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Asymmetric effects of tourist arrivals on the hospitality industry

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ABSTRACT

This study makes a unique contribution to the hospitality literature by examining the asymmetric effects of total tourist arrivals in six segments of tourist arrivals (pleasure, business, visiting relatives, conference, study, and others) on Taiwan's hospitality industry. Regression test results confirm that the contribution of the overall tourist arrivals and both pleasure and visiting relatives segments to hospitality industry growth is not asymmetric, as it is found in periods of expansion and contraction. The beneficial effect of the business segment on hospitality industry growth is asymmetric, existing only in periods of business cycle expansion. However, the conference, study, and other segments make no significant contribution to hospitality industry growth. The study's valuable policy implications offer guidance to Taiwan's tourism authorities, hospitality business owners, and managers.

1. Introduction

Tourism market expansion (or tourism expansion), proxied by the growth rate of total inbound tourist arrivals, is expected to have both a direct and an indirect effect on hospitality industry growth. Tourism expansion could directly increase the demand for hospitality products and services and hence sales revenue (see Channel I in Fig. 1). Chen (2010, 2011, 2016) and Chen and Kim (2010) find that tourism expansion significantly enhances hotel sales and profitability in Taiwan.

In addition, tourism is a significant source of export revenue and contributes to national economic development. On the one hand, Taiwan's tourism market growth brings economic development (Kim et al., 2006). On the other hand, economic development could also foster corporate sales earnings and the financial performance of Taiwan's hospitality firms (Chen, 2007). Thus, tourism expansion would have an indirectly beneficial effect on hospitality industry growth by improving economic conditions (see Channel II in Fig. 1).

While a strong effect of tourism expansion on hospitality industry growth is expected, no research has yet examined the contribution of tourism expansion to hospitality industry growth. Unlike Chen (2010), who analyzes the effects of tourism expansion on hotel firm performance, and Chen and Kim (2010), who investigate the influences of tourism expansion on sales of tourism firms, this paper examines the asymmetric effects of different kinds of tourism on hospitality industry growth in Taiwan. In this way, it makes two unique contributions to hospitality research literature.

The first contribution is that this study tests the asymmetric effects of total tourist arrivals in six segments of tourist arrivals (pleasure, business, visiting relatives, conference, study, and others) on Taiwan's hospitality industry growth, following the classification of Tourism Bureau of Taiwan. Given the different characteristics of these segments of the travel market (Mill and Morrison, 2012), the study argues that different purposes of tourist arrivals should have different influences on Taiwan's hospitality industry because tourists' behaviors and spending depend on the reason for travel.

For instance, tourists who come to Taiwan for business, a conference or pleasure are likely to contribute to hospitality industry growth by paying for their meals and lodging. It would be interesting to see if tourists who are visiting relatives in Taiwan bring similar benefit to the island's hospitality industry. The answer may depend on whether or not they stay and eat in their relatives' homes. In contrast, international students in Taiwan may affect the economy, but not the hospitality industry because they are more likely to live and take their meals on campus. Therefore, different types of tourism expansion are expected to have a variety of effects on hospitality industry growth.

This study's second contribution is that it proposes that the effects of different segments of tourist arrivals on hospitality industry growth could be state dependent, meaning that they depend on the conditions

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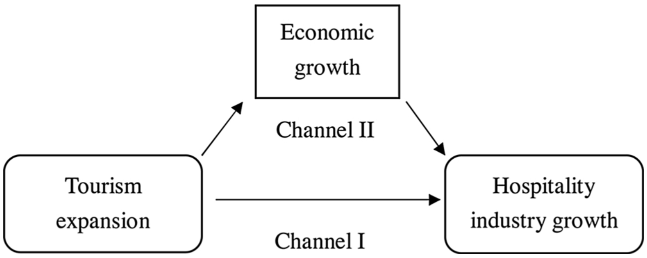

Fig. 1. The effects of tourism expansion on HIG.

of the business cycle; some kinds of travel are sensitive to the business climate than others. For example, during economic downturns, plans for pleasure and business trips can be postponed or canceled. Thus, their effects on hospitality industry growth in periods of expansion and contraction could differ. Empirical test results can reveal which segments of tourism expansion are likely to affect hospitality industry growth in Taiwan, and if those effects are asymmetric. Accordingly, the findings will provide Taiwan's tourism authorities, hospitality business owners, and managers with valuable information to develop appropriate and effective marketing, strategic planning and promotion policies.

This paper is divided into four sections. Section 2 describes all data and the definitions of variables. Regression tests of asymmetric effects of tourist arrivals on the hospitality industry are presented in Section 3. Section 4 reports test results and offers a robustness check. Section 5 discusses the main results and provides practical policy implications and directions for future research.

2. Hospitality industry growth and tourist arrivals

This study uses the gross domestic product (GDP) data of the hospitality industry (HGDP) to measure Taiwan's hospitality industry growth. The quarterly data of HGDP from the first quarter of 1981 to the first quarter of 2016 are taken from the Taiwan Economic Journal (TEJ) database. The value of HGDP data is the sum of GDP value of the lodging sector and GDP value of restaurant (food and beverage) sector. The growth rate of HGDP ($\Delta HGDP$) is computed as:

$$\Delta HGDP_t = \ln(HGDP_t/HGDP_{t-1}) \times 100\%. \tag{1}$$

Tourism expansion is proxied by the growth rate of total inbound tourist arrivals (Kim et al., 2006; Chen, 2010). The data of total tourist arrivals and different tourist arrivals by purpose of travel (pleasure, business, visiting relatives, conference, study, and others) from the first quarter of 1981 to the first quarter of 2016 are also taken from the TEJ database. Fig. 2 shows the share of different tourist arrivals by purposes over the sample period. As shown in Fig. 2, pleasure tourist arrivals account for 55.72% of the total tourist arrivals, following by business (18.40%), others (15.96%), visiting relatives (7.78%), conference (1.14%) and study (1.00%).

Fig. 3 plots the quarterly data of *HGDP* (in millions New Taiwan dollar) and tourist arrivals by purposes of travel. Overall, the *HGDP* data and tourist arrivals display a positive trend with occasional fluctuations, indicating that all data increase over time. The outbreak of SARS on April 22, 2003, is found to harm all data.

Tourism expansion is computed as the growth rate of the number of inbound tourist arrivals (ΔTOL):

$$\Delta TOL_t = \ln(TOL_t/TOL_{t-1}) \times 100\%, \tag{2}$$

where *TOL* is the number of inbound tourist arrivals during quarter *t*. The pleasure segment of tourism expansion is calculated as the growth rate of the number of pleasure tourist arrivals (ΔPLE):

$$\Delta PLE_t = \ln(PLE_t/PLE_{t-1}) \times 100\%, \tag{3}$$

where *PLE* is the number of pleasure tourist arrivals during the quarter *t*. Similarly, we compute ΔBUS_t, ΔVR_t, ΔCON_t, ΔSTD_t, and ΔOTH_t as the corresponding business, visiting relatives, conference, study, and others segments. The summary statistics of $\Delta HGDP$, ΔTOL, ΔPLE, ΔBUS, ΔVR, ΔCON, ΔSTD, and ΔOTH are shown in Table 1.

We use the unit root test to examine the stationary of all variables and avoid the spurious regression before performing panel regression tests. The Augmented Dickey-Fuller (Dickey and Fuller, 1979) and the Phillips-Perron (Phillips and Perron, 1988) unit root tests are executed to examine the stationary of all variables. Results of both tests summarized in Table 2 indicate that *HGDP*, *TOL*, and *PLE* are not stationary, but *BUS*, *VR*, *CON*, *STD,* and *OTH* are stationary (see panel A). Besides, $\Delta HGDP$, ΔTOL, ΔPLE, ΔBUS, ΔVR, ΔCON, ΔSTD, and ΔOTH are all stationary (see panel B).

3. Asymmetric effects of tourist arrivals on the hospitality industry

3.1. Regression tests

Given that *HGDP*, *TOL,* and *PLE* are not stationary, we use the following regression test to examine the effects of *TOL* and *PLE* on *HGDP*:

$$LHGDP_t = c_1 + \alpha_1 LTA_t + \alpha_2 LHGDP_{t-1} + a_3 dSARS + \varepsilon_t, \tag{4a}$$

where *LHGDP* and *LTA* denote *HGDP* and *TA* (i.e., *TOL* and *PLE*) in natural logarithms. The lag of *LHGDP* and the dummy variable of the SARS outbreak (2003Q2) are used as control variables. *LTA* can significantly affect *LHGDP* if the coefficient α_1 is statistically different from zero.

On the other hand, since *HGDP* is not stationary and *BUS*, *VR*, *CON*, *STD,* and *OTH* are stationary, the study performs the following regression test according to Eq. (4b) to analyze the influences of *BUS*, *VR*, *CON*, *STD,* and *OTH* on the hospitality industry:

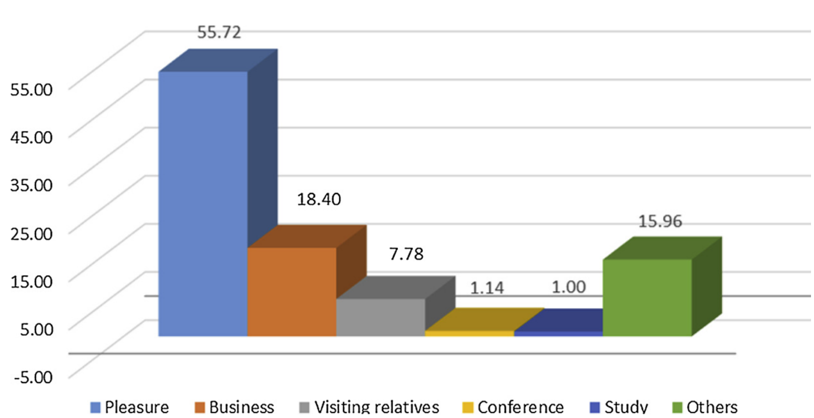

Fig. 2. The share of inbound tourist arrivals by purposes of travel.

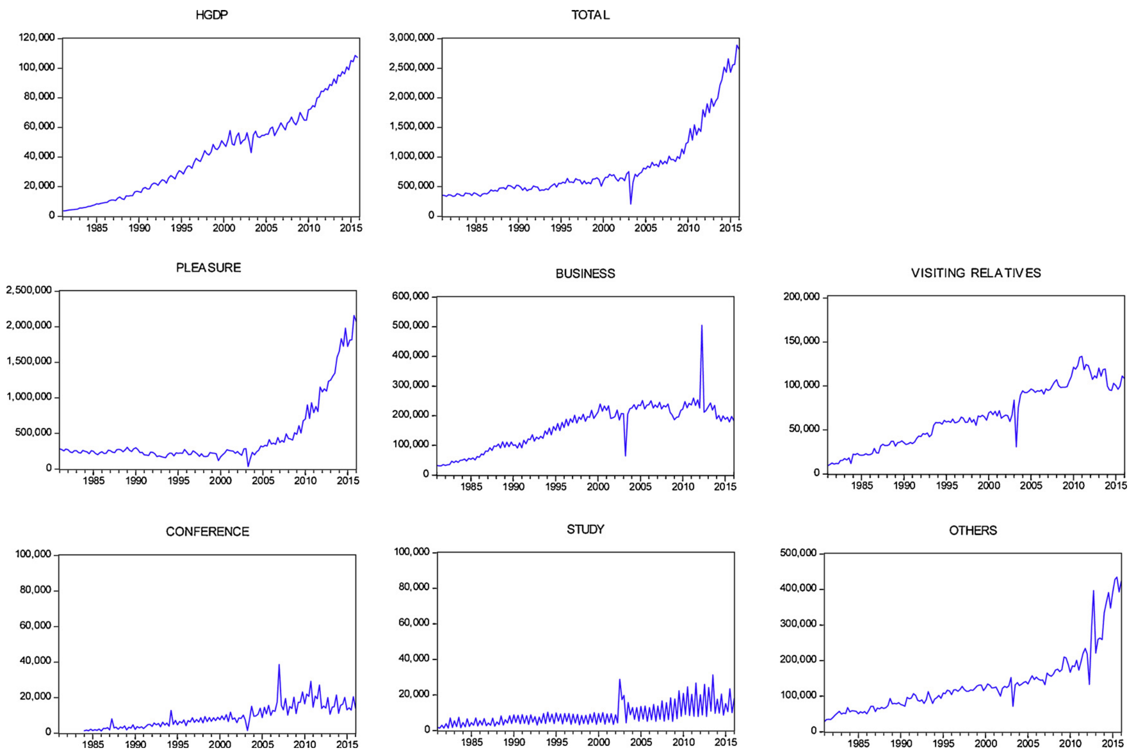

Fig. 3. Plots of *HGDP* and tourist arrivals by purposes of travel.

Table 1
Summary statistics.

Variable	Mean	Median	Maximum	Minimum	Standard deviation
HIG					
$\Delta HGDP$	2.445	2.457	24.207	−17.040	6.523
Tourism expansion					
ΔTOL	1.478	0.307	101.388	−129.039	16.145
ΔPLE	1.421	−1.281	135.889	−208.468	25.852
ΔBUS	1.232	1.901	115.868	−116.725	20.254
ΔVR	1.746	0.924	89.145	−100.047	15.294
ΔCON	1.836	6.826	164.723	−162.427	48.079
ΔSTD	1.688	−6.929	188.967	−152.564	91.063
ΔOTH	1.913	1.590	78.405	−75.576	16.147

Table 2
Unit root test results.

The null hypothesis: The variable under consideration has a unit root	ADF	PP
Panel A: *HGDP*	−1.505	−2.270
TOL	3.817	1.291
PLE	4.033	2.063
BUS	−3.148*	−8.575***
VR	−3.660**	−5.596***
CON	−3.349*	−10.573***
STD	−4.108***	−18.349***
OTH	−3.250*	−5.876***
Panel B: $\Delta HGDP$	−10.598***	−17.640***
ΔTOL	−10.723***	−31.961***
ΔPLE	−12.980***	−21.064***
ΔBUS	−9.944***	−30.947***
ΔVR	−12.357***	−26.458***
ΔCON	−12.694***	−32.728***
ΔSTD	−6.196***	−17.582***
ΔOTH	−14.092***	−15.800***

Note: *** indicate rejection of the null hypothesis of a unit root at the 1% level, based on MacKinnon (1996) one-side *p*-values. Both test equations include an individual intercept and time trend. The optimal lags selected are based on Schwartz Information Criterion (Schwarz, 1978).

$$\Delta HGDP_t = c_2 + \alpha_1 \Delta TA_t + \alpha_2 \Delta HGDP_{t-1} + a_3 dSARS + e_t, \tag{4b}$$

where $\Delta TA = \Delta BUS$, ΔVR, ΔCON, ΔSTD, and ΔOTH. The lag of $\Delta HGDP$ and the dummy variable of the SARS outbreak are control variables. Similarly, ΔTA can significantly impact $\Delta HGDP$ if the coefficient α_1 is statistically different from zero. Regression tests, according to Eqs. (4a)-(4b) are performed based on the Newey and West (1987) consistent estimates to take into account the possible presence of both heteroskedasticity and autocorrelation.

Moreover, to test whether the effects of tourist arrivals on the hospitality industry is asymmetric, the study exploits a dummy variable for the state of the business cycle. The study uses the standard National Bureau of Economic Research (NBER) business cycle turning points (www.businesscycle.com) to construct the business cycle series, which is the proxy for the state of Taiwan's economy. Consequently, the following regression tests based on Eqs. (5a)-(5b) are performed to check how the effects of different tourist arrivals on the hospitality industry vary under different business conditions:

$$LHGDP_t = c_3 + \beta_1 LTA_t \times BC + \beta_2 LTA_t \times (1 - BC) + \beta_3 LHGDP_{t-1} + a_3 dSARS + \varepsilon_t, \tag{5a}$$

and

$$\Delta HGDP_t = c_4 + \beta_1 \Delta TA_t \times BC + \beta_2 \Delta TA_t \times (1 - BC) + \beta_3 \Delta HGDP_{t-1} + a_3 dSARS + e_t \tag{5b}$$

where $LTA = LTOL$ and $LPLE$, $\Delta TA = \Delta BUS$, ΔVR, ΔCON, ΔSTD and ΔOTH, and BC is the business cycle dummy variable and BC is equal to 1 (0) during the expansion (contraction) period. The coefficient β_1 (β_2) captures how LTA (ΔTA) affect $LHGDP$ ($\Delta HGDP$) during expansion (contraction) period.

Accordingly, whether there are asymmetric effects of LTA (ΔTA) on $LHGDP$ ($\Delta HGDP$) during business cycle contraction and expansion is determined if $\beta_1 - \beta_2$ is statistically different from zero. The effect of LTA (ΔTA) on $LHGDP$ ($\Delta HGDP$) is stronger in business expansion than in business contraction, so the effect is asymmetric if $\beta_1 - \beta_2$ is statistically different from zero. The study uses the Wald test based on chi-

Table 3
Test results of effects of tourist arrivals on the hospitality industry.

Panel A: *LTOL*	Coefficient	Panel B: *LPLE*	Coefficient	Panel C:ΔBUS	Coefficient	Panel D:ΔVR	Coefficient
Constant	0.123	Constant	0.212*	Constant	3.117***	Constant	2.625***
LTOL	0.054*	*LPLE*	0.053*	ΔBUS	0.061*	ΔVR	0.141***
$LHGDP_{t-1}$	0.892***	$LHGDP_{t-1}$	0.896***	$\Delta HGDP_{t-1}$	−0.168*	$\Delta HGDP_{t-1}$	−0.121**
dSARS	−0.163**	*dSARS*	−0.179***	*dSARS*	−18.086***	*dSARS*	−5.307
$\bar{R}^2$	0.920	$\bar{R}^2$	0.929	$\bar{R}^2$	0.087	$\bar{R}^2$	0.156

Panel E:ΔCON	Coefficient	Panel F:ΔSTD	Coefficient	Panel G:ΔOTH	Coefficient
Constant	2.879***	Constant	3.096***	Constant	3.303***
ΔCON	0.003	ΔSTD	0.006	ΔOTH	0.024
$\Delta HGDP_{t-1}$	−0.173*	$\Delta HGDP_{t-1}$	−0.128	$\Delta HGDP_{t-1}$	−0.190*
dSARS	−19.860	*dSARS*	−19.284***	*dSARS*	−22.351***
$\bar{R}^2$	0.077	$\bar{R}^2$	0.071	$\bar{R}^2$	0.095

Note: * Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

square value to carry out this coefficient diagnosis.

3.2. Empirical results

Table 3 reports the regression test results of effects of *LTA* (ΔTA) on *LHGDP* ($\Delta HGDP$). As shown in Table 3, while all kinds of *LTA* (or ΔTA) have a positive impact on *LHGDP* (or $\Delta HGDP$), only the positive coefficients of *TOL* (panel A) and *PLE* (panel B), ΔBUS (panel C) and ΔVR (panel D) are significantly different from zero at the 10% level. These suggest that *TOL* and *PLE* have a significant impact on *LHGDP*, and ΔBUS and ΔVR can significantly enhance $\Delta HGDP$.

Table 4 summarizes test results of asymmetric effects of *LTA* (ΔTA) on *LHGDP* ($\Delta HGDP$). As shown in panels A, B, and D of Table 4, both β_1 and β_2 are statistically significant at the 10% level. In panel C, the coefficient β_1 is statistically significant at the 5% level, while the coefficient β_2 is not statistically significant. In contrast, neither β_1 nor β_2 are statistically significant in panels E, F, and G. The Wald tests indicate that only for ΔBUS, $\beta_1 - \beta_2$ is statistically different from zero.

4. A robustness check

To conduct a robust check, we consider seasonality and perform all analyses using data with seasonal adjustment based on the ratio to moving average (RMA) method. The algorithm of seasonal adjustment of the RMA method can be described as follows. Consider that y_t is the quarterly time series to be filtered. The first step is to compute the centered moving average of y_t as:

$$x_t = (0.5y_{t+2} + y_{t+1} + y_t + y_{t-1} + 0.5y_{t-2})/4 \tag{6}$$

The second step is to compute the ratio $\tau_t = y_t/x_t$ and the seasonal indices. The seasonal index i_q for quarter q is the average of τ_t using observations only for quarter q.

We then adjust the seasonal indices by computing the seasonal factors as the ratio of the seasonal index to the geometric mean of the indices:

$$s = i_q/(\sqrt[4]{i_1 i_2 i_3 i_4}) \tag{7}$$

where time series data of s are the scaling factors in the series window. The interpretation is that the series y is s_j percent higher in period j relative to the adjusted series. The seasonally adjusted series is obtained by dividing y_t by the seasonal factors s_j. Accordingly, we obtain seasonality-adjusted data of *HGDP*, *TOL*, *PLE*, *BUS*, *VR*, *CON*, *STD,* and *OTH*.

The results of ADF and the PP unit root test based on seasonality-adjusted data of *HGDP*, *TOL*, *PLE*, *BUS*, *VR*, *CON*, *STD,* and *OTH* reported in Table 5 reveal that *HGDP*, *TOL,* and *PLE* are not stationary, and *BUS*, *VR*, *CON*, *STD,* and *OTH* are stationary (see panel A). $\Delta HGDP$, ΔTOL, ΔPLE, ΔBUS, ΔVR, ΔCON, ΔSTD, and ΔOTH are also found to be stationary (see panel B).

The regression test results of effects of *LTA* (ΔTA) on *LHGDP* ($\Delta HGDP$), as shown in Table 6, still indicate that *TOL* and *PLE* can significantly affect *LHGDP*, and ΔBUS and ΔVR have a significant influence on $\Delta HGDP$. Furthermore, test results of asymmetric effects of *LTA* (ΔTA) on *LHGDP* ($\Delta HGDP$) summarized in Table 7 are found to be similar to those in Table 4. Both β_1 and β_2 in panels A, B, and D of Table 7 are statistically significant at the 10% level. The coefficient β_1 in panel C is statistically significant at the 5% level, while the coefficient β_2 is not. In comparison, neither β_1 nor β_2 in panels E, F, and G are statistically significant.

5. Discussion, implications, and conclusion

This study makes a unique contribution to the hospitality literature by examining the asymmetric effects of different tourist arrivals on hospitality industry growth. The following important and exciting findings emerged. This study confirms that overall tourism expansion can indeed significantly contribute to hospitality industry growth. Among the six segments of tourist arrivals, only the pleasure, business, and visiting relatives segments are significant in affecting hospitality industry growth; the conference, study, and other segments are not.

The pleasure and business segments can enhance hospitality industry growth. This is to be expected since pleasure and business tourists account for corresponding 55.72% and 18.4% of all tourist arrivals. While the pleasure, business and the visiting relatives segments of tourism expansion are significant contributors to hospitality industry growth, the size of the impact of visiting relatives segment (0.141) is more than twice the size of those of the pleasure segment (0.053) and business segment (0.061).

These results have important implications. We should not overlook the contribution of the visiting relatives segment by assuming that these tourists spend less on hotels and restaurants. Instead, it is plausible that while visiting their relatives in Taiwan, these tourists do stay in commercial accommodations, dine more often in restaurants and stay longer than business travelers. Given that tourists who come to Taiwan to see their relatives account only for 7.78% of the total, this segment still has room for growth. Taiwan's tourism authority and hospitality business owners and managers should, therefore, develop marketing and strategy plans to enhance hospitality industry growth by building this segment of tourists.

Another interesting finding is that the beneficial effect of the business segment on hospitality industry growth is asymmetric and state-dependent, and is found only during the expansion of the business cycle. In other words, business conditions matter for the contribution of the business segment to hospitality industry growth. Especially, once Taiwan's economy enters a recession period, the contributions of the business segment to hospitality industry growth will vanish.

Table 4
Test results of asymmetric effects of tourist arrivals on the hospitality industry.

Panel A: *LTOL*	Coefficient	Panel B: *LPLE*	Coefficient
Constant	0.103	Constant	0.204
β_1: $LTOL \times BC$	0.008*	β_1: $LPLE \times BC$	0.003*
β_2: $LTOL \times (1-BC)$	0.009*	β_2: $LPLE \times (1-BC)$	0.002*
$\beta_1 - \beta_2 =$ -0.001		$\beta_1 - \beta_2 = 0.001$	
(Chi-square = 0.137)		(Chi-square = 0.057)	
$LHGDP_{t-1}$	0.891***	$LHGDP_{t-1}$	0.896***
dSARS	−0.161**	*dSARS*	−1.179***
$\bar{R}^2$	0.934	$\bar{R}^2$	0.925
Panel C: ΔBUS	**Coefficient**	**Panel D: ΔVR**	**Coefficient**
Constant	2.886***	Constant	2.481***
β_1: $\Delta BUS \times BC$	0.089**	β_1: $\Delta VR \times BC$	0.174***
β_2: $\Delta BUS \times (1-BC)$	0.115	β_2: $\Delta VR \times (1-BC)$	0.148***
$\beta_1 - \beta_2 = 0.204$		$\beta_1 - \beta_2 = 0.062$	
(Chi-square = 5.433**)		(Chi-square = 0.121)	
$\Delta HGDP_{t-1}$	−0.097	$\Delta HGDP_{t-1}$	−0.101
dSARS	−32.781***	*dSARS*	−9.663
$\bar{R}^2$	0.129	$\bar{R}^2$	0.161
Panel E: ΔCON	**Coefficient**	**Panel F: ΔSTD**	**Coefficient**
Constant	2.862***	Constant	3.096***
β_1: $\Delta CON \times BC$	0.024	β_1: $\Delta VR \times BC$	0.010
β_2: $\Delta CON \times (1-BC)$	−0.016	β_2: $\Delta VR \times (1-BC)$	0.004
$\beta_1 - \beta_2 = 0.040$		$\beta_1 - \beta_2 = 0.006$	
(Chi-square = 0.245)		(Chi-square = 0.167)	
$\Delta HGDP_{t-1}$	−0.158*	$\Delta HGDP_{t-1}$	−0.148
dSARS	−22.711***	*dSARS*	−19.616**
$\bar{R}^2$	0.096	$\bar{R}^2$	0.072
Panel G: ΔOTH			**Coefficient**
Constant			3.257***
β_1: $\Delta OTH \times BC$			0.005
β_2: $\Delta OTH \times (1-BC)$			0.048
$\beta_1 - \beta_2 =$ -0.043			
(Chi-square = 0.255)			
$\Delta HGDP_{t-1}$			−0.180**
dSARS			−24.399**
$\bar{R}^2$			0.121

Note: * Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

Table 5
Unit root test results: Seasonal adjustment.

The null hypothesis: The variable under consideration has a unit root	ADF	PP
Panel A: *HGDP*	−0.567	−2.371
TOL	1.646	0.258
PLE	3.405	2.117
BUS	−3.310*	−7.236***
VR	−3.413**	−5.390***
CON	−8.640***	−9.067***
STD	−4.392***	−7.012***
OTH	−3.150*	−3.271*
Panel B: $\Delta HGDP$	−12.634***	−16.167***
ΔTOL	−13.020***	−30.792***
ΔPLE	−12.855***	−27.252***
ΔBUS	−13.218***	−29.212***
ΔVR	−12.917***	−29.143***
ΔCON	−11.167***	−28.915***
ΔSTD	−6.435***	−18.996***
ΔOTH	−12.873***	−15.332***

Note: *** indicate rejection of the null hypothesis of a unit root at the 1% level, based on MacKinnon (1996) one-side *p*-values. Both test equations include an individual intercept and time trend. The optimal lags selected are based on Schwartz Information Criterion (Schwarz, 1978).

In comparison, the contribution of pleasure and visiting relatives segments to hospitality industry growth is significant in periods of business cycle expansion and contraction, showing that the impact of both segments on hospitality industry growth is not asymmetric. These results reinforce the vital contribution of pleasure and visiting relatives segments to hospitality industry growth in Taiwan. Notably, among the six segments, only pleasure and visiting relatives segments can increase hospitality industry growth in periods of business cycle contraction.

Finally, although tourists coming to Taiwan for other reasons account for 15.96% of all tourist arrivals, its growth is found to be insignificant in enhancing hospitality industry growth. One potential reason is that this segment consists of tourists who have many other reasons for their travel; this makes it difficult to determine its contribution to hospitality industry growth. Indeed, it was not until January 2012 that the Tourism Bureau of Taiwan started to separate tourist arrivals who are coming for exhibitions or medical treatment from this segment. It would be interesting for future research to ascertain if tourists coming to Taiwan for these purposes have a significant impact on hospitality industry growth.

Nonetheless, this study has one limitation.[1] The disaggregation of

[1] We are grateful to an anonymous reviewer for pointing out this limitation.

Table 6
Test results of effects of ΔTA on $\Delta HGDP$: Seasonal adjustment.

Panel A: *LTOL*	Coefficient	Panel B: *LPLE*	Coefficient	Panel C:ΔBUS	Coefficient	Panel D:ΔVR	Coefficient
Constant	1.092	Constant	0.173*	Constant	1.217***	Constant	1.143***
LTOL	0.054*	*LPLE*	0.051*	ΔBUS	0.058**	ΔVR	0.121***
$LHGDP_{t-1}$	0.891***	$LHGDP_{t-1}$	0.895***	$\Delta HGDP_{t-1}$	−0.168**	$\Delta HGDP_{t-1}$	−0.150*
dSARS	−0.113**	*dSARS*	−0.126**	*dSARS*	−3.052	*dSARS*	−1.747
$\bar{R}^2$	0.926	$\bar{R}^2$	0.925	$\bar{R}^2$	0.121	$\bar{R}^2$	0.157

Panel E:ΔCON	Coefficient	Panel F:ΔSTD	Coefficient	Panel G:ΔOTH	Coefficient
Constant	1.224***	Constant	1.310***	Constant	1.377***
ΔCON	0.004	ΔSTD	0.005	ΔOTH	0.030
$\Delta HGDP_{t-1}$	−0.212**	$\Delta HGDP_{t-1}$	−0.191**	$\Delta HGDP_{t-1}$	−0.204**
dSARS	−6.411***	*dSARS*	−6.567***	*dSARS*	−7.812***
$\bar{R}^2$	0.100	$\bar{R}^2$	0.085	$\bar{R}^2$	0.116

Note: * Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

different components of the hospitality GDP data, such as consumption, investments, exports and imports, is not available. Note that the impact of tourist arrivals on different components of the hospitality GDP data is very likely to vary. For example, while tourism growth is expected to have a direct impact on consumption component, the component of investments may not be immediately related to tourism expansion. If the disaggregation of the hospitality GDP data is available, we would be in a better position to see how different kinds of tourist arrivals impact each component of Taiwan's hospitality GDP.

Table 7
Test results of asymmetric effects of ΔTA on $\Delta HGDP$: Seasonal adjustment.

Panel A: *LTOL*	Coefficient	Panel B: *LPLE*	Coefficient
Constant	0.089	Constant	0.174*
β_1: $LTOL\times BC$	0.010*	β_1: $LPLE\times BC$	0.005*
β_2: $LTOL\times (1-BC)$	0.010*	β_2: $LPLE\times (1-BC)$	0.004*
$\beta_1-\beta_2=0.000$ (Chi-square = 0.005)		$\beta_1-\beta_2=0.001$ (Chi-square = 0.012)	
$LHGDP_{t-1}$	0.891***	$LHGDP_{t-1}$	0.895***
dSARS	−0.113**	*dSARS*	−0.126**
$\bar{R}^2$	0.937	$\bar{R}^2$	0.936
Panel C:ΔBUS	**Coefficient**	**Panel D:ΔVR**	**Coefficient**
Constant	1.218***	Constant	1.145***
β_1:$\Delta BUS\times BC$	0.066**	β_1:$\Delta VR\times BC$	0.119***
β_2:$\Delta BUS\times (1-BC)$	0.044	β_2:$\Delta VR\times (1-BC)$	0.102***
$\beta_1-\beta_2=0.022$ (Chi-square = 0.239)		$\beta_1-\beta_2=0.018$ (Chi-square = 0.072)	
$\Delta HGDP_{t-1}$	−0.097	$\Delta HGDP_{t-1}$	−0.150*
dSARS	−4.167	*dSARS*	−2.161
$\bar{R}^2$	0.121	$\bar{R}^2$	0.159
Panel E:ΔCON	**Coefficient**	**Panel F:ΔSTD**	**Coefficient**
Constant	1.225***	Constant	1.291***
β_1:$\Delta CON\times BC$	0.021	β_1:$\Delta VR\times BC$	0.034
β_2:$\Delta CON\times (1-BC)$	−0.021	β_2:$\Delta VR\times (1-BC)$	−0.016
$\beta_1-\beta_2=0.042$ (Chi-square = 1.091)		$\beta_1-\beta_2=0.050$ (Chi-square = 1.249)	
$\Delta HGDP_{t-1}$	−0.196**	$\Delta HGDP_{t-1}$	−0.182**
dSARS	−8.484***	*dSARS*	−7.222**
$\bar{R}^2$	0.106	$\bar{R}^2$	0.097
Panel G:ΔOTH			**Coefficient**
Constant			1.364***
β_1:$\Delta OTH\times BC$			0.024
β_2:$\Delta OTH\times (1-BC)$			0.041
$\beta_1-\beta_2=$ -0.017 (Chi-square = 0.341)			
$\Delta HGDP_{t-1}$			−0.196**
dSARS			−8.077***
$\bar{R}^2$			0.119

Note: * Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

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