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AN EMPIRICAL ANALYSIS OF THE CAUSAL RELATIONSHIP BETWEEN TOURISM GROWTH AND THE SERVICE INDUSTRY IN THAILAND

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ABSTRACT

The relationship between economic growth and tourism development has been a central issue for researchers validating the tourism-led growth hypothesis. Much of this literature revolves around using aggregate measures of economic growth and tourism arrivals to test the tourism-led growth hypothesis. However, this paper aims to investigate the causality between growth in tourism and the expansion of services in Thailand. It is posited that evaluating the causal relationship between tourism and the development of the service sector is relevant since the service sector is a primary driver for economic growth and recovery. For this purpose, a Granger causality test was performed based on Toda-Yamamoto and a vector error correction model (VECM) using aggregated and disaggregated service production index (SPI) and international tourist arrivals. The findings show that causality runs from the development of the production of services as a whole to tourism growth. In turn, the hotel industry benefits from expanding international tourist arrivals. Evidence was also found of bidirectional causality between tourism growth and indices reflecting the production of real estate, transportation, and telecommunications. The findings suggest that the contribution of tourism growth to the production of services may depend on how integrated tourism is with the service sector. Therefore, it is necessary that strategic partnerships between tourism authorities and private stakeholders (i.e., telecommunications firms) be created and strengthened.

Keywords: Tourism-led growth; granger causality; service production index; tourism

1. INTRODUCTION

Tourism and its relationship with economic growth have been widely researched because tourism receipts directly flow to different kinds of business sectors, including hotel and lodging operations, the food and beverage business, retail, and transportation. Tourism can help economic activity by being a source of foreign exchange earnings that promotes financial capital formation (Çakmak et al., 2019) and investment in infrastructure (Fareed et al., 2018). Furthermore, tourism helps job creation (Çakmak & Çenesiz, 2020) and increases incomes (Li et al., 2018), as well as stimulates other sectors of the economy (Tugcu, 2014). Altogether this has led to the development of the tourism-led growth hypothesis.

Tugcu (2014) investigated the causality between tourism and economic growth using the Granger causality test with time series or panel data. They typically use aggregated variables, including GDP, number of

tourist arrivals, and total international tourism receipts (Ridderstaat et al., 2014). The problem is that the findings depend on the scope of the data and the econometric strategy employed. Aratuo and Etienne (2019) mentioned that these studies assume that all tourism businesses work within a homogenous industry. This assumption may lead to inconsistent results because the tourism industry is a system of firms that may respond differently to economic events (Tang & Jang, 2009). Consequently, these studies suffer from variability in outcomes.

In response, researchers have tested the causality between disaggregated or alternative tourism and economic growth measures. For instance, Tang and Tan (2013) investigated the causality between tourism and economic growth using disaggregated measures of tourist markets in Malaysia. Other researchers have attempted to study causality by employing Granger causality tests between the performance of tourism-related industries and economic growth (Aratuo & Etienne, 2019; Tang & Abosedra, 2016; Tang & Jang, 2009). Altogether, these studies have used variables that decompose tourism performance into variables representing the different businesses and sub-industries within tourism. However, the effects of disaggregated tourist market on economic growth have been less investigated in Thailand. Therefore, it is essential to consider using disaggregated tourist arrivals and to investigate how different tourist markets affect tourism development.

Another issue in studying tourism-led growth is the variable used to represent economic growth. Several examples of studies that use different measures representing economic growth, including GDP growth rate, are found in the literature. Other studies used job creation (Perles-Ribes et al., 2017) or IPI (Antonakakis et al., 2015; Tang, 2011; Tang & Tan, 2013; Tang & Jang, 2009) as a measure of economic growth. However, these measures come with limitations. Aggregate measures such as GDP are only available quarterly, and IPI only reflects the development of the industrial sector and does not reflect the development of other industries such as services (Dogru et al., 2017). The development of non-industrial sectors is often not included in tourism-led growth studies. Consequently, the causality between tourism growth and development in non-industrial sectors such as services is not well known.

Understanding this relationship is relevant to the service sector because a large portion of tourist spending is allocated to payments for services rendered at the destination. In Thailand, payment of services represented over 75% of total expenditure in 2017. The service industry might first absorb income generated from tourism and this may later spill over to other sectors, as we can observe from the increasing number of hired labor trends in the service industry (Tourism Council of Thailand, 2019).

On the other hand, several studies have shown that improved services, including transportation and medical care, influence tourists' decisions to visit a destination (de la Hoz-Correa et al., 2018; Gao et al., 2019; Johnson & Garman, 2010; Song et al., 2003). Therefore, the service industry and its subsectors might significantly contribute to tourism development and *vice versa*, which points to the necessity to investigate the causality between tourism growth and the development of the service industry and its subsectors. It is posited that, similar to the economy-led tourism growth argument, the development of the service industry and its subsectors can lead to tourism growth.

Therefore, this paper aims to investigate the causality between tourism growth and aggregated and disaggregated measures of SPI based on the tourism-led growth hypothesis. For this purpose, VECM and Toda-Yamamoto approaches were employed to test the tourism-led growth hypothesis. Furthermore, we employed cointegration techniques based on Johansen and ARDL to investigate the time series properties of the data.

This study further contributes to the literature in that we investigate whether tourists from different markets contribute differently to Thailand's service and subsector growth. The findings can be used in forming marketing strategies that will better target tourists from countries that strongly contribute to the development of Thailand.

2. USE OF SPI AS A MEASURE OF ECONOMIC GROWTH: THE CASE OF THAILAND

As shown in Figure 1, the service sector in Thailand contributes to more than 55% of the total GDP. Moreover, movements in economic activity are tied to those of value-added from the service industry. It can be observed that steady increases in the service industry can support economic activity, even when industrial and agricultural goods are underperforming.

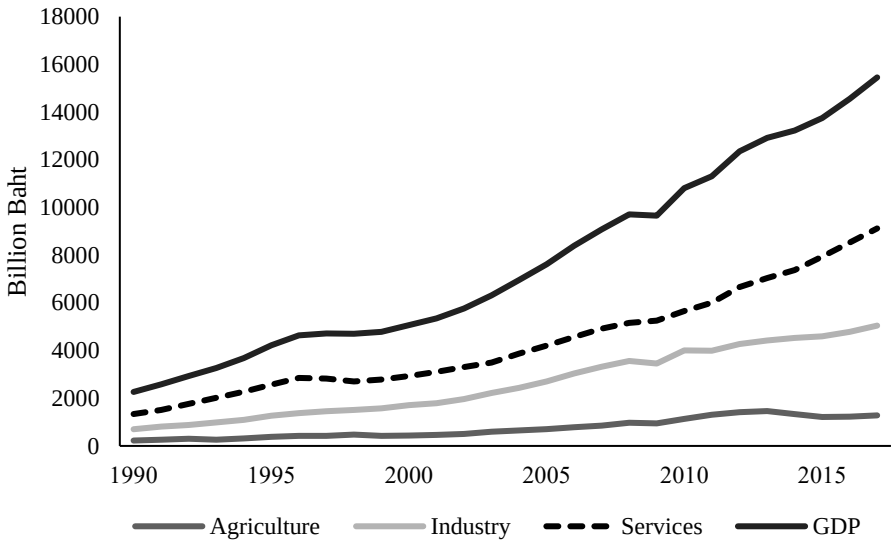

Figure 1: GDP and Value-added Agriculture, Services, and Industrial Sectors in Thailand from 1990 to 2017

Figure 2 reports similar patterns, where the growth of economic activity depends on the performance of the service industry. Sharp falls in GDP growth are brought about by contractions in the contribution of services to economic growth. After 2010, the contribution of services to economic growth outpaced other industries, including the agricultural and industrial sectors, providing indications of the importance of the service industry to the Thai economy. Furthermore, Thailand has experienced an increase in the export of different kinds of services helping the country to accumulate foreign exchange earnings (Amornvivat et al., 2017). Consequentially, studying the growth of services can also be closely tied to economic growth, especially in countries driven by the tourism sector.

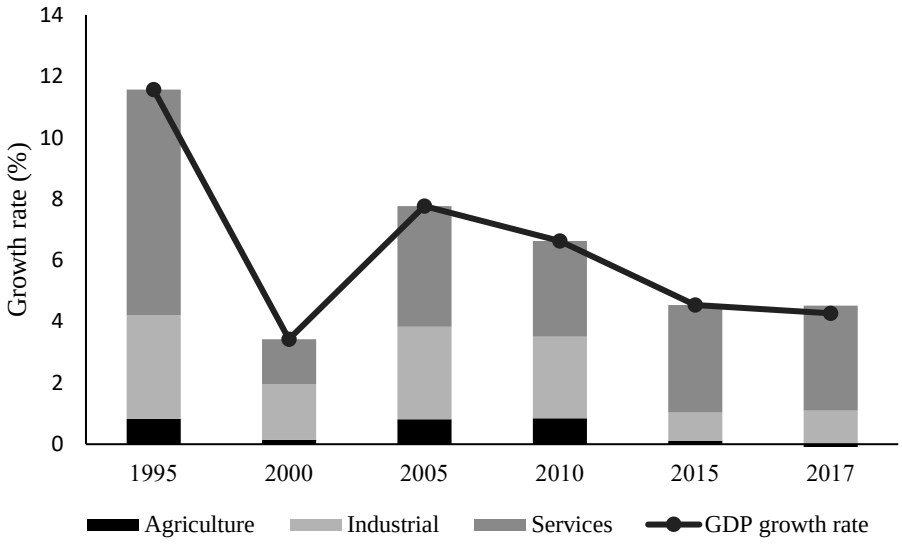

Figure 2: Economic Growth and the Contribution of Each Industry to Economic Growth in Thailand

The service sector is the most relevant to tourism out of all the economic sectors in Thailand. The SPI is decomposed into production indices representing different subsectors of the service industries, including hotel and restaurant, real estate services, and transportation. These services are of particular importance because the performance of these sectors has a direct connection with the tourism industry.

Considering all of this, it can be concluded that measures reflecting the production of services, including aggregated and disaggregated forms of the SPI, can be used to study the causality between economic performance and tourism performance.

3. MATERIALS AND METHODS

As previously mentioned, several types of data and strategies are employed to test for Granger Causality in the literature investigating the tourism-led growth hypothesis. In the following section, we will describe the data used in this study and discuss the empirical approach used to test for Granger Causality.

3.1 Data

The data used in this study include tourist arrivals per month and SPI. The number of monthly international tourist arrivals from January 2011 to December 2018 (aggregated into total numbers and per continent) was collected from the Thailand Ministry of Tourism and Sports and was adjusted for seasonal effects (Antonakakis et al., 2015). The BOT provides the monthly data of the SPI, which is a weighted average of the production of eight major sectors of the service industry, including hotels and restaurants, transport and telecommunications, financial services, real estate, renting and business activities, wholesale and retail, public administration, and education and health. It is constructed based on the Laspeyres index weighted using value-added service activities at 2011 constant prices.

Before testing Granger's non-causality between tourist arrivals and the production of services in Thailand, we investigated time series properties, including the stationarity process of the data set and the existence of the long-run relationship among the variables. The stationarity process of the data set in its natural logarithm was investigated using an Augmented Dickey-Filler test (Dickey & Fuller, 1979, 1981). Furthermore, in the presence of data that is stationary at first-order difference, Johansen's cointegration was used to test the existence of long-run relationships (Johansen, 1988; Johansen & Juselius, 1990). We also employed an ARDL-bound test to confirm whether the variables representing the production of services and tourist arrivals were cointegrated (Pesaran et al., 2001).

3.2 Empirical approach

Granger causality techniques based on augmented VAR or autoregressive distributive lag models are common econometric approaches used to test the causality between economic growth and tourism (Li et al., 2018). The modifications to the models would depend on the time-series properties of the data collected. Park and Phillips (1988), Sims et al. (1990), and Toda and Yamamoto (1995) provide discussions on the advantages and disadvantages of each approach. For this study, we used the Granger causality test based on VECM and the Toda-Yamamoto augmented Granger causality test (Toda & Yamamoto, 1995) in order to shed light on the direction of the causality between the production of services and tourism.

The Toda-Yamamoto Granger causality test has a more robust statistical power than the conventional Granger causality test, and it can be carried out using variables regardless of the presence or absence of cointegration and the level at which the variables are stationary (Aratuo & Etienne, 2019). In turn, performing a Granger causality test based on VECM provides the advantage of testing the causality in the short-run coefficients (Lütkepohl, 2005). In a VECM, the short-run relationship among variables is estimated using the first difference of a set of variables. When these variables are transformed into their natural logarithm form, they closely approximate the variable's growth rate (Lütkepohl, 2005). Therefore, the Granger causality test in the short-run coefficients can be interpreted as the causality of the growth rates among the variables under study.

3.3 VECM Granger causality

The Granger causality test using stationary variables at first difference can be performed using a vector autoregressive model (VAR) set on first differences or a VECM (Tang & Jang, 2009). In the presence of cointegrated variables, Tang and Tan (2015a) mentioned that modeling the Granger causality tests based on a VECM would yield better results than a VAR. If the variables used in this study were found to be cointegrated, we used the following VECM to perform the Granger causality test.

$$\Delta SPI_t = \alpha + \sum_{i=1}^{k} \alpha_{1i} \Delta SPI_{t-i} + \sum_{i=1}^{k} \beta_{1i} \Delta Arr_{t-i} + \mu_1 \pi_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta Arr_t = \alpha + \sum_{i=1}^{k} \alpha_{2i} \Delta SPI_{t-i} + \sum_{i=1}^{k} \beta_{2i} \Delta Arr_{t-i} + \mu_2 \pi_{t-1} + \varepsilon_{2t} \quad (2)$$

where Δ is the first difference operator, and *SPI* and *Arr* are the measures in the logarithm forms of the service production index and international tourist arrivals to Thailand. In turn k is the optimal lag length determined by the Aikake information criterion. π_{t-1} is the error correction term at period t-1. In the absence of cointegrated variables, the VAR would have a similar form to equation 1 and 2; however, the error correction term would not be included since there is no evidence of a long-run relationship among the variables. The Granger causality procedure on the short-run coefficients in equations 1 and 2 would require testing of the following null hypotheses:

$$H_{0,\Delta Arr \to \Delta SPI}: \beta_{11} = \beta_{12} = \cdots = \beta_{1i} = 0 \quad (3)$$

$$H_{0,\Delta SPI \to \Delta Arr}: \alpha_{21} = \alpha_{22} = \cdots = \alpha_{2i} = 0 \quad (4)$$

Failure to reject both null hypotheses in equation 3 and 4 would imply no evidence of causality between the data series at study. However, rejection of the $H_{0,\Delta Arr \to \Delta SPI}$ would suggest that causality runs from *ΔArr* to *ΔSPI*. Correspondingly, the rejection of $H_{0,\Delta SPI \to \Delta Arr}$ would help establish causality from *ΔSPI* to *ΔArr*. The rejection of both null hypotheses would then show a bidirectional relationship between *ΔSPI* and *ΔArr*.

3.4 Toda-Yamamoto Granger causality

The Toda-Yamamoto procedure follows a series of steps. First, the optimal lag length of the VAR is determined using the Aikake information criterion. The maximum order of integration was then determined based on the order at which *SPI* and *Arr* are stationary. Granger causality based on the Toda-Yamamoto would require that the information obtained from the previous steps be used to model an augmented VAR, as shown in equations 3 and 4.

$$SPI_t = \delta + \sum_{i=1}^{k} \delta_{1i} SPI_{t-i} + \sum_{i=1}^{k} \theta_{1i} Arr_{t-i} + \sum_{j=1}^{dmax} \rho_{1j} SPI_{i-k-j} + \sum_{j=1}^{dmax} \sigma_{1j} Arr_{i-k-j} + \varepsilon_{1t} \quad (5)$$

$$Arr_t = \delta + \sum_{i=1}^{k} \delta_{2i} SPI_{t-i} + \sum_{i=1}^{k} \theta_{2i} Arr_{t-i} + \sum_{j=1}^{dmax} \rho_{2j} SPI_{i-k-j} + \sum_{j=1}^{dmax} \sigma_{2j} Arr_{i-k-j} + \varepsilon_{2t} \quad (6)$$

SPI, *ARR,* and *k* are homologous to the variables shown in equations 1 and 2. In turn, *dmax* is the maximum order of integration. Performing the causality tests would require the employment of the Wald test on the coefficients of the independent variables attached to k lags. The hypothesis test would then be the following:

$$H_{0,Arr \to SPI}: \theta_{11} = \theta_{12} = \cdots = \theta_{1i} = 0 \quad (7)$$

$$H_{0,SPI \to Arr}: \delta_{21} = \delta_{22} = \cdots = \delta_{2i} = 0 \quad (8)$$

The null hypothesis in equation 7 states that there is no Granger-causality running from the *Arr* to *SPI*. In turn, the null hypothesis shown in equation 8 indicates that there is no Granger-causality running from *SPI* to *Arr*. The outcomes from the Wald tests in equations 7 and 8 are analogous to those in equations 3 and 4. Failure to reject the null hypothesis shown in equations 7 and 8 would indicate the existence or absence of causality between *Arr* and *SPI*.

4. RESULTS AND DISCUSSION

The results of the unit root test and the cointegration test are shown in 4.1. In turn, the results of the Granger causality test between the production of services and tourist arrivals are shown in 4.2 and 4.3. Section 4.4 discusses the Granger causality test results among the production of services and disaggregated tourist arrivals.

4.1 Unit root tests and the cointegration between SPI and international tourist arrivals

After finding that all of the variables are stationary at the first difference, cointegration tests were performed to see whether there was a long-run relationship among the variables used to represent growth in the production of services and international tourist arrivals. Based on the findings (Table 1), both Trace and Max Eigen statistics show that all production indices of services, including *SPI*, SPI_{HT}, SPI_{RE}, and $SPI_{TT,}$ are cointegrated with total tourist arrivals. Johansen cointegration tests using small sample sizes are associated with several problems, as Aratuo and Etienne (2019) and (Tang & Tan, 2015b) explained.

Table 1: Results of the Cointegration Test

Bivariate relationship		Johansen's cointegration test				Bound test for cointegration[a]		
		Trace stat		Max-Eigen stat			Critical values	
		r = 0	r ≤ 1	r = 0	r ≤ 1	F-stat	Lower	Upper
SPI	***Tour***	22.665**	0.642	22.450**	0.216	8.423	3.62	4.16
SPI_{HT}	***Tour***	43.070**	0.883	42.187**	0.883	26.482	3.62	4.16
SPI_{RE}	***Tour***	22.054**	0.548	21.506**	0.548	4.59	3.62	4.16
SPI_{TT}	***Tour***	28.360**	0.916	27.444**	0.916	9.385	3.62	4.16

Note. * p < 0.05, ** p < 0.01. [a] A bivariate model for the ARDL bound test was composed to include *SPI* measures as dependent variables. In turn, the independent variable is the total number of tourist arrivals. Lower and upper bound values are critical values at a 5% level of confidence.

For this reason, the ARDL bound test for cointegration was employed to confirm the results of the Johansen cointegration test. Following Aratuo and Etienne (2019), the ARDL bound tests between the production of services index and international tourist arrivals were employed by including international tourist arrivals as the independent variable and the different service production indices as the dependent variable. The findings are consistent with those obtained from Johansen's cointegration tests. The computed F statistics for the bound test for cointegration are higher than the upper bound critical value. These findings indicate that all measures of *SPI* and international tourist arrivals are cointegrated.

4.2 Causality between SPI and international tourist arrivals

Granger causality tests were conducted based on a VECM framework. In analyzing the results of the Granger causality tests, the short-run coefficients were a major point of focus since they provide some indications of causality between the growth of production of services and tourist arrivals. The findings in Table 2 show that, in general, causality runs from *ΔTour* to *ΔSPI*. The results also point to a failure to reject the null hypothesis, that causality runs from *ΔTour* to *ΔSPI*. However, the null hypothesis of causality running from *ΔSPI* Granger to *ΔTour* can be rejected at the 5% confidence level.

The findings did not show Granger causality running from the growth of the tourist arrivals to the overall production of services. However, there was evidence of Granger causality running from tourist arrivals to disaggregated measures of the production of services. The findings indicate that causality runs from tourism growth to the expansion of SPI_{HT}. In turn, the changes in the service that businesses offer related to real estate Granger cause tourist arrivals growth (p < 0.01). Lastly, we failed to find any evidence of Granger causality between SPI_{TT} and the increase in tourist arrivals.

Table 2: Granger Causality Test on the Short-run Coefficients of the VECM

Bivariate relationship		Lag	Chi-sq	F-stat	Caus.
Dependent	**Independent**				
ΔSPI	***ΔTour***	3	4.778	1.593	←
ΔTour	***ΔSPI***	3	9.505	3.167[b]	
ΔSPI_{HT}	***ΔTour***	8	36.000	4.499[a]	→
ΔTour	ΔSPI_{HT}	8	8.817	1.102	
ΔSPI_{RE}	***ΔTour***	3	5.688	1.896	←
ΔTour	ΔSPI_{RE}	3	6.315	2.105[c]	
ΔSPI_{TT}	***ΔTour***	2	3.497	1.749	–
ΔTour	ΔSPI_{TT}	2	1.157	0.578	

Note. [a, b,] and [c] denote significance at the 1%, 5%, and 10% levels. Caus. is short for causality, → indicates rejection of $H_{0,Arr \to SPI}$, while ← denotes rejection of $H_{0,SPI \to Arr}$, and – denotes failure to reject $H_{0,Arr \to SPI}$ and $H_{0,SPI \to Arr}$.

4.3 Results of the Toda-Yamamoto Granger causality test

The findings of the Toda-Yamamoto Granger causality test are reported in Table 3. Similar to the VECM Granger causality results, the Toda-Yamamoto Granger causality tests show that causality only runs from

growth in the service industry to growth in tourism arrivals, indicating that the development of the service sector would attract international tourists. In traveling to a foreign country, tourists consume different services, including hotels and transportation. Therefore, the service industry is at the forefront of the tourism industry, and strengthening and improving services would attract tourists to Thailand.

The findings contrast those reported by Tang and Tan (2015a). Tang and Tan (2016) indicated that the tourism sector's contribution to the economy depends on income. They found that the tourism sector helps countries' economic growth with high-income levels. In contrast, Thailand is a medium-income country, which could help explain the absence of the contribution of tourism to the production of services. Moreover, the Toda-Yamamoto Granger causality test results for the disaggregated measures of *SPI* contrast the findings reported in Table 2. The findings point to the acceptance of the feedback hypothesis when considering the bivariate models SPI_{RE}-*Tour* and SPI_{TT}–*Tour*. The growth hypothesis holds for the bivariate model SPI_{HT}–*Tour*. The evidence suggests that different sub-sectors of the service industry will react differently in response to changes in tourism. Analogous to our findings, Tang and Jang (2009) found that the subsectors of the tourism industry could have different responses to a change in the economy.

The results suggest that the service sectors, including transport and telecommunications, real estate, and hotels, benefit from expanding international tourist arrivals. Dogru and Bulut (2018) suggested that economic growth brought by tourism development depends on how integrated the tourism sector is with the overall economy. If these findings hold for the entire economy, then similar conclusions can be drawn between tourism growth and its contribution to the subsectors of the economy. In Thailand, services, including hotels, real estate, and transport, are heavily integrated with the tourist industry. Consequently, these sectors are likely to benefit from expanding the tourism industry.

In agreement with findings reported in this study, Fereidouni and Al-mulali (2014) stated that tourist arrivals increased real estate activities. Moreover, the Thai government has attempted to promote provinces outside of Bangkok as tourist destinations for Thailand; it is launching projects to build and improve the transportation infrastructure (i.e., international airports) in these destinations. Public and private funding have been flowing to areas such as Pattaya, Phuket, Chiang Mai, Krabi, and Samui Island. The investments have increased the number of hotel rooms from 300,000 rooms in 2000 to over 600,000 in 2016. Gutiérrez et al. (2017) reported that short-term rentals have an increasing trend similar to that experienced by hotels. The findings also indicate that the development of real estate and transport and telecommunications leads to growth in international tourist arrivals. These findings correspond to those reported by Barman and Nath (2019), Gao et al. (2019), and Liu and Shi (2019), where they find that both transportation and communication infrastructure are essential in attracting tourists.

Table 3: Toda-Yamamoto Bivariate Granger Causality Test between Tourism Arrivals and SPI and Its Subsectors

Bivariate relationship		Lag	Chi-sq	*P*-value	Caus.
Dependent	**Independent**				
SPI	***Tour***	3	3.382	0.336	←
Tour	***SPI***	3	15.493	0.001	
SPI_{HT}	***Tour***	8	33.469	< 0.01	→
Tour	SPI_{HT}	8	11.180	0.192	
SPI_{RE}	***Tour***	3	9.401	0.024	← →
Tour	SPI_{RE}	3	10.276	0.016	
SPI_{TT}	***Tour***	2	6.838	0.033	← →
Tour	SPI_{TT}	2	6.249	0.044	

Note. Caus. is short for causality, → denotes rejection of $H_{0,Arr\rightarrow SPI}$, while ← denotes rejection of $H_{0,SPI\rightarrow Arr}$, and – denotes failure to reject $H_{0,Arr\rightarrow SPI}$ and $H_{0,SPI\rightarrow Arr}$.

4.4 Causality between SPI and disaggregated international tourist markets

An underlying question is whether all international tourist markets contribute evenly to the production of services. For this reason, the Toda-Yamamoto Granger causality test was employed between measures representing the production of services and the disaggregated measures of international tourist markets. The international tourist arrivals were disaggregated based on their location and the three international tourist markets with the largest number of tourists traveling to Thailand were included in the model. The selected regions include Southeast Asia, Europe, as well as Northeast Asia. The results of the Toda-Yamamoto Granger causality tests are shown in Table 4. The findings in that table provide evidence that not all international tourist markets contribute to the production of services. The Granger causality tests failed to show any relationship between the disaggregated and aggregated measures of SPI and growth in tourist arrivals from Europe, indicating that visitors from the European region do not seem to either contribute to or

be affected by Thailand's service industry growth. These findings agree with Tang and Tan (2013), where not all tourist markets contribute to economic growth.

In contrast, the production measures of services and international tourist arrivals from Asia exhibit a variety of relationships. The results indicate that the development of Thailand's service industry contributes to the growth of international tourist arrivals, not *vice versa*. In turn, the Granger Causality tests show that international tourist arrivals from Asia contribute to the development of SPI_{HT}, providing evidence of the growth hypothesis. Furthermore, we found evidence supporting the feedback hypothesis when tourists from Asia were included in the SPI_{RE} and SPI_{TT} bivariate models. It is worth noting that the relationships are similar to those reported in Table 3, indicating the importance of Asian tourists for the production of services in Thailand. Similar to our findings, Tang (2011) used disaggregated tourist arrivals and found robust evidence of economic-driven tourism growth in Malaysia. Intuitively, the results suggest that for tourist destinations in Southeast Asia, the development of the economy and its capacity to offer high-quality services is vital to expanding the tourism industry continuously.

Consistent with Aratuo and Etienne (2019), we can conclude that international tourist arrivals from Southeast and Northeast Asia contribute to the production services, including hotels and restaurants, real estate, and transportation and telecommunications. The results reported in this study also show that improvements in real estate, renting, and business activities can help expand tourist arrivals to Thailand. Koo et al. (2017) stated that direct services connected to tourism, such as air flights, were beneficial in attracting more tourists to the destination. Although the subsectors included in this study are the provisions of services for Thai society, these services connect directly to the Thai tourism industry. It is thus likely that the development of these sectors will benefit tourism growth.

For example, the expansion of transportation infrastructures in Thailand, such as the Metro Transport Railway, the Bangkok Transportation System, and Airlink in Bangkok, has helped to ease the transportation congestion in Bangkok (Verougstraete & Enders, 2014). The transportation network connects tourist attractions and makes local transportation more convenient, thus attracting more international tourists. On the other hand, the connection between real estate services and tourism growth is interesting. In Thailand, the expansion of companies, such as Airbnb, has motivated Thai nationals to purchase or rent real estate to offer a listing in the short-term rental platform (Sritama, 2018). In response, the expansion of these digital platforms significantly affects the development of tourism (Tussyadiah & Pesonen, 2016). Airbnb listings in Bangkok, for example, increased from 4,000 rooms in 2015 rooms to 9,000 rooms in 2016 (Akaraphanth, 2016). As a result, real estate and tourism growth benefit from each other, supporting the feedback hypothesis between the former and the latter.

Table 4: Toda-Yamamoto Bivariate Granger Causality Test between International Tourism Arrivals from Different Tourist Markets and SPI and Its Subsectors

Bivariate relationship		Southeast Asia			EU			Northeast Asia		
Dep	**Ind**	**Lag**	**Chi-sq**	**Caus.**	**Lag**	**Chi-sq**	**Caus.**	**Lag**	**Chi-sq**	**Caus.**
SPI	***Tour***	3	2.844	←	3	1.752	–	2	1.631	←
Tour	***SPI***	3	15.045[a]		3	1.835	–	2	11.678[a]	
SPI_{HT}	***Tour***	8	17.337[b]	→	3	0.406	–	8	18.043[b]	→
Tour	***SPI_{HT}***	8	6.881		3	4.197	–	8	10.945	
SPI_{RE}	***Tour***	3	8.572[b]	← →	3	1.453	–	3	6.452[c]	← →
Tour	***SPI_{RE}***	3	7.341[c]		3	2.415	–	3	7.592[c]	
SPI_{TT}	***Tour***	1	4.479[b]	← →	5	5.569	–	2	4.664[c]	← →
Tour	***SPI_{TT}***	1	9.881[a]		5	3.102	–	2	8.260[b]	

Note. [a, b,] and [c] denotes significance at the 1%, 5%, and 10% levels. In turn, Caus. is short for causality, → indicates rejection of $H_{0,Arr \to SPI}$, while ← denotes rejection of $H_{0,SPI \to Arr}$, and – denotes failure to reject $H_{0,Arr \to SPI}$ and $H_{0,SPI \to Arr}$.

5. CONCLUSION

The causal relationship between tourism and economic growth has been a central issue in the tourism growth literature. This study differs from others in that it is the first to use aggregated and disaggregated measures of SPI to test the tourism-led growth hypothesis in Thailand. VECM and Toda-Yamamoto Granger causality tests provide robust evidence of unidirectional causality running from the development of the entire service sector of Thailand to the growth of international tourist arrivals. Likewise, the development of the hotel industry is dependent on tourism growth. In contrast, the Toda-Yamamoto tests provide evidence that services, including real estate, transportation, and telecommunications, contribute to and benefit from growth in the international tourist arrivals. The same conclusions were drawn when international tourist arrivals from

Southeast and Northeast Asia were included in the Toda-Yamamoto Granger causality tests. However, the tests failed to find any evidence of Granger causality between European visitors and the disaggregated and aggregated measures of SPI, which points to the need to consider the tourist market when testing the tourism-led growth hypothesis.

The results of this study provide several implications. First, the findings show that aggregated variables may not reflect the dynamics among the different sub-sectors of the service industry and tourism growth. This is evident from the results, showing that causality runs from SPI as an aggregate to tourism. In contrast, different relationships are observed when testing Granger causality among the different sub-sectors and tourism arrivals. This is especially relevant in tourism-led growth studies, where aggregated variables such as GDP and IPI are commonly used. Therefore, there is a need to investigate further how the tourism-led growth hypothesis holds when using disaggregated variables.

Furthermore, the contribution of tourism to the development of services could depend on how integrated the tourism sector is with the production of services. Recent hotel, transportation, telecommunications, and real estate developments have linked these services to Thailand's tourism industry. Consequently, these sectors benefit from the expansion of the tourism industry. Therefore, the government must engage private firms from these services to formulate tourism development policies.

In Thailand, public and private initiatives usually include tourist agencies and hotel operators (Thailand Incentive and Convention Association, 2015). The government should also consider telecommunication firms as strategic partners in developing tourism campaigns and travel packages. Furthermore, these initiatives should cater to Asian tourists since Southeast and Northeast Asia tourist markets are the most connected to the Thai economy. Partnerships between the government and telecommunication firms would also facilitate investments in digital technologies. These investments would help attract Asian tourists because they increasingly rely on digital technologies (Box & Lopez-Gonzalez, 2017). Amornvivat et al. (2017) reported that over 51% of tourists use mobile devices to gather information about tourist activities and places to eat in tourist destinations. Furthermore, travelers are increasing their usage of social media to share and live stream their traveling experiences, leading to a surge in demand for high-speed Internet.

It is worth noting that investments in new transportation infrastructure, including new train networks, public transportation, roads, etc., should include a tourism component. The expansion of transportation services in emerging tourist destinations in Thailand could help connect different tourist attractions making transportation more convenient, thus attracting more tourists. The growth in tourists could generate enough revenue to support the transportation services.

The findings also provide evidence connecting the real estate sector to the expansion of tourism. Such a connection might have been brought about by developing short-term rental platforms (i.e., Airbnb) in Thailand. In 2018, the government enforced a law prohibiting owners from listing properties because they violated the Hotel Act. The consequences of this law could be devastating since the contribution between real estate and tourist expansion could be interrupted. Thus, it is critical for the government to implement clear policies to facilitate short-term rental platforms in Thailand.

The limitation of this paper is the availability of the data set. Further studies may include other industries besides the service sub-sectors included in this study (i.e. health services, insurance, sports, etc.). Moreover, the magnitude of the effect of the COVID-19 pandemic on industry sectors may need further investigation in order to explore the resilience of the tourism industry and its contribution to economic growth.

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