study employs the Johansen cointegration test to examine the long-term equilibrium relationship between business travel and trade volume between Taiwan and its major trading partners in Asia, North America, and Australia. In Table 3, the results of Johansen trace test show that JPN and US reject H_0:γ=0 in 5% significant level that means there is a cointegration relationship between Japan and Taiwan, and between US and Taiwan. The results indicate that there is a long-term equilibrium relationship between business travelers and trade volume both in Japan-Taiwan and US-Taiwan. The study adopts Vector Error Correction Model (VECM) to address the long-term equilibrium relationship and the short-term dynamic adjustment among variables. The VECM models are shown as below.

$$
\begin{aligned}
\Delta Tourist_t =& \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta Tourist_{t-i} + \sum_{i=1}^{p} \alpha_{2i}\Delta Volume_{t-i} + \alpha_3\Delta DFI_t + \\
& \alpha_4\Delta GDP_t + \alpha_5\Delta EX_t + \alpha_6 SARS_t + \alpha_7 GFC_t + \alpha_8 Covid19_t + \\
& \alpha_9 ECT_{t-1} + \varepsilon_t
\end{aligned} \tag{1}
$$

Table 2: ADF test for the time series variables.

Country	Traveler		Trade volume		Approved DFI	
	Data	Difference	Data	Difference	Data	Difference
Japan	-0.740	-3.638**	-3.213*	-4.671***	-3.970**	-6.031***
Korea	0.064	-3.544**	-3.453*	-3.777**	-3.354*	-5.952***
Singapore	-1.336	-3.596**	-2.246	-4.084***	-4.019**	-5.835***
Indonesia	-1.350	-4.236***	-1.362	-4.007**	-2.053	-4.872***
Thailand	-1.386	-3.378*	-2.928	-3.753**	-4.408***	-8.000***
Canada	-1.525	-4.098***	-3.768**	-3.845**	-4.193***	-6.817***
United States	-1.417	-4.511***	-3.142	-4.384***	-1.735	-2.281
United Kingdom	-2.183	-3.970**	-2.704	-4.535***	-2.430	-5.744***
Australia	-1.451	-4.955***	-1.902	-3.527**	-3.344*	-5.779***

Country	GDP growth rate		Exchange rate	
	Data	Difference	Data	Difference
Japan	-3.879**	-6.782***	-2.334	-3.882**
Korea	-4.126***	-5.881***	-2.998	-3.916**
Singapore	-3.942**	-4.600***	-0.182	-4.486***
Indonesia	-2.606***	-5.321***	-3.464*	-3.672**
Thailand	-4.608***	-5.961***	-1.944	-4.248***
Canada	-4.501***	-7.154***	-1.918	-5.300***
United States	-3.253*	-5.868***	-2.444	-3.782**
United Kingdom	-3.934**	-6.238***	-3.250*	-3.802**
Australia	-4.301***	-6.455***	-1.831	-5.057***

*, **, and *** indicate the rejection of the null hypothesis (H_0) at the 0.10, 0.05, and 0.01 significance level, respectively.

$$\Delta Volume_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta Volume_{t-i} + \sum_{i=1}^{p} \beta_{2i} \Delta Tourist_{t-i} + \beta_3 \Delta DFI_t +$$
$$\beta_4 \Delta GDP_t + \beta_5 \Delta EX_t + \beta_6 SARS_t + \beta_7 GFC_t + \beta_8 Covid19_t + \qquad (2)$$
$$\beta_9 ECT_{t-1} + \eta_t$$

where $\Delta Tourist$ (one thousand people per unit) and $\Delta Volume$ (10 billion per unit) represent the quarterly change in business travel and the quarterly trade volumes (imports plus exports) between Taiwan and its nine major trading partners; ΔDFI represents the quarterly change of direct foreign investment in Taiwan and its nine key trading countries; ΔGDP (one thousand dollars per unit) indicates the quarterly change in annual nominal GDP growth rate for Taiwan and the nine major trading partners; and ΔEX represents the quarterly change in the exchange rate between Taiwan and the nine major trading partners. $SARS$ represents the SARS outbreak in 2003; this takes the value of 1 when the SARS outbreak occurred between November 2002 and July 2003, and 0 otherwise. GFC represents the global financial crisis in 2008 (i.e., the subprime financial crisis) and 2011 (i.e., the European sovereign rating crisis); it takes the value of 1 when the global financial crisis occurred during August 2007-December 2008 and May 2011-June 2011, and 0 otherwise. $Covid19$ represents the outbreak of the global pandemic of coronavirus disease 2019-2020; it takes the value of 1 when the virus was identified from Wuhan in December 2019- December 2020, and 0 otherwise. α and β represent regression coefficients, ECT represents error correction term, p represents the lags, and ε and η are error terms. Because Taiwan do not have cointegration relationships with the other seven countries, the study adopts VAR models as the equations (3) and (4).

$$\Delta Tourist_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta Tourist_{t-i} + \sum_{i=1}^{p} \alpha_{2i}\Delta Volume_{t-i} + \alpha_3\Delta DFI_t +$$
$$\alpha_4\Delta GDP_t + \alpha_5\Delta EX_t + \alpha_6 SARS_t + \alpha_7 GFC_t + \alpha_8 Covid19_t + \varepsilon_t \tag{3}$$

$$\Delta Volume_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\Delta Volume_{t-i} + \sum_{i=1}^{p} \beta_{2i}\Delta Tourist_{t-i} + \beta_3\Delta DFI_t +$$
$$\beta_4\Delta GDP_t + \beta_5\Delta EX_t + \beta_6 SARS_t + \beta_7 GFC_t + \beta_8 Covid19_t + \eta_t \tag{4}$$

α and β represent regression coefficients, p represents lags, and ε and η represent error terms. In the study, the lags (p) for VECM and VAR are decided by AIC and the results as shown below (Table 4).

Table A1 and Table A2 of the Appendix show the parametric estimates of VECM for business travelers and trade volume both in Japan-Taiwan and US-Taiwan. For the

Table 3: Johansen cointegration test.

	$\gamma = 0$				$\gamma \leq 1$			
	Statistics	10%	5%	1%	Statistics	10%	5%	1%
JPN	**17.713**	15.66	17.95	23.52	1.054	6.5	8.18	11.65
KOR	10.083	15.66	17.95	23.52	3.173	6.5	8.18	11.65
SGP	10.510	15.66	17.95	23.52	0.012	6.5	8.18	11.65
INA	13.038	15.66	17.95	23.52	2.017	6.5	8.18	11.65
THA	7.725	15.66	17.95	23.52	1.536	6.5	8.18	11.65
CAN	9.447	15.66	17.95	23.52	0.330	6.5	8.18	11.65
US	**18.059**	15.66	17.95	23.52	3.944	6.5	8.18	11.65
UK	9.646	15.66	17.95	23.52	0.405	6.5	8.18	11.65
AUS	5.967	15.66	17.95	23.52	0.387	6.5	8.18	11.65

Table 4: The results of AIC for Taiwan's nine trading countries.

	JPN	KOR	SGP	INA	THA	CAN	US	UK	AUS
Lag	5	4	2	3	4	8	5	7	8

trade volume both in Japan-Taiwan and US-Taiwan and business traveler in US-Taiwan, the *ECT* is negative at the 0.05 significant level which continuously adjusts to the next quarter at a specific speed until achieving in long-term equilibrium. In addition, both in Japan and US, $Tourist_{t-i}$ has negative impacts on $Tourist_t$, $Volume_{t-i}$ has positive impacts on $Tourist_t$, and business travelers and diseases (i.e. SARS and Covid19) have negative impacts both in Japan and US. For the trade volume both in Japan and US, $Tourist_{t-i}$ has positive impacts on $Volume_t$ and US EX_t has negative impacts on the trade volume. Table A3 to Table A9 of the Appendix show the parametric estimates of VAR for the other seven countries. For the business travelers, $Tourist_{t-i}$ has negative impacts on $Tourist_t$, and business travelers and diseases (i.e. SARS and Covid19) have negative impacts (except Indonesia). For the trade volume, there is no consistency variable impacting trade volume except the trade volume has autocorrelation in the most countries (except United Kingdom).

For the residual analysis, the study uses Poermanteau test to detect autocorrelation in the residuals of a model: it tests whether any of a group of autocorrelations of the

residual time series are different from zero. The results are shown in the Table A10 of the Appendix. The results indicate that Canada and Australia have residual time series at 0.05 significant level. The study increases the lags to decrease the residual time series but the model was typically uninformative and questionably specified. In contrast, the residual does not have heteroscedasticity at 0.05 significant level when the study uses ARCH-LM test to exam heteroscedasticity.

Importantly, the cointegration of the two time series variables in this study may also indicate the presence of at least one unidirectional Granger causality running from one time series variable to another time series variable (Granger, 1988). However, the weakness of using cointegration tests is this approach does not show the direction(s) of the causal relationship(s) between the two time series variables. Therefore, the study continues to employ the Granger causality test to examine the directions of Granger causality between business travel and trade volume for each of Taiwan's nine major trading partners. The choice of the Granger causality test over other techniques is owing to its favorable response for both large and small samples (Akinboade & Braimoh, 2010). The hypotheses shown in Eqs (5) and (6) are established, and the null hypothesis (H_0) is also tested with the conventional F-test. In performing the F-test, the null hypothesis is rejected when the p-value is smaller than 0.05; for example, a rejection of the null hypothesis in Eq. (5) means one time series variable does Granger-cause another time series variable.

H_0: testing trade volume does not Granger-cause business travel for Taiwan and its nine partners, respectively.

$$H_0 : \alpha_{21} = \alpha_{22} = \cdots = \alpha_{2p} = 0 \tag{5}$$

H_0: testing business travel does not Granger-cause trade volume for Taiwan and its nine partners, respectively.

$$H_0 : \beta_{21} = \beta_{22} = \cdots = \beta_{2p} = 0 \tag{6}$$

The Granger causality test results are reported in Table 5. The results indicate rejection of the null hypothesis that trade volume does not Granger-cause business

Table 5: Granger causality between business travel and trade volumes.

| Country | Granger-causality | | | | | |
| | Volumes do not Granger cause tourist | | | Tourists do not Granger cause volumes | | |
	Statistics	P-value	Adjusted P-value	Statistics	P-value	Adjusted P-value
Japan	2.348	0.045	0.102	2.128	0.067	0.201
Korea	0.733	0.571	0.571	1.435	0.227	0.301
Singapore	0.860	0.426	0.479	2.337	0.101	0.226
Indonesia	1.760	0.158	0.237	1.792	0.152	0.274
Thailand	1.394	0.240	0.309	2.411	0.053	0.201
Canada	2.793	0.008	**0.036**	2.562	0.014	0.126
United States	5.859	0.000	**0.001**	1.370	0.241	0.301
United Kingdom	2.661	0.014	**0.043**	1.216	0.301	0.301
Australia	1.636	0.124	0.224	1.263	0.272	0.301

Adjust P-values for Multiple Comparisons using the BH procedure (Benjamini and Hochberg, 1995).

travel is the case for Canada, U.S., and U.K, but not for all Asian countries, including Japan, Korea, Singapore, Indonesia, and Thailand, and Australia. In addition, in this study, the null hypothesis that business travel does Granger-cause trade volume is the cases for all nine major trading countries. In general, the results indicate only one-way direction of trade volume between Taiwan and Canada, U.S., and U.K. do Granger-cause the number of business travelers from Canada, U.S., and U.K. visiting Taiwan.

4. Discussion and policy implications

The results of this study show a long-term equilibrium relationship (cointegration) between business travel and trade volume between Taiwan and Japan, and between Taiwan and the U.S. The evidence of two-way Granger causality between business travel and trade volume does not exist in this study that cannot support the concept of a reciprocal linkage between business travel and trade volume, and is not consistent with the findings reported in the literature, in terms of Granger causality between business travel and trade volume in different nations (Khan *et al.*, 2005; Kulendran & Wilson,

2000; Shan & Wilson, 2001). However, there is an unidirectional (one-way Granger causality) causal effects run from trade volume to business travel between Taiwan and Canada, U.S., and U.K. Meanwhile, there is no relationship between business travel and trade volume between Taiwan and Japan, Korea, Singapore, Indonesia, Thailand, and Australia.

Taiwan has traditionally been a famous travel destination in Asia for the reasons of hospitality, culture, customs, and geography, which possibly explain why business travel between Taiwan and Asian countries does not Granger-cause trade volume, and vice versa. Looking to the future, regional economic integration will be the mainstream. To maintain the enterprises' competitive advantages, the Taiwan government announced political policies, such as the "Southern Policy", "Law for the Development of the Cultural and Creative Industries", and "New Southbound Policy", to continually reinforce industrial cooperation and economic and trade expansion with southeast Asian countries to respond to changing global conditions and fulfill the trend towards regional integration by making appropriate adjustments. Under the New Southbound Policy, the Taiwan government has strengthened Taiwan's partnerships with New Southbound Policy-target countries and has strived for bilateral or multilateral cooperation opportunities based on Taiwan's strengths in the areas of medical care, culture, tourism, science, and technology, as well as agriculture. Given this, it should not be surprising there is no statistical Granger causality because of the development of regional economy and the political policies can only have short-term effects.

The findings of this study have important implications for the Taiwan government and the Tourism Bureau, R.O.C., in terms of implementing suitable policies and strategic planning to attract international corporations to do business with Taiwanese companies, in addition to allocating more resources for advertising and promoting the country (Figure 3 shows the growth rate of the trade volumes of foreign corporations in Taiwan are increasing; also, this sector may be highly correlated with the value-added market for Taiwan's economy and tourism). Importantly, policymakers and government ministers in Taiwan must recognize the differences in the motivations and requirements of foreign corporations to provide more convenient investment opportunities for businesses. Further analysis of their unique motivations and requirements

will assist policymakers in developing actions that boost economic and tourism growth in Taiwan through the provision of high-quality labor forces (e.g., intelligent labor) and attractive tariff concessions, as well as upgrading the investment environment and facilities to attract more high-end foreign corporations to do business in Taiwan.

Further, it is important the government pays considerable attention to the factors influencing trade volumes between its nine trading partners in recent years. With the exception of the exogenous impacts mentioned in Section 2, movement of the exchange rate could be another trigger changing the business negotiation ability of Taiwan with multinational corporations that are doing business in different countries. The exchange rate volatility experienced by Asian and Oceanic countries during the early parts of 1996 and 1997 likely had a significant impact on trade volumes both within those countries and with other parts of the world. Most of the volatility resulted in substantial downward movements in exchange rates vis-à-vis the U.S. dollar. In particular, one commodity that is likely to be affected by exchange rate volatility is tourism (both business and leisure travel), as a substantial component of the expense of a foreign holiday is expenditure at the destination. Regarding the effect of exchange rate volatility on trade, the literature shows the underlying trade theory that international trade responds adversely to exchange rate uncertainty holds (McKenzie, 1999; Clark *et al.*, 2004; Ozturk, 2006). However, this theoretical relationship is sensitive, and depends on the attitude towards risk of agents and the presence of developed forward exchange markets. In relation to the effect of exchange rate volatility on tourism, Webber (2001) investigates the impact of exchange rate volatility on tourism demand and concludes the exchange rate is a significant determinant of long-term tourism demand. It can be inferred if the exchange rate is more volatile in Taiwan and its major trading partners, this will lead to a lower trade volume being initiated by those trading partners, and moreover, business travel will be influenced in the long run.

Among Taiwan and its major trading partners, it is not surprising that the Taiwan government and multinational corporations of Taiwan have focused on investment opportunities since the Government announced the Southern Policy to expand "two-way" exchange in the areas of the economy and trade relations, investment, and tourism within the southern Asian region. To boost two-way investment and trade, and in-

stigate more vigorous economic cooperation, the government invests in soft and hard infrastructure, and strengthens linkages with regional markets to cooperate with the nations of ASEAN with southern Asia and offering immense business opportunities. Taiwan's past success in economic development came about because of its comparative advantages - an outward-looking strategy and strength in contract electronic manufacturing. These could be key factors earning Taiwan a place in global supply chains and, within Asia, a key role as a provider of capital and technology and an integrator of resources. In terms of policy implications, it is imperative policymakers in Taiwan realize Taiwan must redefine its role in the process of regional development when faced with a reshuffling of global supply chains and the rise of emerging economies.

5. Concluding remarks

The aim of this study is to empirically investigate the Granger causality relationship between business travel and trade volumes between Taiwan and its nine key trading partners, both in Asia (i.e., Japan, Korea, Singapore, Indonesia, and Thailand), in North America (i.e., Canada and the United States), and in Australia using the Engle-Granger VAR model for the period of 2001Q1-2020Q4. The results of this study in terms of cointegration and Granger causality reveal several important insights. First, cointegration tests reveal long-term equilibrium relationships exist between Taiwan and Japan and between Taiwan and the United States. The policy implication for Taiwan is, for the most part, trends in business travel cannot be used to predict trade volume in the future, and vice versa. Cointegration between business travel and trade volume exists, but is not common. Second, there is no bidirectional (two-way) causal relationship in the study. However, between Taiwan and Canada, the United States, and the United Kingdom only unidirectional (one-way) Granger causality running from trade volume to business travel is seen during the study period.

The key findings of this study have several significant implications for strategic planning and decision-making by policymakers regarding how to devise the best strategies and/or approaches to enhance two-way trading opportunities that maintain trading volume and the numbers of business travelers visiting and/or revisiting Taiwan for business purposes and staying for either work purposes or holidays. It is generally accepted

there is a bidirectional causal relationship between trading volume and business travel. Moreover, especially in Taiwan, higher trading volumes between different countries have significant positive impacts on Taiwan's business travel and exchange rate, as well as the profitability of multinational corporations; also, a high frequency of trading activity with other countries can foster people-to-people ties (either in an intercultural manner or in tourism exchange) and promote Taiwan's international reputation as the "Formosa". Again, evidence of a long-term equilibrium relationship between business travel and trade volume (e.g., between Taiwan and Japan, and Taiwan and the United States), and the unidirectional relationship between Taiwan and three of its nine key trading partners (Canada, U.S., and U.K.), justify the necessity of extra effort to attract more trade volumes to Taiwan, which will positively affect Taiwan's economic development. Finally, this study concludes that although some common traits are identified, the empirical results and findings are essentially idiosyncratic to the data.

Appendix. Tables

Table A1: Estimates of VECM for business travelers and trade volume both in Japan-Taiwan.

| | $Tourist \sim Volume$ | | | | | $Volume \sim Tourist$ | | | |
Parameter	Estimate	Std.	t-value	Pr(>|t|)	Parameter	Estimate	Std.	t-value	Pr(>|t|)
α_0	22.691	15.367	1.477	0.145	β_0	53.617	19.649	2.729	**0.008**
α_{11}	-0.561	0.167	-3.353	**0.001**	β_{11}	0.223	0.127	1.760	**0.084**
α_{12}	-0.483	0.177	-2.721	**0.009**	β_{12}	-0.037	0.128	-0.284	0.777
α_{13}	-0.356	0.164	-2.170	**0.034**	β_{13}	-0.224	0.121	-1.855	**0.069**
α_{14}	-0.176	0.163	-1.085	0.283	β_{14}	0.113	0.121	0.937	0.353
α_{15}	-0.130	0.127	-1.024	0.310	β_{15}	-0.119	0.117	-1.023	0.311
α_{21}	0.291	0.099	2.938	**0.005**	β_{21}	0.470	0.214	2.195	**0.032**
α_{22}	0.179	0.100	1.787	**0.079**	β_{22}	0.198	0.227	0.874	0.386
α_{23}	0.139	0.095	1.472	0.147	β_{23}	0.240	0.210	1.142	0.258
α_{24}	0.123	0.094	1.300	0.199	β_{24}	0.315	0.208	1.517	0.135
α_{25}	0.132	0.091	1.448	0.153	β_{25}	0.080	0.162	0.492	0.625
α_3	0.000	0.002	-0.228	0.820	β_3	0.001	0.002	0.649	0.519
α_4	-23.295	61.833	-0.377	0.708	β_4	93.498	79.063	1.183	0.242
α_5	-1.715	2.320	-0.739	0.463	β_5	0.019	2.967	0.006	0.995
α_6	-26.396	5.416	-4.874	**0.000**	β_6	-7.838	6.925	-1.132	0.263
α_7	-3.178	3.528	-0.901	0.372	β_7	2.023	4.511	0.448	0.656
α_8	-41.125	5.204	-7.902	**0.000**	β_8	-4.949	6.655	-0.744	0.460
α_9	-0.138	0.109	-1.272	0.209	β_9	-0.428	0.139	-3.081	**0.003**
R^2	0.675				R^2	0.398			

Table A2: Estimates of VECM for business travelers and trade volume both in US-Taiwan.

	$Tourist \sim Volume$				$Volume \sim Tourist$			
Parameter	Estimate	Std.	t-value	Pr(>|t|)	Parameter	Estimate	Std.	t-value	Pr(>|t|)
α_0	29.122	13.370	2.178	**0.034**	β_0	134.656	50.419	2.671	**0.010**
α_{11}	-0.376	0.124	-3.036	**0.004**	β_{11}	0.042	0.140	0.304	0.762
α_{12}	-0.394	0.126	1.104	0.274	β_{12}	0.046	0.142	0.326	0.745
α_{13}	-0.239	0.128	-3.122	**0.003**	β_{13}	-0.099	0.146	-0.675	0.503
α_{14}	-0.152	0.118	4.915	**0.000**	β_{14}	0.443	0.134	3.299	**0.002**
α_{15}	-0.060	0.098	-1.872	**0.066**	β_{15}	0.042	0.140	0.304	0.762
α_{21}	0.041	0.037	2.107	**0.040**	β_{21}	0.046	0.142	0.326	0.745
α_{22}	0.186	0.038	-1.289	0.203	β_{22}	-0.099	0.146	-0.675	0.503
α_{23}	0.082	0.039	1.234	0.222	β_{23}	0.443	0.134	3.299	**0.002**
α_{24}	0.044	0.036	-0.615	0.541	β_{24}	0.004	0.004	0.985	0.329
α_{25}	0.045	0.039	1.144	0.258	β_{25}	-32.084	87.540	-0.367	0.715
α_3	0.002	0.001	1.826	**0.073**	β_3	-2.090	1.065	-1.961	**0.055**
α_4	-20.012	23.214	-0.862	0.392	β_4	-5.057	9.100	-0.556	0.581
α_5	-0.153	0.283	-0.541	0.591	β_5	-1.564	5.403	-0.289	0.773
α_6	-14.346	2.413	-5.945	**0.000**	β_6	0.270	8.406	0.032	0.974
α_7	-0.364	1.433	-0.254	0.800	β_7	-0.928	0.354	-2.621	**0.011**
α_8	-15.288	2.229	-6.858	**0.000**	β_8	134.656	50.419	2.671	**0.010**
α_9	-0.340	0.094	-3.622	**0.001**	β_9	0.042	0.140	0.304	0.762
R^2	0.755				R^2	0.416			

Table A3: Estimates of VAR model for business travelers and trade volume both in Korea-Taiwan.

	$Tourist \sim Volume$					$Volume \sim Tourist$			
Parameter	Estimate	Std.	t-value	Pr($>$|t|)	Parameter	Estimate	Std.	t-value	Pr($>$|t|)
α_0	0.123	0.222	0.555	0.581	β_0	0.734	0.666	1.101	0.275
α_{11}	-0.597	0.114	-5.223	**0.000**	β_{11}	0.094	0.117	0.802	0.426
α_{12}	-0.581	0.114	-5.101	**0.000**	β_{12}	-0.117	0.125	-0.937	0.353
α_{13}	-0.421	0.119	-3.547	**0.001**	β_{13}	0.147	0.122	1.209	0.231
α_{14}	-0.068	0.128	-0.534	0.595	β_{14}	0.110	0.120	0.917	0.363
α_{21}	0.055	0.039	1.398	0.167	β_{21}	0.122	0.343	0.355	0.724
α_{22}	0.044	0.042	1.058	0.294	β_{22}	-0.503	0.342	-1.474	0.146
α_{23}	0.048	0.041	1.182	0.242	β_{23}	-0.469	0.356	-1.317	0.193
α_{24}	-0.011	0.040	-0.281	0.780	β_{24}	-0.423	0.383	-1.104	0.274
α_3	0.000	0.003	-0.107	0.915	β_3	0.017	0.009	1.813	**0.075**
α_4	-5.617	3.111	-1.806	0.076	β_4	-24.913	9.334	-2.669	**0.010**
α_5	-0.024	0.193	-0.124	0.902	β_5	-1.823	0.579	-3.150	**0.003**
α_6	-3.195	1.171	-2.728	**0.008**	β_6	-0.177	3.515	-0.050	0.960
α_7	-0.589	0.846	-0.696	0.489	β_7	-0.068	2.538	-0.027	0.979
α_8	-8.561	1.128	-7.588	**0.000**	β_8	-0.081	3.386	-0.024	0.981
R^2	0.588				R^2	0.437			

Table A4: Estimates of VAR model for business travelers and trade volume both in Singapore-Taiwan.

	Tourist $\sim$ *Volume*					*Volume* $\sim$ *Tourist*			
Parameter	Estimate	Std.	t-value	Pr($>$|t|)	Parameter	Estimate	Std.	t-value	Pr($>$|t|)
α_0	0.226	0.172	1.311	0.194	β_0	0.993	0.614	1.619	0.110
α_{11}	-0.540	0.099	-5.465	**0.000**	β_{11}	-0.152	0.121	-1.257	0.213
α_{12}	-0.469	0.095	-4.948	**0.000**	β_{12}	-0.275	0.120	-2.301	**0.025**
α_{21}	0.016	0.034	0.469	0.640	β_{21}	0.106	0.352	0.303	0.763
α_{22}	-0.030	0.034	-0.881	0.382	β_{22}	-0.115	0.337	-0.342	0.733
α_3	0.000	0.000	0.391	0.697	β_3	0.001	0.001	0.743	0.460
α_4	-7.968	3.262	-2.443	**0.017**	β_4	-35.235	11.612	-3.035	**0.003**
α_5	-0.074	0.448	-0.165	0.869	β_5	1.334	1.594	0.837	0.406
α_6	-5.360	0.989	-5.420	**0.000**	β_6	-0.085	3.521	-0.024	0.981
α_7	-1.000	0.597	-1.676	**0.098**	β_7	-1.037	2.124	-0.489	0.627
α_8	-6.131	0.858	-7.147	**0.000**	β_8	1.858	3.054	0.608	0.545
R^2	0.595				R^2	0.198			

Table A5: Estimates of VAR model for business travelers and trade volume both in Indonesia-Taiwan.

	$Tourist \sim Volume$					$Volume \sim Tourist$			
Parameter	Estimate	Std.	t-value	Pr($>$|t|)	Parameter	Estimate	Std.	t-value	Pr($>$|t|)
α_0	0.011	0.076	0.140	0.889	β_0	0.075	0.349	0.215	0.831
α_{11}	0.007	0.123	0.055	0.956	β_{11}	-0.171	0.132	-1.298	0.199
α_{12}	0.012	0.122	0.098	0.922	β_{12}	-0.334	0.127	-2.630	**0.011**
α_{13}	-0.299	0.147	-2.032	**0.046**	β_{13}	-0.072	0.130	-0.555	0.581
α_{21}	-0.032	0.029	-1.101	0.275	β_{21}	-0.209	0.564	-0.370	0.712
α_{22}	0.005	0.028	0.173	0.863	β_{22}	0.427	0.557	0.768	0.445
α_{23}	0.005	0.029	0.167	0.868	β_{23}	-0.035	0.674	-0.052	0.959
α_3	-0.001	0.001	-0.893	0.375	β_3	0.005	0.007	0.671	0.504
α_4	0.241	0.272	0.886	0.379	β_4	1.349	1.243	1.085	0.282
α_5	-530	552	-0.961	0.340	β_5	1161	2526	0.460	0.647
α_6	-0.484	0.447	-1.083	0.283	β_6	0.452	2.045	0.221	0.826
α_7	-0.078	0.276	-0.281	0.779	β_7	1.558	1.261	1.235	0.221
α_8	-0.429	0.334	-1.285	0.204	β_8	-0.593	1.526	-0.388	0.699
R^2	0.149				R^2	0.173			

Table A6: Estimates of VAR model for business travelers and trade volume both in Thailand-Taiwan.

	Tourist ~ Volume					*Volume ~ Tourist*			
Parameter	Estimate	Std.	t-value	Pr(>|t|)	Parameter	Estimate	Std.	t-value	Pr(>|t|)
α_0	0.066	0.093	0.712	0.479	β_0	0.303	0.186	1.635	0.107
α_{11}	-0.220	0.127	-1.730	**0.089**	β_{11}	0.269	0.123	2.186	**0.033**
α_{12}	-0.071	0.130	-0.543	0.589	β_{12}	-0.154	0.118	-1.307	0.196
α_{13}	-0.245	0.128	-1.914	**0.060**	β_{13}	-0.085	0.118	-0.716	0.477
α_{14}	0.077	0.133	0.577	0.566	β_{14}	0.125	0.119	1.044	0.301
α_{21}	-0.032	0.062	-0.514	0.609	β_{21}	0.125	0.255	0.490	0.626
α_{22}	-0.045	0.059	-0.761	0.450	β_{22}	-0.155	0.260	-0.596	0.553
α_{23}	0.035	0.059	0.589	0.558	β_{23}	-0.515	0.255	-2.016	**0.048**
α_{24}	0.019	0.060	0.316	0.753	β_{24}	0.477	0.265	1.800	**0.077**
α_3	0.000	0.000	-0.122	0.903	β_3	0.000	0.001	-0.289	0.774
α_4	-2.098	1.538	-1.364	0.178	β_4	-10.893	3.076	-3.541	**0.001**
α_5	-7.254	3.872	-1.874	**0.066**	β_5	-7.416	7.742	-0.958	0.342
α_6	-1.005	0.521	-1.928	**0.059**	β_6	-0.420	1.042	-0.403	0.689
α_7	-0.247	0.312	-0.792	0.432	β_7	-1.340	0.623	-2.149	**0.036**
α_8	-1.175	0.412	-2.853	**0.006**	β_8	0.096	0.823	0.117	0.907
R^2	0.317				R^2	0.416			

Table A7: Estimates of VAR model for business travelers and trade volume both in Canada-Taiwan.

	$Tourist \sim Volume$					$Volume \sim Tourist$			
Parameter	Estimate	Std.	t-value	Pr(>|t|)	Parameter	Estimate	Std.	t-value	Pr(>|t|)
α_0	-0.029	0.047	-0.615	0.541	β_0	0.105	0.109	0.963	0.341
α_{11}	-0.729	0.095	-7.688	**0.000**	β_{11}	-0.173	0.134	-1.284	0.205
α_{12}	-0.568	0.114	-4.991	**0.000**	β_{12}	0.097	0.140	0.691	0.493
α_{13}	-0.523	0.125	-4.188	**0.000**	β_{13}	0.079	0.135	0.582	0.564
α_{14}	-0.193	0.137	-1.408	0.166	β_{14}	0.025	0.136	0.183	0.855
α_{15}	-0.142	0.138	-1.035	0.306	β_{15}	-0.124	0.135	-0.914	0.365
α_{16}	-0.044	0.138	-0.318	0.752	β_{16}	-0.109	0.138	-0.788	0.434
α_{17}	-0.171	0.125	-1.365	0.179	β_{17}	-0.253	0.132	-1.914	**0.062**
α_{18}	0.024	0.105	0.230	0.819	β_{18}	-0.208	0.133	-1.558	0.126
α_{21}	0.082	0.058	1.406	0.166	β_{21}	0.101	0.218	0.464	0.645
α_{22}	0.139	0.061	2.283	**0.027**	β_{22}	0.202	0.262	0.773	0.443
α_{23}	0.063	0.059	1.072	0.289	β_{23}	0.011	0.287	0.038	0.970
α_{24}	0.038	0.059	0.632	0.531	β_{24}	-0.279	0.315	-0.885	0.381
α_{25}	0.003	0.059	0.053	0.958	β_{25}	-0.069	0.316	-0.218	0.828
α_{26}	0.038	0.060	0.633	0.530	β_{26}	0.139	0.316	0.439	0.662
α_{27}	0.028	0.057	0.480	0.633	β_{27}	-0.074	0.288	-0.257	0.798
α_{28}	-0.008	0.058	-0.141	0.889	β_{28}	-0.257	0.242	-1.058	0.295
α_3	0.000	0.003	0.182	0.856	β_3	-0.009	0.006	-1.445	0.155
α_4	-2.133	1.329	-1.604	0.115	β_4	-4.692	3.056	-1.536	0.131
α_5	-0.023	0.046	-0.505	0.616	β_5	0.180	0.105	1.710	**0.094**
α_6	-2.539	0.359	-7.072	**0.000**	β_6	-0.401	0.825	-0.486	0.629
α_7	-0.203	0.147	-1.379	0.174	β_7	-0.133	0.338	-0.395	0.695
α_8	-1.136	0.204	-5.581	**0.000**	β_8	0.237	0.468	0.507	0.614
R^2	0.770				R^2	0.337			

Table A8: Estimates of VAR model for business travelers and trade volume both in United Kingdom-Taiwan.

Parameter	Estimate	Std.	t-value	Pr(>|t|)	Parameter	Estimate	Std.	t-value	Pr(>|t|)
	$Tourist \sim Volume$					$Volume \sim Tourist$			
α_0	-0.083	0.078	-1.066	0.292	β_0	0.074	0.194	0.382	0.704
α_{11}	-0.664	0.117	-5.651	**0.000**	β_{11}	-0.186	0.139	-1.339	0.187
α_{12}	-0.784	0.126	-6.217	**0.000**	β_{12}	-0.007	0.159	-0.044	0.965
α_{13}	-0.598	0.141	-4.234	**0.000**	β_{13}	-0.100	0.154	-0.648	0.520
α_{14}	-0.514	0.155	-3.320	**0.002**	β_{14}	0.151	0.160	0.944	0.350
α_{15}	-0.299	0.157	-1.901	**0.063**	β_{15}	-0.061	0.157	-0.387	0.700
α_{16}	-0.332	0.139	-2.389	**0.021**	β_{16}	0.096	0.151	0.639	0.526
α_{17}	-0.105	0.116	-0.904	0.370	β_{17}	-0.162	0.146	-1.114	0.271
α_{21}	0.053	0.056	0.938	0.353	β_{21}	-0.216	0.290	-0.744	0.460
α_{22}	0.167	0.064	2.600	**0.012**	β_{22}	-0.229	0.312	-0.733	0.467
α_{23}	0.091	0.062	1.456	0.152	β_{23}	-0.350	0.349	-1.001	0.322
α_{24}	0.084	0.065	1.296	0.201	β_{24}	-0.593	0.382	-1.550	0.127
α_{25}	0.080	0.064	1.255	0.215	β_{25}	-0.430	0.389	-1.105	0.275
α_{26}	0.095	0.061	1.550	0.127	β_{26}	-0.050	0.344	-0.146	0.884
α_{27}	-0.017	0.059	-0.288	0.775	β_{27}	0.119	0.287	0.413	0.681
α_3	0.000	0.000	-0.708	0.482	β_3	0.000	0.001	-0.032	0.975
α_4	-1.024	2.065	-0.496	0.622	β_4	-3.347	5.105	-0.656	0.515
α_5	-0.022	0.042	-0.529	0.599	β_5	0.152	0.104	1.460	0.151
α_6	-2.019	0.431	-4.685	**0.000**	β_6	-0.876	1.066	-0.822	0.415
α_7	-0.095	0.267	-0.356	0.723	β_7	-0.048	0.659	-0.073	0.942
α_8	-2.019	0.350	-5.766	**0.000**	β_8	-0.465	0.866	-0.537	0.594
R^2	0.668				R^2	0.379			

Table A9: Estimates of VAR model for business travelers and trade volume both in Australia-Taiwan.

	Tourist ~ Volume					Volume ~ Tourist			
Parameter	Estimate	Std.	t-value	Pr(>|t|)	Parameter	Estimate	Std.	t-value	Pr(>|t|)
α_0	-0.063	0.049	-1.281	0.206	β_0	0.383	0.462	0.828	0.412
α_{11}	-0.820	0.099	-8.300	**0.000**	β_{11}	-0.041	0.159	-0.259	0.797
α_{12}	-0.642	0.122	-5.260	**0.000**	β_{12}	-0.176	0.153	-1.145	0.258
α_{13}	-0.638	0.128	-4.989	**0.002**	β_{13}	-0.014	0.152	-0.091	0.928
α_{14}	-0.447	0.134	-3.337	**0.002**	β_{14}	-0.102	0.145	-0.703	0.485
α_{15}	-0.409	0.138	-2.968	**0.005**	β_{15}	0.102	0.164	0.626	0.534
α_{16}	-0.230	0.140	-1.637	0.108	β_{16}	-0.299	0.148	-2.016	**0.049**
α_{17}	-0.221	0.127	-1.739	**0.089**	β_{17}	0.133	0.146	0.910	0.367
α_{18}	-0.075	0.096	-0.780	0.439	β_{18}	-0.021	0.150	-0.139	0.890
α_{21}	0.011	0.017	0.621	0.538	β_{21}	0.866	0.926	0.935	0.354
α_{22}	0.001	0.016	0.050	0.960	β_{22}	0.413	1.144	0.361	0.720
α_{23}	0.012	0.016	0.766	0.448	β_{23}	-1.084	1.198	-0.904	0.370
α_{24}	0.004	0.015	0.229	0.820	β_{24}	-0.098	1.256	-0.078	0.938
α_{25}	-0.016	0.017	-0.912	0.366	β_{25}	0.468	1.292	0.362	0.719
α_{26}	0.002	0.016	0.107	0.915	β_{26}	0.101	1.315	0.077	0.939
α_{27}	0.018	0.016	1.137	0.261	β_{27}	-0.870	1.190	-0.731	0.468
α_{28}	0.005	0.016	0.288	0.775	β_{28}	-0.395	0.904	-0.437	0.664
α_3	0.000	0.000	-0.048	0.962	β_3	-0.002	0.002	-0.651	0.518
α_4	-2.827	2.753	-1.027	0.310	β_4	-8.628	25.801	-0.334	0.740
α_5	0.011	0.047	0.243	0.809	β_5	0.088	0.439	0.199	0.843
α_6	-2.861	0.358	-8.000	**0.000**	β_6	-1.825	3.351	-0.545	0.589
α_7	-0.053	0.155	-0.343	0.733	β_7	0.892	1.453	0.614	0.542
α_8	-1.567	0.212	-7.404	**0.000**	β_8	-1.401	1.983	-0.706	0.483
R^2	0.781				R^2	0.308			

Table A10: The diagnostics for the residuals.

	Serially correlated errors		Heteroscedasticity	
	Statistics	P-value	Statistics	P-value
Japan	20.97	0.398	112.69	0.164
Korea	29.77	0.074	87.32	0.793
Singapore	24.74	0.211	81.16	0.904
Indonesia	27.96	0.111	121.69	0.061
Thailand	20.57	0.423	98.93	0.482
Canada	45.63	0.001	98.99	0.481
United States	20.27	0.208	101.50	0.412
United Kingdom	24.76	0.211	76.97	0.951
Australia	44.33	0.001	83.56	0.867

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商務旅行與貿易量的因果關係

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摘　要

　　本研究以共整合分析與 Granger 因果關係檢定探討商務旅行與貿易量之因果關係。研究樣本取自 2001 年到 2020 年臺灣分別與日本、韓國、新加坡、印尼、泰國、加拿大、美國、英國與澳洲等九個國家之間商務旅行與貿易量。實證結果顯示臺灣與日本、臺灣與美國之間存在長期均衡關係。此外，臺灣分別對上述九個貿易國家之商務旅行與貿易量並不存在雙邊因果效應；僅臺灣分別對加拿大、美國和英國存在著貿易量對商務旅行之單向因果效應。本研究主要連結商務旅行與貿易量之間聯繫的概念。值得注意的是，本研究之結果期望可以提供給政策擬定者在制訂與相關貿易國之貿易政策時，可以有效的整合資源，與公、私部門之優勢以產生雙邊互惠之模式。

關鍵詞：商務旅行、貿易量、共整合分析、Granger 因果關係。

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