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Cointegration analysis of tourism demand by Mainland China in Taiwan and stock investment strategy

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ABSTRACT

Mainland China is the most important source of tourism for Taiwan in recent years. The purpose of this paper is to investigate the changes in the long-run demand for tourism in Taiwan by Mainland China. Using program trading and three different data sources, including the stock prices of Regent Taipei (2707), weighted index of the tourism sector (2700) and CSI ETF (0061), we find support for our hypotheses. That is, Taiwan's tourism market does not fulfil the conditions of a strong-form efficient market hypothesis. Also, positive feedback trading does exit in Taiwan's tourism market.

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1.0 Introduction

In July 2000, the Ministers of Tourism of 21 APEC member countries signed a Tourism Charter. They suggested that developing tourism could bring positive and sustainable benefits to the economy, society, environment and culture. According to the World Tourism Organization, UNWTO, the tourism industry represents 11% of the world GDP and has the most future potential. The Taiwan government also held an international conference on "The New Strategy for Tourism Development in Taiwan in the 21st Century" in November 2000 and made a formal announcement of its new tourism development strategy. The aim was to create a brand new image for Taiwan as "an island for tourism". Taiwan is renowned for its culture and natural scenery, and is the first choice of tourism destination by people in Mainland China among overseas Chinese community. Therefore, creating a friendly tourism environment, market development and cultivation of talent in the tourism industry are the priorities for raising a country's competitiveness.

Political factors have a significant impact on Taiwan's tourism industry. In 1969, the Taiwan government proposed a Tourism Development Act, showing the importance of tourism industry in Taiwan's economic development. In 1979, the citizens of Taiwan were allowed to travel overseas for tourism reasons. In 1987, Taiwan government allowed people to visit their relatives in China. In 2001, people in Mainland China were allowed to conduct tourist travels in Taiwan. In 2008, Taiwan government allowed charter flight between Taiwan and China and opened up for citizens of China to visit Taiwan. In 2009, the two countries had cross-strait direct flights. In 2011, Taiwan government further allowed independent travelers from three cities of Mainland China, including Beijing, Shanghai and Xiamen. According to the statistics reported by National Immigration Agency, in 2011 approximately 30,000 people came to Taiwan. In 2012, the Taiwan government opened up independent travelers from another ten cities in China including Tianjin. The number of independent travels increased sharply by more than six times to 190,000 people. On 28 June 2013, 13 more cities were allowed to travel independently to Taiwan. In 2015, ten more cities in China were opened up for independent travelers.[1]

Tourism travel is one of the fast developing industries in Taiwan. According to the Tourism Bureau report, the number of tourists in Taiwan reached the first million of people in 1976. In 2014, the number had risen to 9.91 million people. Of which, 3.98 million people were from China, representing 40.18% of total tourists. China has become the main tourist incoming country for Taiwan. The tourism industry has an increasing importance to Taiwan's economic development. According to the Global Competitiveness Report in 2014, the competitiveness of Taiwan's tourism receipts ranked 28. The ratio of tourism receipts to GDP increased from 2.38% in 2013 to 2.46% in 2014, which was at an all-time-high since 1995. Hence, how to grab the investment opportunities during this time is an important issue. Specifically, this study analyzes the factors that influence tourism demand by Mainland China in Taiwan and estimates the tourist numbers in order to provide references for relevant policy makers. The organization of this paper is as follows. The literature review is provided in Section 2. In Section 3, we discuss the error correction model. Descriptions of the data and the results are provided in Section 4 and 5, respectively. A conclusion is provided in Section 6.

2.0 Literature review

Fama (1970) surveyed past literature and formally proposed the efficient market hypothesis (EMH). According to Fama (1965, 1970), there were three different levels of market efficiency. The first level was weak-form market efficiency. If the information incorporated in historical prices were completely reflected in current prices, then investors would not be able to make abnormal returns based on historical price information. The second level was semi-strong-form market efficiency. It suggested that stock prices have reflected all public information about the company's future prospects. Investors would not be able to make abnormal returns based on historical price information or by analyzing current public information. The third level was strong-form market efficiency, which suggested that stock prices had reflected all company-related information. Investors would not be able to make abnormal returns even with insider information. Later, neoclassical economics proposed the rational expectations theory (Lucas, 1972) and the intertemporal CAPM (Merton, 1973). However, later studies then discovered market anomalies, which cause market inefficiency. Black (1986) argued that there existed irrational trading or noise trading which could increase the risk in asset pricing due to its unpredictability and random occurrence. Also, due to the limits of arbitrage, even with rational trading, the stock price might not be able to return to its base value (Shleifer and Vishny, 1997). In addition, there existed irrational traders in the market who were noise traders and followed positive feedbacks. Their trading strategy was solely based on short-term performance of stock prices. They bought the stocks when stock prices went up and sold when stock prices fell. De Long, Shleifer, Summers and Waldmann (1990) provided evidence for the positive feedback trading strategy. They showed that some rational investors might also follow the positive feedback trading strategy, causing further instability in short-term stock prices. Therefore, to some extent, rational traders were further reinforcing the strength of positive feedback.

In an asymmetric information and highly uncertain market, the ability to gather information and process information differed between investors. Institutional investors possessed more information about their industry and had higher ability to predict future performance than individual investors. Hence, they were more likely to have herd behavior, which was caused by positive feedback. Other trading strategies based on positive feedback included extrapolative expectations and technical analysis. Herd behavior was prevalent in the financial market and the behavior might be reasonable under high information uncertainty.

Extrapolative expectations suggested that the trend in economic indicators in the last period was used to predict the trend for the next period. Accordingly, technical analysis, which suggested traders to follow the trends, was a typical positive feedback trading strategy (Murphy, 1986). Froot, Scharfstein and Stein (1993) found that institutional investors often paid attention to the same market information such as fundamental and technical indicators, and used the same models, investment portfolio and hedging strategies. As a result, they often had very similar investment heavier, showing herd behavior. Other studies that showed support for herd behavior included Trueman (1994) who found evidence among financial analysts. Grinblatt et al. (1995) found herd behavior in fund investments. Kim and Wei (1999) found evidence among QFIIs in Korea. Shiller (2002) further suggested that when investors were being misled and caused investment bubble, this was also one kind of herd behavior. However, Lakonishok (1992) argued that the herd behavior of institutional investors did not necessarily lead to stock

1 Refer to Commercial Times (21 January 2015) "Independent travelers from China will increase by 10%).

market uncertainty. Therefore, this study develops the following hypotheses and uses quantitative models and optimal program trading to test the above arguments. The aim is to find safe and sound investment strategies.

H1: The Taiwan stock market is not strong-form market efficient.
H2: The stock price movements in tourism industry reveal positive feedback trading behavior.

3.0 Johansen cointegration test and estimation methods

3.01 Vector autoregression model and Johansen cointegration test

This study adopts vector autoregression (VAR) model, Granger causality test and Johansen cointegration to test the effect of exchange rates, import/export trade volume, income and tourists consumption on tourism demand by Mainland China in Taiwan for the period January 2001 to June 2014 (that is, a total of 162 months).

3.1.1 VAR model

Using the vector autoregression (VAR) model can ensure that all variables in the model have the causal relationship and can avoid the recognition problem in traditional simultaneous structural equations (Sims et al., 1990). All variables in the model are lagged variables of itself and other variables. Extending the single variable autoregression to multi-variable vector autoregression can solve the exogenous variable problem as all variables become endogenous. They can be used to predict a relevant time series system and the dynamic impact on this system by random noises.

The three variables in the program trading are y_{1t}, y_{2t}, y_{3t} (where y_{1t} is the price of stock symbol 2707; y_{2t} is the price of stock symbol 2700; and y_{3t} is the price of stock symbol 0061). Variable in time t is formed by the variable in the prior time period k and error term. For example, VAR(1) (i.e., k = 1) is as shown below:

$$\begin{aligned} y_{1t} &= m_1 + a_{11}y_{1,t-1} + a_{12}y_{2,t-1} + a_{13}y_{3,t-1} + \varepsilon_{1t} \\ y_{2t} &= m_2 + a_{21}y_{1,t-1} + a_{22}y_{2,t-1} + a_{23}y_{3,t-1} + \varepsilon_{2t} \quad \text{.........................} (2) \\ y_{3t} &= m_3 + a_{31}y_{1,t-1} + a_{32}y_{2,t-1} + a_{33}y_{3,t-1} + \varepsilon_{3t} \end{aligned}$$

where $E(\varepsilon_t) = 0, \forall t, E(\varepsilon_t \varepsilon_s^{'}) = \{ \begin{matrix} \Omega, s = t \\ 0, s \neq t \end{matrix}, \Omega = E(\varepsilon_t \varepsilon_t^{'})$, the error term ε_{it} is white noise. m is the constant; a is the coefficient; Ω is a positive definite variance and covariance matrix. That is, the error term ε_{it} can be correlated in the same period but not with the lagging period or the variables in the right-hand side of the equation. From here, we can conduct the causality test.

3.1.2 Johansen cointegration test and error correction model

As the economic theory has not yet concluded the causality relationship between tourism and economic development, Granger (1969, 1988) causality test can be used to determine such relationship. That is, by testing if the coefficients of current y series and the past values of x series have causal relationship, we are in essence examining if the past values of x can explain the present values of y. In other words, if adding a lagged value of x can increase the degree of explanation, or the correlation coefficient of x and y are statistically significant, we can conclude that y is Granger caused by x.

However, while the economic variables in time series model may exist a long-run equilibrium, in a short period of time, such equilibrium may not exist. The error in one period may be corrected in the next period. This suggests that the cointegration between variables is related to equilibrium adjustment and error correction. According to Granger Representation Theorem of Engle and Granger, when a long-run cointegration relationship exists in time series, there must exist a vector error correction model (VECM) between the time series. Therefore, series with VECM must have cointegration relationships. The two-stage cointegration test proposed by Engle and Granger (1987) cannot effectively deal with multivariate cointegration test. One important function of VAR is that it can test the long-run dynamic relationship between variables using a VAR conditioned on the cointegration relationship. Later, Johansen (1988, 1991) propose a multivariate VAR(P) cointegration test:

$$Y_t = C + \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \ldots + \Pi_p Y_{t-p} + U_t \qquad \text{..................(3)}$$

where $Y_t = (y_{1t} \ldots y_{nt})'$ with the assumption $Y_t \sim I(1)$. After adjustments, VAR(P) in model (2) can be represented as:

$$\Delta Y_t = C + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 Y_{t-2} + \ldots + \Gamma_{p-1} \Delta Y_{t-p+1} + \Omega Y_{t-p} + U \qquad \text{...............(4)}$$

where $\Gamma_i = -I + \Pi_1 + \ldots + \Pi_i, i = 1 \ldots p,$, $\Omega = -I + \Pi_1 + \ldots + \Pi_p$

All terms in model (4) are stationary except for ΩY_{t-p}. Hence, same as VAR(1), reducing the matrix Ω before vector Y_{t-p} can be used to test the cointegration relationship between variables. If the rank of coefficient matrix Ω is $rk\Omega = r < n$, there exist vectors α and β ($n \times r$) with rank *r*. Therefore, $\Omega = \alpha\beta'$ and $\beta' Y_{t-p}$ is stationary with $\beta' Y_{t-p} \sim I(0)$. β is a cointegrated variable matrix reflecting the long-run relationship between variables. α is an adjusted coefficient matrix reflecting the short-run adjustments in variables between this period and last period's disequilibrium. Johansen cointegration test can be carried out in two ways. First, the trace test which can be calculated as follows:

$$LR_r = -T * \sum_{i=r+1}^{n} Ln(1 - \lambda_i) \qquad \text{..............................(5)}$$

where λ_i is the eigenvalue of a matrix produced during the calculation.

Secondly, the maximum eigenvalue test, which is calculated as follows:

$$LR_{\max} = -T * Ln(1 - \lambda_r) \qquad \text{...............................(6)}$$

where λ_i is the largest eigenvalue. Based on the characteristics of the time series (that is, whether there is a trend or second order), cointegration equation and VAR model can derive five possible situations. They can then all use Johansen cointegration likelihood ratio (LR) to conduct the tests.

3.02 Experimental design and estimation method

This study uses real market transactions and a two-stage test to see how positive feedbacks can consistently profit in Taiwan stock market. Specifically, we first use program trading to obtain the optimal trading simulation. Then, we substitute the coefficients from the first stage of optimal transaction to the second stage using Taiwan stock market data. If abnormal returns still exist, this suggests that Taiwan stock market is not efficient.

Based on the design concept of program trading (Williams, 1999), we include two more sets of data (data2 and data3) as filters to increase the trading performance. In Model 1, data1 is the weighted index of the tourism sector; data2 is the stock price of individual stocks in the tourism industry; data3 is price of CSI ETF (0061). In Model 2, data1 is the stock price of Regent Taipei (2707); data2 is the weighted index of the tourism sector; data3 is the price of CSI ETF (0061).

To ensure the fairness in evaluation, the following trading strategies are adopted. (1) The RSI of 14-day closing price of data1 is higher than the best-buy threshold. (2) The RSI of 14-day closing price of data2 is higher than the best-buy threshold. (3) The RSI of 14-day closing price of data3 is higher than the best-buy threshold. When all these three conditions are fulfilled, a long position is adopted. On the other hand, if the following three conditions are met, a short position is adopted, and they are: (1) the RSI of 14-day closing price of data1 is lower than the best-sell threshold. (2) The RSI of 14-day closing price of data2 is lower than the best-sell threshold. (3) The RSI of 14-day closing price of data3 is lower than the best-sell threshold. The transaction fee is set at $1 and this study does not consider other transaction costs or the changes in price after making a buy or sell order. The position is closed out if the profit is greater than 350 points or the loss is greater than 100 points. Moreover, when an investor has a long position and the RSI of data2 touches the best-sell threshold, he/she will close out the position. Similarly, if an investor has a short position and the RSI of data2 touches the best-buy threshold, he/she will buy the stock.

Moreover, this study uses the optimal MultiCharts[2] program trading to conduct back-testing. By comparing with the optimal trading performance (that is, the 14-day price and the best-buy/sell threshold produced by the program trading), we can see if adding external information or the information of the leader among the herd can still lead to trading profit in the spot market based on the technical analysis.

4.0 Data

Previous research of the determinants of international tourism demand suggested that income, which was the most commonly used factor and was found to be a significant variable. The basic economic theory suggested that other things being equal when the income of the origin country increased, the tourism demand for the destination country would increase. Studies by Hui and Yuen (1996), Lee (1996) and Webber (2001) all showed support for this argument and suggested that personal consumption or income and GNP were normal good. On the other hand, Crouch (2000) and Vogt and Wittayakorn (1998) did not find significant results. Chadee and Mieczkowski (1987) even found evidence of inferior good. The study by Shenzhen Stock Exchange shows that in 1995, the securitization ratio (stock market value / GDP) was 96.59% and 298.66% in 2003. The ratio in Taiwan was 120% in 2004 and 167% in 2014. The research suggests that as the economy develops, the income increases and stock prices also rise. In the next section, this study uses CSI ETF (0061) as a substitute variable for the income of Chinese tourists and proceeds with trading simulation of tourism stocks.

To test the positive feedback trading strategy, as the price of CSI ETF (0061) begins on 15 August 2009, the first stage of optimal trading based on program trading starts on 15 August 2009 and ends on 9 February 2011. The second stage of program trading covers the period 15 August 2009 to 9 February 2015. The coefficients in the second stage of program trading are based on the coefficients obtained in the first stage of program trading, which conducts the optimal back testing. Then, we can find out if the technical analysis can lead to profits. The tourism industry classification is based on the stock market information provided on Yahoo's website and tourism companies that were listed prior to 15 August 2009. They include Wanhwa Enterprise Company (2701), Hotel Holiday Garden (2702), Ambassador Hotel (2704), Leofoo Development (2705), Standard Foods (2706), Regent Taipei (2707), Phoenix Tours International (5706), Holiday Entertainment (9943), New Palace International (8940), Tourism Industry Stock Index (2700), and CSI ETF (0061).

5.0 Empirical results and analysis

5.01 ADF Unit Root and Cointegration Test

This study chooses 3 November 2007, the highest point (9859) in twenty years, and 9 February 2011, the highest point (9220) in recent five years for the first stage of simulation tests. The ADF unit root test shows that after taking the first difference, the null hypothesis that the time series are not stationary is rejected (as shown in Table 01). That is, they are stationary. We also use Johansen maximum likelihood method to conduct the cointegration test. The results show that there exist two cointegration significant at the 10% level. Therefore, there is a long-run stationary relationship between variables.

Table 01: Unit root test of tourism stocks

Variables / Model	Level		First difference	
	Intercept and Trend	Intercept	Intercept and Trend	Intercept
2701	-3.6687(0)***	-3.7533(0)***	-	-
2702	-2.6536(0)***	-3.6473(0)**	-	-
2704	-3.3828(1)**	-3.3563(1)*	-	-
2705	-2.7695(0)*	-3.7628(0)**	-	-
2706	-2.5603(0)*	-3.2699(0)*	-	-
2707	-2.3394(1)	-2.2653(3)	-46.8370(1)***	-46.8422(0)***
5706	-2.7859(0)*	-2.5950(0)	-48.7584(0)***	-48.7691(0)***
9943	-1.5830(0)	-2.4372(0)	-49.2327(0)***	-49.2233(0)***
8940	-3.5470(1)**	-3.4921(1)**	-	-
2700	-2.8300(1)**	-3.0641(1)	-45.1104(0)***	-45.1189(0)***
0061	-1.2018(0)	-2.0039(0)	-51.0962(0)***	-51.0861(0)***

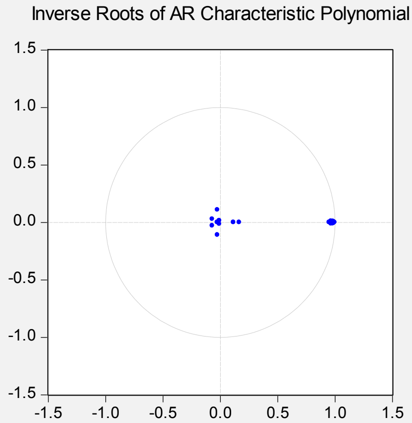
Note: The test is based on Mackinnon (1991). *，**，*** represents the significance at the 1%, 5% and 10% level. ( ) represents the lagging period. The first column shows the symbol of tourism stocks.

2 Please refer to http://www.multicharts.com.

5.02 Stationary test of VAR model

This study adopts AR roots graph to test if the VAR model is theoretically stationary as shown in Figure 01. The inverse roots of nine variables are within the unit circle. This proves that the model is stationary.

Figure 01: AR roots stationary test



5.03 Granger causality test of tourism stocks

VAR models can be used to determine the relationship between variables that may not be possible based on theoretical economic theories. This can be achieved by first assuming that the every variable in the system is related with each other. Then, we regress the present values of all variables with their lagged values. This allows us to determine the dynamic relationships between all variables. This study includes the stock prices of all nine tourism stocks in VAR and conducts the Granger causality test. The results show that when lagging two periods, Regent Taipei (2707) is the Granger cause of other tourism stocks for seven times and is the best among other tourism stocks (as shown in Table 02). In other words, the stock price of Regent Taipei should be included as an endogenous variable in trading simulations and there appears to be herd behavior in trading. One possible reason is that Regent Taipei has the highest stock price in the tourism industry and is included among the medium-sized 100 component stocks of Taiwan. Nofsinger et al. (1999) point out that the herd behavior of institutional investors has more influential effects than individual investors. A good high priced stock is often the first choice of mutual funds. Institutional investors' agent relationship may lead them to behave in certain ways, pushing the price further in a certain direction. The results confirm with Scharfstein et al.'s (1990) argument that institutional investors have blame sharing effect in herd behavior. Hence, the stock price of Regent Taipei is the benchmark price of other tourism stocks.

Table 02: Granger causality test of tourism stocks

Dependent variable: A2701			Dependent variable: A2705			Dependent variable: A5706		
Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.
A2702	13.38364	0.0012	A2701	5.063681	0.0795	A2701	7.264911	0.0265
A2704	7.113511	0.0285	A2702	16.59387	0.0002	A2702	9.096675	0.0106
A2705	7.595919	0.0224	A2704	11.94274	0.0026	A2704	13.67081	0.0011
A2706	2.574424	0.2760	A2706	1.566663	0.4569	A2705	2.038054	0.3609
A2707	4.933147	0.0849	A2707	10.80093	0.0045	A2706	10.11674	0.0064
A5706	4.368917	0.1125	A5706	7.267752	0.0264	A2707	5.830774	0.0542
A8940	2.016109	0.3649	A8940	6.157706	0.0460	A8940	1.163704	0.5589
A9943	12.23652	0.0022	A9943	7.991384	0.0184	A9943	7.596003	0.0224
All	36.53885	0.0024	All	47.00583	0.0001	All	59.43073	0.0000
Dependent variable: A2702			Dependent variable: A2706			Dependent variable: A8940		
Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.
A2701	3.392138	0.1834	A2701	3.861289	0.1451	A2701	2.477223	0.2898
A2704	7.394752	0.0248	A2702	17.32924	0.0002	A2702	0.488513	0.7833
A2705	4.285448	0.1173	A2704	11.08652	0.0039	A2704	7.683094	0.0215
A2706	5.961206	0.0508	A2705	1.651532	0.4379	A2705	0.413434	0.8132

A2707	8.685541	0.0130	A2707	8.083065	0.0176	A2706	2.690313	0.2605
A5706	1.107455	0.5748	A5706	3.678066	0.1590	A2707	10.32247	0.0057
A8940	2.423039	0.2977	A8940	0.256113	0.8798	A5706	0.881135	0.6437
A9943	3.485436	0.1750	A9943	0.842150	0.6563	A9943	5.712044	0.0575
All	38.35465	0.0013	All	37.68700	0.0017	All	28.73872	0.0258
Dependent variable: A2704			Dependent variable: A2707			Dependent variable: A9943		
Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.
A2701	0.357359	0.8364	A2701	0.009071	0.9955	A2701	2.323171	0.3130
A2702	5.830322	0.0542	A2702	5.459773	0.0652	A2702	2.378356	0.3045
A2705	7.495159	0.0236	A2704	15.08758	0.0005	A2704	0.954457	0.6205
A2706	0.447982	0.7993	A2705	1.953245	0.3766	A2705	3.440707	0.1790
A2707	0.853736	0.6525	A2706	0.650672	0.7223	A2706	2.496777	0.2870
A5706	3.419433	0.1809	A5706	0.415598	0.8124	A2707	6.523656	0.0383
A8940	1.898865	0.3870	A8940	6.820191	0.0330	A5706	0.664261	0.7174
A9943	1.722356	0.4227	A9943	0.942218	0.6243	A8940	2.818179	0.2444
All	30.78500	0.0143	All	55.57485	0.0000	All	25.39653	0.0631

Note: The stock symbol is same as in Table 06.

The above evidence suggests that income and herd behavior are important factors for investment in the tourism industry. Hence, we use Model 1 where data1 is the weighted index of the tourism sector, data2 is the stock price of individual stocks in the tourism industry and data3 is price of CSI ETF (0061) which is the most representative of China's stock market ETF to conduct program trading tests. The results show that in the first stage (from 15 August 2009 to 9 February 2011), by considering the stock price of Regent Taipei and CSI ETF, the optimal net profit is $18.31 (as shown in Table 08). When using the simulated coefficients from the optimal trading, the net profit till 2014 increases to $27.28 while no profits can be made on other tourism stocks. The results provide evidence supporting our two hypotheses that the Taiwan stock market is not strong-form efficient and that positive feedback trading behavior exists in tourism stock trading.

Table 03: Trade analysis of Model 1 program trading (Unit: dollar, times, %)

	2009.8.15~2011.2.9			2009.8.15~2015.2.9		
Stock symbol	Net profit	Trade counts	Winning probability (%)	Net profit	Trade counts	Winning probability (%)
2701	0	0	0	-	-	-
2702	1.97	1	100%	-16.57	5	40%
2704	9.42	2	50%	-10.96	6	33%
2705	6.22	1	100%	-2.82	6	66%
2706	1.97	1	100%	-9.15	3	66%
2707	18.31	2	100%	27.28	7	85%
5706	0	0	0	-	-	-
9943	0	0	0	-	-	-
8940	0	0	0	-	-	-

Note: The stock symbol is same as in Table 06.

As data1 (the weighted index of tourism stocks) is not tradable, we interchange data1 with data2 and proceed with the second program trading model where data1 is the stock price of Regent Taipei (2707), data2 is the weighted index of the tourism sector and data3 is the price of CSI ETF (0061). The net profit from the optimal trading simulation is $46 (as shown in Table 04). However, when the simulated optimal coefficients are applied to the later period till 2014, the net profit increases to $82. The results suggest that the trading profits in tourism industry are due to positive feedback trading strategy which can reduce uncertainty in investment, increase investors' confidence and enhance investment performance.

Table 04: Trade analysis of Model 2 program trading Unit: dollar, times, %

	2009.8.15~2011.2.9			2009.8.15~2015.2.9		
Stock symbol	Net profit	Trade counts	Winning probability (%)	Net profit	Trade counts	Winning probability (%)
2707	46	2	100%	82	7	54%

Note: The stock symbol is same as in Table 06.

6.0 Conclusion and policy implications

This study examines the impact on tourism industry when Chinese tourists were allowed in Taiwan in 2009. Adopting the Granger causality test, this study first shows that the stock price of Regent Taipei (2707) is the benchmark for tourism stocks. The two-stage program trading simulation shows that by considering the stock price of Regent Taipei and CSI ETF (0061), there will be trading profits. Hence, the results support our hypotheses that the Taiwan stock market is not strong-form efficient and the investment behavior in tourism stocks reveal positive feedback trading strategy.

Finally, this study proves that using the following information together (including, the stock price of Regent Taipei, the weighted index of tourism sector and CSI ETF), investors can profit from program trading. This provides an investment reference on tourism stocks for interested investors. Future research can study how the factors influencing tourism demand affect the investment strategy.

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Appendix

1. Estimation results of VAR model based on Regent Taipei (2707), index of tourism sector (2700) and CSI ETF (0061):

$$ly_t = \begin{bmatrix} 0.8670^{***} & 0.8994^{***} & -0.3857 \\ -0.0182 & 1.1778^{***} & -0.1958^{***} \\ 0.0012 & -0.0106 & 0.9047^{***} \end{bmatrix} * ly_{t-1} + \begin{bmatrix} -0.0067 & -0.5847^{**} & 0.6467 \\ -0.0146 & -0.1247^{**} & 0.2463^{**} \\ 0.0079^{*} & 0.0016 & 0.0044 \end{bmatrix} * ly_{t-2} +$$

$$\begin{bmatrix} 0.1286^{***} & -0.3045 & -0.0902 \\ 0.0330^{***} & -0.0616 & -0.0437 \\ -0.0048 & -0.0039 & -0.0027 \end{bmatrix} * ly_{t-3} + \begin{bmatrix} 0.3370 \\ 0.9945 \\ 1.5337^{***} \end{bmatrix} \quad \text{................ (A1)}$$

where $ly = [2707 \quad 2700 \quad 0061]'$, ***significant at the 1% level, **significant at 5%, and *significant at the 10% level.

2. Granger causality test of VECM based on Regent Taipei (2707), index of tourism industry (2700) and CSI ETF (0061):

Table A.1: Granger causality test of VECM

Granger cause / Granger results	2707	2700	0061
2707		25.6165 0.0000***	4.4716 0.2148
2700	12.5792 0.0056**		6.1652 0.1038*
0061	85.8590 0.0000***	51.2596 0.0000***	

Note: The numbers represent F-value (above) and P-value (below).