A PANEL COINTEGRATION ANALYSIS: THAILAND'S INTERNATIONAL TOURISM DEMAND MODEL

PRASERT CHAITIP, CHUKIAT CHAIBOONSRI *

ABSTRACT: *This paper sought to find the long-run relationships between international tourist arrivals in Thailand and economic variables such as GDP, cost of transportation and exchange rates for the period 1986 to 2007. Also this paper used five standard panel unit root tests such as LLC (2002) panel unit root test, Breitung (2000) panel unit root test, IPS (2003) panel unit root test, Maddala and Wu (1999), Choi (2001) panel unit root test, Handri (1999) panel unit root test. Moreover, the panel cointegration test based on Pedroni residual cointegration tests, Kao residual cointegration tests and Johansen fisher panel cointegration test were used to test in panel among the variables. The FMOLS estimator was used to find the long-run relationship of the international tourism demand model for Thailand. The long-run results indicated that growth in income (GDP) of Thai's Asia major tourist source markets has a positive impact on international tourist arrivals to Thailand. The empirical data implies that when the GDP of Asia major international tourist source markets such as Malaysia, Japan, Korea, China, Singapore, Taiwan increases by 1% then the number of international tourist arrivals to Thailand increases by 1.46%. In addition, when Thailand's currency strengthens by 1% in comparison to the currencies of the above countries, then the number of international tourist arrivals to Thailand from those countries increases by 0.74%.*

KEY WORDS: *Thailand; tourism demand; Panel Unit Root Test; Panel Cointergration Test; long-run relationship*

1. INTRODUCTION

In Thailand international tourism is the fastest growing industry and the earnings from international tourism in Thailand have increases substantially, rising from 220 billion baht in 1997 to 299 billion baht in 2001. Moreover, the earnings from international tourism in Thailand have risen from 323 billion baht in 2002 to 450 billion baht in 2005. While, the number of international tourist arrivals to Thailand was 7.22 million in 1997, by 2005 the number of international tourist arrivals to Thailand

* *Assoc.Prof., Ph.D., Chiang Mai University, Thailand*
Ph.D. Student, Bangalore University, India, chukiat1973@yahoo.com

had increases to 13 million (source: Thailand's tourism organization). Additionally, the domestic tourism industry in Thailand is also the fastest growing industry and the earnings of the domestic tourism industry has increases substantially, rising form 180 billion baht in 1997 to 223 billion baht in 2001. Furthermore, the earnings of the domestic tourism industry in Thailand have risen from 235 billion baht to 347 billion baht in 2005. In major source international tourism market of Thailand as mostly tourists from East Asia's countries. In 2005 the numbers of tourists from this area is 50% of international tourism market share of Thailand. Moreover, the top six countries from this area such as Malaysia, Japan, Korea, China, Singapore and Taiwan are import impact to the number of international tourism market of Thailand during period of 2000-2005(source: Thailand's tourism organization). Based on information above have inspired to produce this paper for education of Thailand's international tourism demand as well as this paper would like to study only tourists from these countries such as Malaysia, Japan, Korea, China, Singapore and Taiwan. For a long time now, economists have tried to understand the international tourist consumer behavior through demand models. For example, Barry and O'Hagan (1972): studied the demand of British tourists going to Ireland; Jud, G.D. and Joseph, H., (1974); studied the demand of international tourist going to Latin American; Uysal and Crompton (1984) studied the demand of international tourists going to Turkey. Summary (1987) studied the demand of international tourists going to Kenya, Kulendran, N. (1996) studied the demand of international tourists going to Australia; Lim C. and M.McAleer (2000) studied the demand of international tourist going to Australia; Durbarry (2002) studied the demand of international tourists (French) going to the UK, Span and Italy. As well as Paresh Kumar and Narayan (2004) and Resina Katafono and Aruna Gounder (2004) who studied the demand of international tourists going to Fiji. Also the aim of this paper is to find out the international tourist consumer behavior in coming to Thailand during the period 1968-2007 through the demand model. The consumer behavior information gathered from this research will help to develop the international tourism industry in Thailand.

2. RESEARCH AIM AND OBJECTIVE

This research aimed to determine how various factors affect international tourist demand arrivals to Thailand in the long-run and to use the international tourism demand model to explain international tourist behavior in Thailand.

3. SCOPE OF THIS RESEARCH

The focus of this research was during period of 1968 to 2007. Most of the data was secondary data and also the countries under analysis were Asia major tourism market of Thailand such as Malaysia, Japan, Korea, China, Singapore and Taiwan. All of these countries had a significant impacted on the international tourism industry of Thailand in the same period (source: Thailand's tourism organization). The variables used in this research such as the numbers of international tourists arriving in Thailand, the GDP of the countries that the tourists were coming from, the international price of aviation fuel, and the exchange rate of Thai currency in comparison to foreign currencies.

4. THE METHODOLOGY AND RESEARCH FRAMEWORK

4.1. The theory of International Tourism Demand Model

The concept of international tourist demand has been applied since 1950 but the estimation of international tourist demand by the econometric method was first used by Artus (1972). Following that, a lot of studies on international tourist demand function used the econometric method. This researcher reviewed the work of Archer (1976), Crouch (1994), Walsh (1996), Lim (1997), Inclair (1998), Lise & Tol (2002), McAleer (2001, 2003), Resina and Aruna (2004), Narayan (2004), Prasert, Rangaswamy and Chukiat (2006). Growth in international tourism is closely aligned to economic variables, which at both the microeconomic and macroeconomic levels influences the consumer's decision to undertake overseas travel. Empirical research on international tourism demand has overwhelmingly been based on aggregate time series data which permits the estimation of income and price elasticity on inbound tourism (see Lim, 1997 and McAleer (2001, 2003) and Prasert, Rangaswamy and Chukiat (2006)). A simple origin-destination demand model for international tourism can be represented as follows:

$$D_t = f(\ Y_t \ \ TC_t \ \ P_t\ ) \tag{1}$$

where:
D_t = is a measure of travel demand at time t;
Y_t = is a measure of income of the tourist-generating or origin country at time t;
TC_t = is a measure of transportation costs from the origin to destination country at t;
P_t = is a measure of tourism price of goods and services at time t;

And assume that ($+Y_t$), ($-TC_t$), ($-P_t$) and explain that when income at time t is increasing then the demand for international tourism is increasing simultaneously. When the measure of transportation costs from the origin to destination country at time t is increasing then the demand for international tourism decreases. And when the measure of tourism price of goods and services is increasing then the demand for international tourism is decreasing. Equation (1) can be expressed in log-linear (or logarithmic) form:

$$\ln D_t = \alpha + \beta \ln Y_t + \gamma \ln \{F1_t \text{ or } F2_t\} + \delta \ln \{RP_t , ER_t \text{ or } RER_t\} + \\ + \phi \ln D_{t-1} + \theta \ln CP_t + u_t \tag{2}$$

where:
$\ln D_t$ = logarithm of short-term quarterly tourist arrivals (or demand) from the origin to destination country at time t;
$\ln Y_t$ = logarithm of real GDP in original country at time t;
$\ln F1_t$ = logarithm of real round-trip coach economy airfares in Neutral Units of construction (NUC) between original country and destination country at time t;

$lnF2_t$ = logarithm of real round-trip coach economy airfares in original country currency between original country and destination country at time t;
ln RP_t = logarithm of relative prices (or CPI of destination country/CPI of original country) at time t;
$lnER_t$ = logarithm of exchange rate (original country per destination country) at time t;
$lnRER_t$ = logarithm of real exchange rate [or CPI(destination country)/CPI(original country)*1/ER] at time t;
ln CP_t = logarithm of competitive prices [using CPI(destination country)/(other destination country)]
u_t = independently distributed random error term, with zero mean and constant variance at time t;

And defined that: $\alpha, \beta, \gamma, \delta, \phi, \theta$ = parameters to be estimated; $\beta > 0$, $\gamma < 0$, $\delta < 0$, $0<\phi< 1$, $\theta > 0$ (substitutes) and $\theta < 0$ (complements).

The above information mostly focuses on the international tourism demand function based on time series analysis. Recently a lot of research about international tourist demand function has used the econometric method based on the panel data analysis. This researcher reviewed the following studies which applied this technique: Durbary (2000), Munoz and Amaral (2002), Naude and Saayman (2004), Eilat and Einav (2004), Chin and Pan (2004), Proenca and Soukiazis (2005), Maloney and Rojas (2005), Chaiboonsri, Chaitip, Rangaswamy (2008). Also the models used in this research were a modification of equation (2A) and can be written as equation (3).

$$\ln D1_{it} = \alpha + \beta \ln (GDP_{it}) + \gamma \ln (PO_{it}) + \theta \ln (ER_{it}) + u_{it} \qquad (3)$$

where:
i = cross-section-data (the number of country arrival to Thailand)
t = time series data
ln $D1_{it}$ = logarithm of tourist arrivals (or demand) from the origin countries number i to destination country (Thailand) at time t;
ln GDP_{it} = logarithm of real GDP in original countries number i at time t (Y_{it});
$lnPO_{it}$ = logarithm of price of aviation fuel of original countries number i at time t (TC_{it});
$lnER_{it}$ = logarithm of exchange rate of original country number i per destination country (Thailand) at time t;
u_{it} = independently distributed random error term, with zero mean and constant variance number i at time t ;

And defined that $\alpha, \beta, \gamma, \theta$ = parameters to be estimated; $\alpha > 0$, $\beta > 0$, $\gamma< 0$, $\theta< 0$.

4.2. Panel Unit-Root Tests

Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. See Levin, Lin and Chu (2002), Im, Persaran and Shin (2003), and Breitung (2000) which mention test purchasing power parity (PPP) and growth convergence in macro panels using country data over time. This research focused on five types of panel unit root tests such as Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Fisher-Type test using ADF and PP-test (Maddala and Wu (1999) and Choi (2001), Hadri (1999)). These methods also see more detail in Chukiat Chaiboonsri, Prasert Chaitip and N. Rangaswamy (2008).

4.3. Panel Cointegration Test

Kao (1999) uses both DF and ADF to test for cointegration in panel as well as this test similar to the standard approach adopted in the EG-step procedures. Also this test starts with the panel regression model as set out in equation (4).

$$Y_{it} = X_{it}\beta_{it} + Z_{it}\gamma_0 + \varepsilon_{it} \tag{4}$$

where Y and X are presumed to be non-stationary and: see equation (5)

$$\hat{e}_{it} = \rho\, \hat{e}_{it} + \nu_{it} \tag{5}$$

where $\hat{e}_{it} = (Y_{it} - X_{it}\hat{\beta}_{it} - Z_{it}\hat{\gamma})$ are the residuals from estimating equation (4). To test the null hypothesis of no cointegrarion amounts to test H_0: $\rho = 1$ in equation (5) against the alternative that Y and X are conitegrated (i, e., H_1: $\rho<1$). Kao (1999) developed both DF-Type test statistics and ADF test statistics were used to test cointegration in panel also both DF-Type(4 Type) test statistics and ADF test statistics can present below that:

$$DF_\rho = \frac{\sqrt{N}T(\hat{\rho}-1)+3\sqrt{N}}{\sqrt{51/5}},$$

$$DF_t = \sqrt{\frac{5t_\rho}{4}} + \sqrt{\frac{15N}{8}}.$$

$$DF_\rho^* = \frac{\sqrt{N}T(\hat{\rho}-1)+\frac{3\sqrt{N}\hat{\sigma}_v^2}{\hat{\sigma}_{0v}^2}}{\sqrt{3+\frac{36\hat{\sigma}_v^4}{5\hat{\sigma}_{0v}^4}}},$$

$$DF_t^* = \frac{t_\rho + \frac{\sqrt{6N}\hat{\sigma}_v}{2\hat{\sigma}_{0v}}}{\sqrt{\frac{\hat{\sigma}_{0v}^2}{2\hat{\sigma}_v^2}+\frac{3\hat{\sigma}_v^2}{10\hat{\sigma}_{0v}^2}}},$$

$$ADF = \frac{t_{ADF} + \sqrt{6N}\hat{\sigma}_v/2\hat{\sigma}_{0u}}{\sqrt{\hat{\sigma}_{0v}^2/2\hat{\sigma}_v^2 + 3\hat{\sigma}_v^2/10\hat{\sigma}_{0v}^2}}$$

where:
N = cross-section data
T = time series data
$\rho^{\wedge}$ = co-efficiencies of 21I
$t_{\rho} = [(\rho^{\wedge} -1) \sqrt{} (\Sigma^{N}_{i=1} \Sigma^{T}_{t=2} e^{\wedge *2}_{i\,t-1})]/Se$
$Se = (1/NT) \Sigma^{N}_{i=1} \Sigma^{T}_{t=2}(e^{\wedge *}_{i\,t} - \rho^{\wedge} e^{\wedge *}_{i\,t-1})^{2}$
$\sigma_u^{\wedge 2}$ = variance of u
$\sigma_v^{\wedge 2}$ = variance of v
$\sigma_u^{\wedge}$ = standard deviation of u
$\sigma_v^{\wedge}$ = standard deviation of v
$t_{ADF} = [(\rho^{\wedge} -1) (\Sigma^{N}_{i=1} (e^{/} Q_{i} e_{i}))^{1/2}]/ S_v$

Pedroni (1995) provides a pooled Phillips and Perron-Type test and these test have the null hypothesis of no cointegration. The panel autoregressive coefficient estimator, $\square^{\wedge}_{N,T,}$ can be constructed as follow: see equation (6).

$$\gamma^{\wedge}_{N,T}{}^{-1} = [\Sigma^{N}_{i=1} \Sigma^{T}_{t=2}(e^{\wedge}_{i\,,\,t-1}\, \Delta e^{\wedge}_{i\,,\,t-1} - \lambda^{\wedge}_{i})] / \Sigma^{N}_{i=1} \Sigma^{T}_{t=2}(e^{\wedge 2}_{i\,,\,t-1}) \quad (6)$$

where
N = cross-section data
T = time series data
$e_{i\,t-1}$ = error term of model
$\lambda^{\wedge}_{i}$ = a scalar equivalent to correlation matrix

And also Pedroni (1995) provides the limiting distributions of two test statistics as well as can be written in equation (7):

$$\text{PP-statistic} = [T \sqrt{N} (\gamma^{\wedge}_{N,T}{}^{-1})]/\sqrt{2} \rightarrow N(0,1) \quad (7)$$

And this research focus on ADF test statistic based on residual-based test follow concept of Kao (1999) to test cointegration in panel and also this research focus on PP-test statistic based on concept of Pedroni (1995) to test cointegration in panel. Both ADF–statistics and PP-statistic have same null hypothesis of no cointegration in panel. In term of combined individual test (Fisher/Johansen) also Maddala and Wu (1999) use Fisher's result to propose and alternative approach to testing for cointegration in panel data by combining tests from individual cross-sections to obtain at test statistics for the full panel. If Π_i is the p-value from an individual cointegration test for cross-section i, then under the null hypothesis fir the panel, see formula (8)

$$-2 \Sigma \log(\Pi_i) \rightarrow \chi^2\, 2n \quad (8)$$

By default the χ^2 value based on MacKinnon-Haug-Michelis(1999) P-value use for Johansen's cointegration trace test and maximum eigenvalue test. And the Johansen's Maximum likelihood procedure (see more detail at equation (9)).

$$\Delta Y_{i,t} = \Pi_i y_{i,t-1} + \sum_{k=1}^{n} \mathrm{T}_k \Delta Y_{i,t-k} + u_{i,t} \quad (9)$$

Ho: rank (Π_i) = $r_i \leq r$ for all i from 1 to n
Ha: rank (Π_i) = P for all i from 1 to n

The standard rank test statistics is defined in terms of average of the trace statistic for each cross section unit and mean and variance of traces statistics.

4.4. Estimating panel cointegration model

The various (casually single equation) approach for estimating a cointegration vector using panel data such as the Pedroni (2000, 2001) approach, the Chiang and Kao (2000, 2002) approach and the Breitung (2002) approach. The various estimators available include with-and between-group such as OLS estimators, fully modified OLS (FMOLS) estimators and dynamic OLS estimators. FMOLS is a non-parametric approach to dealing with corrections for serial correlation, serial correlation, while OLS and DOLS are a parametric approach which DOLS estimators include lagged first-differenced term are explicitly estimated as well as consider a simple two variable panel regression model: see detail calculated of OLS, FMOLS and DOLS in equation (11), (12) and (14).

$$Y_{i\,t} = \alpha_i + ß_i X_{i\,t} + \varepsilon_{i\,t} \quad (10)$$

A standard panel OLS estimator for the coefficient $ß_i$ given by :

$$ß^{\wedge}_{i,\,OLS} = [\Sigma^N_{i=1}\Sigma^T_{t=1}(X_{i\,t} - X^*_i)^2]^{-1}\, \Sigma^N_{i=1}\Sigma^T_{t=1}(X_{i\,t} - X^*_i)\,(Y_{i\,t} - Y^*_i) \quad (11)$$

where:
i = cross-section data and N is the number of cross-section
t = time series data and T is the number of time series data
$ß^{\wedge}_{i\,OLS}$ = a standard panel OLS estimator
$X_{i\,t}$ = exogenous variable in model
X^*_i = average of X^*_i
$Y_{i\,t}$ = endogenous variable in model
Y^*_i = average of Y^*_i

To correct for endogeneity and serial correlation, Pedroni (2000) has suggested the group-means FMOLS estimator that incorporates the Phillips and Hanseri (1990) semi-parametric correction to the OLS estimator to adjusts for the heterogeneity that is present in the dynamics underlying X and Y. Specifically, the FMOLS statistics is: see equation 24I).

$$ß^{\wedge}_{i\,,\,FMOLS} = N^{-1}\, \Sigma^N_{i=1}[\Sigma^T_{t=1}(X_{i\,t} - X^*_i)^2]^{-1}\, [\, \Sigma^T_{t=1}(X_{i\,t} - X^*_i)\, Y^+_{it} - TY^{\wedge}_i \quad (12)$$

where:

i = cross-section data and N is number of cross-section data
t = time series data and T is number of time series data
$\hat{ß}_{i\,FMOLS}$ = Full modified OLS estimator
$X_{i\,t}$ = exogenous variable in model
X^*_i = average of X^*_i
$Y_{i\,t}$ = endogenous variable in model
Y^*_i = average of Y^*_i
$Y^+_{it} = X_{i\,t} - X^*_i) – [(\hat{\Omega}_{21i} / \hat{\Omega}_{22i})\Delta X_{i\,t}]$ and $\hat{\Omega}$ is covariance

In contrast to the non-parametric FMOLS estimator, Pedroni (2001) has also constructed a between-dimension, group-means panel DOLS estimator that incorporate corrections for endogeneity and serial correlation parametrically. This is done by modifying equation (10) to include lead and lag dynamics: see equation (13).

$$Y_{i\,t} = \alpha_i + ß_i X_{i\,t} + \Sigma^{ki}_{j=-k} \gamma_{ik} \Delta X_{i\,,t-k} + \varepsilon_{i\,t} \qquad (13)$$

$$\hat{ß}_{i\,,DOLS} = [N^{-1} \Sigma^N_{i=1}(\Sigma^T_{t=1} Z_{it} Z^*_{it})^{-1}(\Sigma^T_{t=1} Z_{it} \hat{Z}_{it})] \qquad (14)$$

where:
i = cross-section data and N is number of cross-section data
t = time series data and T is number of time series data
$\hat{ß}_{i\,DOLS}$ = dynamics OLS estimator
$Z_{i\,t}$ = is the 2(K+1) x 1
$\hat{Z}_{it} = (X_{i\,t} - X^*_i)$
X^*_i = average of X^*_i
$\Delta X_{i\,,t-k}$ = differential term of X

The above methods, used to estimate panel cointegration models, were mostly developed by Pedroni (2000, 2001). This research focused on only the FMOLS estimator for estimating panel cointegration for modeling international tourism demand of Thailand.

5. THE EMPIRICAL RESULTS OF THE RESEARCH

5.1. The empirical results of the panel unit root test

This research used the panel unit root test of the variables by five standard method tests for panel data. Namely Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Fisher-Type test using ADF and PP-test (Maddala and Wu (1999) and Choi (2001)) and Hadri (1999). Table 1 presents the results of the panel unit root tests based on the five method tests for all variables used in modeling international tourism demand of Thailand. The Levin, Lin and Chu (2002) method test indicate that LD_{it}, LY_{it}, LTC_{it} and LER_{it} are at the level of insignificance for accepting the null of a unit root. The Breitung (2000) method test indicate that that LD_{it}, LTC_{it} and LER_{it} is of the level of significance for rejecting the null of a unit root but LY_{it} have unit root. The Im, Pesaran and Shin (2003) method test indicate that LD_{it}, LTC_{it}

and LER_{it} have a unit root but LY_{it}, have not unit root. Maddala and Wu (1999) and Choi (2001) method based on ADF-Fisher Chi-square test indicate that LD_{it}, LTC_{it} and LER_{it} have a unit root but LY_{it} have not unit root. And also Maddala and Wu (1999) and Choi (2001) method based on PP-Fisher Chi-square test indicate that LD_{it}, LY_{it}, LTC_{it} and LER_{it} have unit root. The Hadri (1999) method test indicates that LD_{it}, LY_{it}, LTC_{it} and LER_{it} have a unit root because this method has a null hypothesis of no unit root. From the results of the panel unit root test, it can be concluded that most variables used in this model have unit root. So all variables should be take first differing or take second differing as well as after take first differing in all variables then the results of the panel unit root test based on five methods are presented in table 2.

The Levin, Lin and Chu (2002) method test indicate that LDit, LY_{it}, LTC_{it} and LER_{it} are at the level of significance for rejecting the null hypothesis of a unit root. The Breitung (2000) method test indicates that LD_{it}, LY_{it}, LTC_{it} and LER_{it} are at the level of significance for reject the null hypothesis of a unit root. The Im, Pesaran and Shin (2003) method test indicate that LD_{it}, LY_{it}, LTC_{it} and LER_{it} are of the level of significance for rejecting the null hypothesis of a unit root. The Maddala and Wu (1999) and Choi (2001) method based on both ADF-Fisher Chi-square test and PP-Fisher Chi-square test indicated that LD_{it}, LY_{it}, LTC_{it} and LER_{it} are at the level of significance for rejecting the null hypothesis of a unit root. The Hadri (1999) method test indicated that LD_{it}, LY_{it}, LTC_{it} and LER_{it} have a unit root because this method has a null hypothesis of no unit root (see more detail in table 2).

5.2. The empirical results of panel cointegration test

Table 3 present the results of the panel cointegration test of the modeling international tourism demand of Thailand based on Pedroni Residual Cointegration Tests, Kao Residual Cointegration Tests and Johansen Fisher Panel Cointegration Test. Most of these method were used to test for this model indicate that all variables used in this model are of the level of significant for rejecting the null hypothesis (no cointegration). The empirical results imply that all variables used in modeling international tourism demand of Thailand have cointegration with each other.

5.3. The empirical results of estimating panel cointegration model

The table 4 presents the results of estimating panel cointegration of Thailand's international tourism demand (PANEL GROUP FMOLS RESULTS). From this table shown that six countries as in long-run base on FMOLS-estimator to estimating panel cointegration model suggested that LY_{it} has a positive impact on international tourist arrival to Thailand. The empirical results imply that in the long-run when LY_{it} increases by 1 % then the number of tourists from the six countries arriving in Thailand increases by 1.46%. And when LER_{it} increases by 1% then the number of tourists from the six countries arriving in Thaialnd increases by 0.74%.

6. THE CONCLUSIONS OF RESEARCH AND POLICY RECOMMENDATIONS

This paper was motivated by the need for empirical analysis of international tourist behavior arriving in Thailand and an analysis of the determinants of Thailand's international tourism demand from its six main source markets such as Malaysia, Japan, Korea, China, Singapore and Taiwan. In this article, five standard panel unit root test were used test for all variables. Namely, Levin, Lin and Chu(2002), Breitung(2000), Im, Pesaran and Shin(2003), Fisher-Type test using ADF and PP-test (Maddala and Wu(1999) and Choi (2001)) and Hadri (1999). And in this article were used panel cointegration test base on Pedroni Residual Cointegration Tests, Kao Residual Cointegration Tests and Johansen Fisher Panel Cointegration Test.

Table 1. Results of panel unit root tests based on 5 method tests for all variables

Method test	Test statistic	Significance level for rejection
Null : unit root (assumes common unit root process)		
Levin,Lin and Chu (2002) t*- Statistics		
1. lnD_{it}	0.57	0.71
2. lnY_{it}	-0.49	0.30
3. $lnTC_{it}$	3.73	0.99
4. $lnER_{it}$	1.61	0.94
Breitung(2000) t*-Statistics		
1. lnD_{it}	-2.73	0.00
2. lnY_{it}	0.35	0.64
3. $lnTC_{it}$	-4.51	0.00
4. $lnER_{it}$	-1.69	0.04
Null : unit root (assumes individual unit root process)		
Lm, Pesaran and Shin (2003) W-Statistics		
1. lnD_{it}	0.77	0.78
2. lnY_{it}	-1.85	0.03
3. $lnTC_{it}$	5.96	0.99
4. $lnER_{it}$	2.04	0.97
Maddala and Wu (1999) and Choi (2001)		
ADF-Fisher Chi-square		
1. lnD_{it}	11.36	0.49
2. lnY_{it}	22.17	0.03
3. $lnTC_{it}$	0.03	0.99
4. $lnER_{it}$	2.04	0.97
PP-Fisher Chi-square		
1. lnD_{it}	14.51	0.26
2. lnY_{it}	12.02	0.44
3. $lnTC_{it}$	0.79	0.99
4. $lnER_{it}$	4.56	0.97
Null : No unit root (assumes common unit root process)		
Hadri (1999) Z-Statistics		
1. lnD_{it}	5.36	0.00
2. lnY_{it}	5.39	0.00
3. $lnTC_{it}$	5.58	0.00
4. $lnER_{it}$	4.18	0.00

From: computed

Furthermore in this article also used the FMOLS-estimator to investigate long-run equilibrium relationships between the numbers of international tourists arriving in

Thailand with economics variables. These methods were suggested by Pedroni (2000, 2001). The economic variables such as the GDP of major countries of international tourists coming to Thailand, the world price of aviation fuel and the exchange rate of Thailand compared with the origin countries of international tourists.

Table 2. Results of panel unit root tests based on 5 method tests for all variables after first differencing or second differencing into these variables

Method test	Test statistic	Significance level for rejection
Null : unit root (assumes common unit root process)		
Levin,Lin and Chu (2002) t*- Statistics		
5. lnD_{it}	-6.78	0.00
6. lnY_{it}	-6.21	0.00
7. $lnTC_{it}$	-8.00	0.00
8. $lnER_{it}$	-6.61	0.00
Breitung(2000) t*-Statistics		
5. lnD_{it}	-3.18	0.00
6. lnY_{it}	-2.14	0.01
7. $lnTC_{it}$	-8.82	0.00
8. $lnER_{it}$	-5.48	0.00
Null : unit root (assumes individual unit root process)		
Lm, Pesaran and Shin (2003) W-Statistics		
5. lnD_{it}	-7.35	0.00
6. lnY_{it}	-5.30	0.00
7. $lnTC_{it}$	-7.06	0.00
8. $lnER_{it}$	-4.48	0.00
Maddala and Wu (1999) and Choi (2001)		
ADF-Fisher Chi-square		
5. lnD_{it}	64.36	0.00
6. lnY_{it}	46.66	0.00
7. $lnTC_{it}$	62.84	0.00
8. $lnER_{it}$	39.31	0.00
PP-Fisher Chi-square		
5. lnD_{it}	72.48	0.00
6. lnY_{it}	42.01	0.00
7. $lnTC_{it}$	110.21	0.00
8. $lnER_{it}$	42.82	0.00
Null : No unit root (assumes common unit root process)		
Hadri (1999) Z-Statistics		
5. lnD_{it}	1.79	0.036
6. lnY_{it}	2.35	0.009
7. $lnTC_{it}$	24.23	0.00
8. $lnER_{it}$	2.48	0.00

From: computed

The only one important both conclusions and recommendations that emerge from the empirical analysis of this research. The 1% increase in income (GDP) of the Asia tourism markets of Thailand (Malaysia, Japan, Korea, China, Singapore and Taiwan) leads to an increase the number of international tourists traveling to Thailand by 1.46%. This result is consistent with economic theory and was similar to the results of previous empirical studies on tourist demand (Lim & McAleer (2003), Kafono & Gounder (2004) and Narayan (2004) and Prasert, N. Rangaswamy and Chukiat, (2006, 2008)). The long-run result for Thailand's international tourism demand implies that Thailand will receives the number of international visitors more when the income (GDP) of Asia tourism markets of Thailand will growth up more in the same of during period. If this can be generalized for future years, then it argues well for the continued development of the Thailand tourism industry.

Table 3. Results from panel cointegration test of the international tourism demand of Thailand

Test Name	Test statistic	Significance level for rejection of the null hypothesis (no cointegration)
(1).Pedroni Residual Cointegration Tests		
• Panel v-Statistic	0.703680	(0.3114)
• Panel rho-Statistic	0.280608	(0.3835)
• Panel PP-Statistic	-2.350831	(0.0252)
• Panel ADF-Statistic	-2.426043	(0.0210)
• Group rho-Statistic	1.031702	(0.2343)
• Group PP-Statistic	-2.103406	(0.0437)
• Group ADF-Statistic	-1.978332	(0.0564)
(2) Kao Residual Cointegration Tests		
• ADF-Statistics	-3.233149	(0.0006)
(3) Johansen Fisher Panel Cointegration Test		
• Fisher Statistics from Trace Test	30.7829	(0.0021)
• Fisher Statistics from Max-Eigen Test	18.4540	(0.1026)

From: computed

Table 4. Results of the long-run relationship of the modeling international tourism demand of Thailand based on FMOLS-estimator($lnD_{i\,t}$ is dependent variable) INDIVIDUAL FMOLS RESULTS (t-stats in parentheses)

Asia-Country	Variable	Coefficient	t-statistic
No.1	LY	0.68***	(6.60)
No.1	LTC	0.18**	(3.28)
No.1	LER	0.77*	(1.91)
No.2	LY	2.67***	(4.74)
No.2	LTC	-0.07	(-0.91)
No.2	LER	0.72***	(4.84)
No.3	LY	3.07***	(9.85)
No.3	LTC	-0.25	(-0.63)
No.3	LER	1.04	(0.56)
No.4	LY	2.14***	(20.16)
No.4	LTC	-0.71***	(-5.14)
No.4	LER	-0.82***	(-3.19)
No.5	LY	0.12	(0.72)
No.5	LTC	0.20***	(5.95)
No.5	LER	1.23***	(8.75)
No.6	LY	0.08	(0.22)
No.6	LTC	-0.19*	(-1.37)
No.6	LER	1.48**	(2.28)

No.1=Malaysia, No.2=Japan, No.3= Korea, No.4= China, No.5=Singapore, No.6=Taiwan		
PANEL GROUP FMOLS RESULTS		
	Coefficient	**t-statistic**
LY	1.46***	(17.26)
LTC	-0.14	(0.48)
LER	0.74***	(6.19)
Nsecs = 6 , Tperiods = 22 , no. regressors = 3		

From: computed

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