MODELLING INTERNATIONAL TOURISM DEMAND IN THAILAND

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ABSTRACT: This paper sought to find the short-run and long-run relationships between international tourist arrivals in Thailand with economic variables such as GDP, the price of goods and services, transportation costs, and the exchange rate for the period from 1997(Q1)-2005(Q2). Both the Cointegration techniques based on Johansen and Juselius (1990) and Error Correction Mechanisms based on Engle and Granger concept (1987) were used to find the long-run and short-run relationships of the international tourism demand model for Thailand. This paper used the full six standard method test for unit root tests such as ADF-Test (1979), PP-Test (1987,1988), KPSS-Test (1992), DF-GLS Test (1996), the ERS Point Optimal Test and Ng and Perron (2001). The full six standard method test for unit root test have not previously been used to test unit roots for estimating tourism demand models. The long-run results indicate that growth in income (GDP) of Thailand’s major tourist source markets has a positive impact on international visitor arrivals to Thailand while both transportation cost and exchange rate has a negative impact on international visitor arrivals to Thailand. The findings were consistent with economic theory and the implications of the model can be used for policy making.

KEY WORDS: Thailand; tourism demand; unit root test; cointegration; error correction model

1. INTRODUCTION

The international tourism business entered an interesting period for many countries in Asia between 1997-1998 (many Asian countries including Thailand experienced an economic crisis during this time: Lim (2003)). Since 1997, the Asian economy

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region faced an economic crisis which was due to Thailand's policy of the liberalization of its international currency called BIBF in 1993 (Kriangsak, 1998). This policy resulted in a huge inflow of loans to Thailand amounting to the following sums: (1) 193.2 B baht in 1992, (2) 253.4 B baht in 1993, and (3) 202.4 B baht in 1994. Most of these loans flowed into the minor business sector such as the stock market and real estate leading to low productivity and unemployment. Thus, the balance of trade in Thailand led to continuous deficits annually because the products of Thailand could not compete in the world market (Bank of Thailand, 1994).

In addition to this, Thailand applied an international policy of fixed value on its exchange rate which was incongruent with the real value of the US dollar (Chukiat, 2003) that made imports much greater than exports for Thailand. This again contributed to continuous deficits and an imbalance of trade. The imbalance of trade, unfeasible international currency policy, inflow of capital to the unproductive business sector all contributed to the economic crisis from 1997 onwards. As a consequence, Thailand took out a huge loan of 17.2 billion US dollars from the international Monetary Fund (IMF) in the form of a Stand-by Arrangement to help its economy. The crisis that started in Thailand also affected its neighbors such as the Philippines, Indonesia, Singapore and South Korea (Lim and McAleer, 2001).

Another effect of the economic crisis in 1997 was the decreasing GDP of Thailand from 1997 to 2001. In 1997 the GDP of Thailand was 3,073,615 million baht and in 1998 the GDP of Thailand was 2,749,684 million baht. In 1999 the GDP of Thailand was 2,871,980 million baht and in 2000 to 2001 the GDP of Thailand was 3,008,662 million baht and 3,072,925 million baht respectively (source: National Economic and Social Development Board of Thailand). Despite the economic crisis, however, the effect on the tourism industry of Thailand was positive because of the increasing number of foreign tourists coming to Thailand that thereby brought high income to country. In 1997 the number of foreign tourists that came to Thailand was 7.22 million contributing an income of 220 billion baht to the Thai economy. In 1998, the number of foreign tourists increased to 7.76 million and the income increased to 242 billion baht. The following year there were 8.58 million tourists and the income was 253 billion baht. In 2000 to 2001 tourist arrivals continued to increase to 9.51 million people and 10.06 million people with incomes of 285 billion baht and 299 billion baht respectively (source: Thailand’s tourism organization).

It is therefore concluded from this study that the international tourism industry in Thailand was not affected by the economic crisis. For a long time now, economists have tried to understand the international tourist consumer behaviour 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 tourists) going to the UK, Spain and Italy. As well as Paresh Kumar and Narayan (2004) and Resina Katafano and Aruna
Gounder (2004): who studied the demand of international tourists going to Fiji. Based on many articles, the aim of this paper is to find out the international tourist consumer behavior in coming to Thailand during the period 1997-2005 through demand modeling. The consumer behavior information gathered from this research will help in developing the international tourism industry in Thailand.

2. RESEARCH AIM AND OBJECTIVE

This research has the aim and objective of seeking to know how many factors affect international tourist demand arrivals to Thailand in the long-run and short-run and to use the international tourism demand model to explain international tourist’s behaviour in Thailand.

3. SCOPE OF THIS RESEARCH

The scope of this research is the period 1997(Q1)-2005(Q2) and mostly the data was secondary data. The countries used for analysis in International Tourism Demand in Thailand were the major countries for the international tourism industry of Thailand, namely Malaysia, China, England, German, France, America and Canada. Almost all of them had an influence on the income of the international tourism industry of Thailand in the same period (source: Thailand’s tourism organization).

The variables used in this research were economic variables, for example the numbers of international tourist arriving in Thailand, the GDP of major countries of international tourists coming to Thailand, the world price of Kerosene-Type Jet Fuel, the relative prices between Thailand and the countries of origin of international tourists coming to Thailand and the exchange rate of Thailand in relation to the exchange rates of major countries of international tourists.

4. THE METHODOLOGY AND RESEARCH FRAMEWORK

4.1. The concept background of International Tourism Demand Model

The concept of theory has been used in international tourist demand since 1950 but the estimation in international tourist demand by econometric method beginning from the first time by Artus (1972). After that a lot of research about international tourist demand function used the econometric method. The researcher studied research such as Archer (1976), Crouch (1994), Walsh (1996), Lim (1997), Inclair (1998), Lise&Tol (2002), McAleer (2001,2003) Resina and Aruna (2004). Growth in international tourism is closely aligned to economic variables, which at a microeconomic level influence 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 estimation of income and price elasticity on inbound tourism (see Lim, 1997 and McAleer, 2001, 2003). A simple origin-destination demand model for international tourism can be written as: (equation number (1)).
where:
\(D_t\) = a measure of travel demand at time \(t\);
\(Y_t\) = a measure of income of the tourist-generating or origin country at time \(t\);
\(TC_t\) = 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. And the equation (1) can be expressed in log-linear (or logarithmic) form equation number (2).

\[
\ln D_t = \alpha + \beta \ln Y_t + \gamma \ln \{F_1_t \text{ or } F_2_t\} + \delta \ln \{RP_t, ER_t \text{ or } RER_t\} + \\
+ \Phi \ln D_{t-1} + \theta \ln CP_t + u_t
\]

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 \(t\)
\(\ln F_{1t}\) = logarithm of real round-trip coach economy airfares in Neutral Units of construction (NUC) between original country and destination country at time \(t\)
\(\ln F_{2t}\) = 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 \(t\)
\(\ln ER_t\) = logarithm of exchange rate (original country per destination country) at \(t\)
\(\ln RER_t\) = 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 \(\alpha, \beta, \gamma, \Phi, \theta\) = parameters to be estimated; \(\beta>0, \gamma<0, \delta<0, 0<\Phi<1, \theta>0\) (substitutes) and \(\theta<0\) (complements).

And this research or the “Modeling International Tourism Demand in Thailand” modified from equation (2) as well as can be written as equation (3).

\[
\ln D_{1t} = \alpha + \beta \ln (GDP_t) + \gamma \ln (PO_t) + \delta \ln (RP_t) + \theta \ln(ER_t) + \\
+ \rho \ln(RER_t)+ u_t
\]

where:
\(\ln D_{1t}\) = logarithm of tourist arrivals (or demand) from the origin (each 7 country) to
destination country (Thailand) at time \( t \)

\[ \ln GDP_t = \text{logarithm of real GDP in original countries (each 7 country) at time } t \]

\[ \ln PO_t = \text{logarithm of price of Jet Fuel at time } t \]

\[ \ln RP_t = \text{logarithm of relative prices (or CPI of destination country: (Thailand)/CPI of original country: (each 7 country) at time } t \]

\[ \ln ER_t = \text{logarithm of exchange rate (original country (each 7 country) per destination country(Thailand)) at time } t \]

\[ \ln RER_t = \text{logarithm of real exchange rate [or CPI (Thailand) / CPI (each 7 country)*1 / ER] at time } t \]

\[ u_t = \text{independently distributed random error term, with zero mean and constant variance at time } t \]

And defined that \( \alpha, \beta, \gamma, \delta, \theta, \rho = \text{parameters to be estimated; } \beta>0, \gamma<0, \delta<0, \theta<0, \rho<0. \)

### 4.2. Unit-Root Tests

This research to test the stationary in all variables were used in International Tourism Demand Model by standard test for unit root. Such as ADF-Test (1979), PP-Test(1987,1988) , KPSS-Test (1992) , DF-GLS Test (1996) , The ERS Point Optimal Test and Ng and Perron (2001).

#### 4.2.1. DF-Test, ADF Test (1979)

The DF-Test uses three equation for unit root test in \( Y_t \) and \( Y_t \) is a time series data.

\[
\begin{align*}
D Y_t &= \alpha Y_{t,1} + U_t \quad (4) \quad \text{[No Intercept Term]} \\
D Y_t &= \beta_t + \alpha Y_{t,1} + U_t \quad (5) \quad \text{[Intercept Term]} \\
D Y_t &= \beta_1 + \beta_t + \alpha Y_{t,1} + U_t \quad (6) \quad \text{[Intercept + Trend]}
\end{align*}
\]

where: null hypothesis is that \( \alpha = (\rho-1) = 0 \) (Non-stationary data (\( \rho=1 \))

- if \( \alpha > \text{Mackinnon statistics} \) statistics then time series data was stationary or \( I(d) = I(0) \) otherwise rejected \( H_0 \) is that \( \alpha = (\rho-1) = 0 \) or \( [\rho-1] \) because if \( \alpha \) has a statistic significance at any level then \( \alpha \neq 0 \) (\( \rho \neq 1 \));

- if \( \alpha < \text{Mackinnon statistics} \) statistics then time series data was non-stationary or \( I(d) = I(d) \) as well as accepted \( H_0 \) is that \( \alpha = (\rho - 1) = 0 \) or \( [\rho = 1] \) because if \( \alpha \) has not a statistics significance at any level then \( \alpha = 0 \) (\( \rho = 1 \)).

The ADF-Test was used for unit root test when found that higher order autocorrelation in time series data. Before uses ADF-Test should be check dw statistics from DF-Test equation (5) and (6).

\[
D Y_t = \beta_1 + \beta_t + \alpha Y_{t,1} + \beta_i \sum_{i=1}^{m} \Delta Y_{t,i} + \varepsilon_t \quad (7)
\]

When added term \( (\beta_i \sum_{i=1}^{m} \Delta Y_{t,i}) \) in equation (7) then \( t \)-statistics value of \( \alpha \) before \( Y_{t,1} \) to be change as well as all \( t \)-statistics value of them to be change too. So
ADF-Test corrects for higher order serial correlation by adding lagged difference terms on the right-hand side. The hypothesis test for unit root in time series data by ADF-Test method the same as the DF-test method with the same conclusion about time series data were stationary or non-stationary.

4.2.2. Phillips-Perron Test (PP-Test: 1987, 1988)

This method test for unit root was developed by Phillips and Perron (1988) and they propose a nonparametric method of controlling for higher-order serial correlation in a time series data.

\[ D Y_t = \alpha + \beta_t Y_{t-1} + \varepsilon_t \quad (8) \]

The PP-test makes a correction to the t-statistic of the \( \gamma \) coefficient from the AR(1) regression to account for the serial correlation in equation (8). The correction is nonparametric since it uses an estimate of the spectrum of equation (8) at frequency zero that is robust to heteroskedasticity and autocorrelation of unknown form.

\[ \gamma_j = \frac{1}{T} \sum_{t=1}^{T} \varepsilon^*_t \varepsilon^*_{t+j} \quad (9) \]

\[ W^2 = \gamma_0 + 2 \sum_{j=1}^{q} \left[ 1 - j/(q+1) \right] \gamma_j \quad (10) \]

where:
- \( W^2 \) = Newey-west heteroskedasticity autocorrelation consistent estimation
- \( \gamma_j \) = coefficient from AR(1) in equation (8)
- \( \varepsilon^*_t \varepsilon^*_{t+j} \) = error term received from equation (8)
- \( q = \text{floor} \left( \frac{4 \left( \frac{T}{100} \right)^2}{9} \right) \) , \( q \) is the truncation lag

And the PP-Test (\( t_{pp} \)) has a t-statistic is computed as equation (11) as well as where \( t_b, s_b \) are the t-statistics and standard error of (\( \beta_t \)) received from regress in equation (8) and \( s^* \) is the standard error received from regress in same equation.

\[ \text{PP-Test} (t_{pp}) = \left[ (\gamma_0^{1/2} t_b) / (W) \right] - \left[ (W^2 - \gamma_0) T s_b / (2 W s^*) \right] \quad (11) \]

The asymptotic distribution of the PP-Test (\( t_{pp} \)) is the same as the ADF-Test. And the hypotheses to be tested are follow up: \( H_0 \): null hypothesis as time series data was non-stationary; \( H_1 \): time series data was stationary
- if PP-Test (\( t_{pp} \)) > Mackinnon statistics conclusion that time series data was stationary otherwise rejected \( H_0 \) is that Non-stationary data;
- if PP-Test (\( t_{pp} \)) < Mackinnon statistics conclusion that time series data was non-stationary as well as accepted \( H_0 \).

4.2.3. The KPSS-Test (1992)

The KPSS-Test for unit root test was produced by the Kwiatkowski, Phillips, Schmidt and Shin (1992). And the KPSS statistic is based on the residuals from the OLS regression of \( Y_t \) on the exogenous variables \( X_t \) (see equation (12)) and \( X_t \) is a
random walk: \( X_t = X_{t-1} + \epsilon_t \).

\[
Y_t = X_t + \epsilon_t
\]  

(12)

where:
- \( X_t \): \( X_t = a_0 + b_0 t + \epsilon_t \) [intercept and trend]
- \( X_t \): \( X_t = a_0 + \epsilon_t \) [intercept]
- \( \epsilon_t \): is a stationary random error
- \( Y_t \): is data test stationary or non-stationary

Regress \( Y_t \) on \( X_t \) or regress \( Y_t \) on a constant and a trend then obtain the residual \( \epsilon_t \) from equation (12) as well as take this residual to calculate in the KPSS statistic (see equation (13)).

\[
\text{KPSS} = T^{-2} S S_t^2 / (s^2(L))
\]  

(13)

where:
- \( T \) = is the sample size
- \( S_t = \sum_{i=1}^{t} \epsilon_i \), \( t = 1,2,\ldots, T \)
- \( s^2(L) = T^{-1} \sum_{t=1}^{T} \epsilon_t^2 + 2 T^{-1} \sum_{s=L}^{T} w(s,L) \sum_{t=s+1}^{T} \epsilon_t \epsilon_{t-s} \)
- \( w(s,L) \) = is an optional weighting function corresponding to the choice of a spectral window
- \( w(s,L) = 1 - s / (L + 1) \) in estimation (see Newey and west, 1987: and Kwiatkowski al., 1992, for more details)
- \( L \) = the number of truncation (lags) is chosen

The KPSS-test method test for unit root has the hypothesis to be tested are \( H_0 \) (null hypothesis) and \( H_1 \) (\( H_0 \): time series was stationary; \( H_1 \): time series was non-stationary)

- if KPSS-statistics > Quantities of distribution of KPSS statistics table as rejected \( H_0 \) and accepted \( H_1 \) then conclusion that \( Y_t \) was non-stationary.
- if KPSS-statistics < Quantities of distribution of KPSS statistics table and accepted \( H_0 \) or rejected \( H_1 \) then conclusion that \( Y_t \) was stationary.

4.2.4. The DF-GLS Test (1996)

This test suggested by Elliott, Rothenberg, Stock (1996) and the DF-GLS Test is performed by testing the hypothesis \( a_0 = 0 \) (\( \rho = 1 \), \( a_0 = (\rho - 1) \)) in equation (14) to be start for this test (because PP-Test and ADF-Test have low power for unit root test and conclude that tests for unit root need to be developed (DeJong et al (1992)) as well as Madala and Kim (1998) suggested that DF-GLS Test is a one method that higher power for unit root test).

\[
D Y^d_t = a_0 Y^d_{t-1} + a_1 D Y^d_{t-1} + \ldots + a_p D Y^d_{t-p} + \epsilon_t
\]  

(14)

Where \( Y^d_t \) is the locally de-trend series \( Y_t \) and \( Y^d_{t-1} = Y_{t-1} - B^*0_B^*t \) as well as where \( (B^*_0, B^*_1t) \) are obtained by regressing \( y^* \) on \( z^* \). And where \( y^* = [y_t, (1- \alpha*L)] \).
\[ y_2, \ldots, (1- \alpha^*L) y_T \] as well as \[ z^* = [z_1, (1- \alpha^*L) z_2, \ldots, (1- \alpha^*L) z_T] \].

where:
\[ L = \text{the lag operator} \]
\[ \alpha^* = 1+c^*/ T, \ c^* = -7: \text{in the model with drift}, \ c^* = 13.5: \text{in the linear trend case} \]

Both DF-GLS and ADF-Test have non-stationary as null hypothesis and to show below that: \[ H_0: a_0 = 0: \text{[time series data was non-stationary]}; H_1: a_0 \neq 0: \text{[time series data was stationary]} \]
- if \[ a_0 > \text{Critical values for the DF-GLS Test for a model with linear trend (Elliott et al. 1996)} \] and rejected \( H_0 \) as well as conclusion that time series data was stationary or \( I(d) = I(0) \);
- if \[ a_0 < \text{Critical values for the DF-GLS Test for a model with linear trend (Elliott et al.1996)} \] and accepted \( H_0 \) as well as conclusion that time series data was non-stationary or \( I(d) = I(d) \).

### 4.2.5 The ERS Point Optimal Test

The ERS Point Optimal Test is based on quasi-differencing regression in equation (15). When a time series has an unknown mean or linear trend and this method to start from equation (15).

\[ d(y_t | a ) = d(x_t | a ) \delta (a) + \varepsilon_t \tag{15} \]

where:
\[ d(y_t | a ) \text{ and } d(x_t | a ) \text{ are quasi-differenced data for } y_t \text{ and } x_t \]
\[ \varepsilon_t: \text{error term that is independently and identically distributed} \]
\[ y_t: \text{time series data were tested} \]
\[ x_t: \text{contain a constant only or both a constant and time trend} \]
\[ \delta (a): \text{the coefficient to be estimated in equation (15)} \]
\[ a: \text{a}^* = 1-7/T \text{ when } x_t \text{ contains a constant} \]
\[ a: \text{a}^* = 1-13.5/T \text{ when } x_t \text{ contains a constant and time trend} \]

The \( P(T) \) statistics was used in ERS Point Optimal Test for unit root test in time series data and show it below that: (see equation (16))

\[ P(T \text{ statistics} = ((SSR(a*)) - (a*)SSR(1)) / \xi_0 \tag{16} \]

where:
\[ SSR = \text{the sum of squared residuals from equation (12B)} \]
\[ \xi_0 = \text{is a frequency zero spectrum estimation or } \xi_0 = \Sigma_{j=1-T}^{T} \gamma^*(j). k(j/T) \]
\[ j = \text{the } j\text{-th sample autocovariance of the } \varepsilon_t \]
\[ t = \text{a truncation lag in the covariance weighting} \]
\[ \gamma^*(j) = \Sigma_{j=1-T}^{T} (\varepsilon_t \varepsilon_{t+j}) / T, T = \text{the number of observation} \]
\[ k = \text{a kernel function (for detail see Eview 5.1 (2004))} \]
and where:
Bartlett: \( k(x) = \begin{cases} 1-|x| & \text{if } |x| \leq 1, \\ 0 & \text{otherwise} \end{cases} \)
Parzen: \( k(x) = \begin{cases} 1-6x^2 +6|x|^3 & \text{if } 0 < |x| < 1/2 \\ 2(1-|x|^3) & \text{if } 1/2 < |x| < 1 \\ 0 & \text{otherwise} \end{cases} \)
Quadratic spectral: \( k(x) = k(x) = \frac{25}{12\pi^2 x^2} * \left[ \sin \left( \frac{6\pi x}{5} \right) / \left( \frac{6\pi x}{5} \right) \right] - \cos \left( \frac{6\pi x}{5} \right) \)

The null hypothesis of ERS Point Optimal Test for unit root test in time series data can show below that: \( H_0: \alpha = 1 \) [time series data was non-stationary]; \( H_1: \alpha = a^* \) [time series data was stationary]
- if \( P(T) \) statistics > Critical values for ERS test statistic are computed by interpolating the simulation result provided by ERS (1996, table 1, p.825) for \( T = \{50,100,200, \infty \} \) then accepted \( H_0: \alpha = 1 \) [time series data was non-stationary] and said that time series data was non-stationary;
- if \( P(T) \) statistics < Critical values for ERS test statistic are computed by interpolating the simulation result provided by ERS (1996, table 1, p.825) for \( T = \{50,100,200, \infty \} \) then accepted \( H_1: \alpha = a^* \) [time series data was stationary] and said that time series data was stationary (perception: the ERS –Test was used to test unit root for time series data have big sample size at least more than 50 observations).

4.2.6. The Ng and Perron (NP-test:2001)

Ng and Perron (2001) developed from four test statistics based on the GLS detrended data \( Y^d_t \) and these test statistics are modified forms of Philips and Perron \( Z^d_\alpha \) and \( Z_t \) statistics, Bhargava (1986) \( R_1 \) statistic and the ERS Point Optimal statistic. This method to start by first define term follow that: (see equation (17)).

\[
K = \sum_{t=2}^{T-1} \left( \frac{Y^d_{t,1}}{T^2} \right)^2
\]  

\( (17) \)

And modified statistics of Ng and Perron (2001) be written as, (four statistics were used to test for unit root in time series data : \( MZ^d_\alpha \), \( MZ^d_t \), \( MSB^d \) and \( MP^d_t \)).

where:
\[
MZ^d_\alpha = \left( T^{-1} \left( Y^d_{t,1} - \varepsilon_0 \right) \right) / (2k)
\]
\[
MZ^d_t = MZ^d_\alpha \cdot MSB^d
\]
\[
MSB^d = \left( k / \varepsilon_0 \right)^{1/2}
\]
and
\[
MP^d_t = \{ \begin{align*}
& (c^*^2 k - c^* T^{-1} (Y^d_{t,1})^2) / \varepsilon_0 \quad \text{if } x_t = 1 \text{ or } z^* = 1, \\
& (c^*^2 k + (1-c^*) T^{-1} (Y^d_{t,1})^2) / \varepsilon_0 \quad \text{if } x_t = (1,t) \text{ or } z^* = (1,t)
\end{align*} \}
\]

where:
\[
c^* = \{ -7 \text{ if } x_t = 1 \text{ or } z^* = 1, -13.5 \text{ if } x_t = (1,t) \text{ or } z^* = (1,t) \}
\]
\[
\varepsilon_0 = \sum_{j=(T-1)}^{\infty} \gamma^* (j) . k(j/t),
\]
\( j \) = the \( j \)-th sample autocovariance of the \( \varepsilon_t \)
\( t \) = a truncation lag in the covariance weighting
\[ \gamma^*(j) = \Sigma_{t=j+1}^{T} (\varepsilon_t, \varepsilon_{t-j})' / T, \quad T = \text{the number of observation} \]

or

\[ \varepsilon_0 = \text{kernel-based sum-of-covariance estimator, and autoregressive spectral density estimators} \]

The null hypothesis of Ng and Perron (2001) Test for unit root test in time series data can show below that: \( H_0 \): time series data was non-stationary; \( H_1 \): time series data was stationary

- if \( MZ^d, MZ^d, MSB^d, MP^d \) statistics > Critical values of Ng and Perron (2001), table 1 then accepted \( H_0 \): [time series data was non-stationary] and said that time series data was non-stationary;

- if \( MZ^d, MZ^d, MSB^d, MP^d \) statistics < Critical values of Ng and Perron (2001), table 1 then rejected \( H_0 \): [time series data was non-stationary] one other hand accepted \( H_1 \): [time series data was stationary] and said that time series data was stationary.

4.3. Cointegration and Error-Correction Mechanism

The problems with Engle-Granger two step procedure in co-integration approach. For example if it is assumed that the Economic theory can guide in determining the dependent and the independent variable, like in the consumption function (equation number (18)).

\[ C_t = \alpha_0 + \alpha_1 Y_t + u_t \]  

(18)

But if equation (18) has three variables \((Y, W, Z)\) then these are three possible long run relationships then can show equation numbers (19), (20) and (21).

\[ Y_t = \alpha_0 + \alpha_1 W_t + \alpha_2 Z_t + u_t \]  

(19)

\[ Z_t = \beta_0 + \beta_1 Y_t + \beta_2 W_t + u_t \]  

(20)

\[ W_t = \gamma_0 + \gamma_1 W_t + \gamma_2 Z_t + u_t \]  

(21)

So that the co-integration approach of EG can not do it in more than two variables and these weaknesses limit applicability of the this approach. To introduce a technique that consider co-integration not only between pairs of variables, but also in a system this technique is the ML approach of Johansen and Juselius (1990). The Johansen and Juselius approach start at model \( Z_t \) unrestricted vector auto-regression (VAR) involving up to K-lags of \( Z_t \) : (equation number (22))

\[ Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + u_t, \quad u_t \sim \text{IN}(0, \Sigma) \]  

(22)

Where \( Z_t \) is \((n \times 1)\) and each of the \( A_i \) is an \((n \times n)\) matrix of parameters. Equation (22) has been expressed in first differenced form and it is convenient to rewrite the equation (22) to be (23) as well as described below.
\[ \Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-k} + u_t \]  

(23)

where:
\[ \Gamma_i = - (I - A_1 - \ldots - A_i), \quad (i = 1, \ldots, k-1) \]
\[ \Pi = - (I - A_1 - \ldots - A_{k-1}) \]
\[ \Pi = \alpha \beta' \]

and \( \alpha \) is adjustment coefficients of disequilibrium and \( \beta \) is Co-integrating vectors (and the value of \( \alpha \beta' \) to be found).

This way of specifying the system contains information on both the short- and long-run adjustment to changes in \( Z_t (\Delta Z_t) \) and rewriting (23) as: (equation number (24)).

\[ \Delta Z_t + \Pi Z_{t-k} = \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + u_t \]

(24)

It is possible to correct for short-run dynamics by regressing \( \Delta Z_t \) and \( Z_{t-k} \) separately on the right-hand side of (24). That is, the vectors \( R_0 t \) and \( R_{k t} \) are obtained from: equation number (25) and number (26).

\[ \Delta Z_t = P_1 \Delta Z_{t-1} + \ldots + P_{k-1} \Delta Z_{t-k+1} + R_{0t} \]  

(25)

\[ Z_{t-k} = T_1 \Delta Z_{t-1} + \ldots + T_{k-1} \Delta Z_{t-k+1} + R_{kt} \]  

(26)

Which can then be used to form residual (product moment) matrices: equation number (27).

\[ S_{ij} = T_1 \Sigma \sum T_{t-1} R_{i j} R', \quad (i,j = 0,k) \]  

(27)

The maximum likelihood estimate of \( \beta \) is obtained as the eigenvectors corresponding to the \( r \) largest eigenvalues from solving the number (28).

\[ \lambda S_{jj} - S_{ji} S_{jj}^{-1} S_{ij} = 0 \]  

(28)

Which gives the \( n \) eigenvalues \( \lambda_1^\wedge > \lambda_2^\wedge > \ldots > \lambda_n^\wedge \) and the corresponding eigenvectors \( \nu^\wedge = (\nu_1^\wedge , \ldots, \nu_n^\wedge) \). Those \( r \) elements in \( \nu^\wedge \) which determine the linear combinations of stationary relationships can be denoted \( \beta^\wedge = (\nu_1^\wedge , \ldots, \nu_r^\wedge) \), that is, these are the cointegration vectors. The ECM model first used by Sargan (1964) after that reproduced by K.F. Wallis and D.F. Hendry (1984) as well as popularized by Engle and Granger corrects for disequilibrium. The background concept of ECM model can be show below that: (see equation (29))

\[ \Delta Y_t = B \Delta X_t + u_t \]

(29)

where:
\[ \Delta Y_t = \text{the changing of dependent variable} \]
\[ \Delta X_t = \text{the changing of independent variable} \]
\[ B = \text{coefficient of } \Delta X_t \]
\[ u_t = \text{error term of equation (29)} \]
If interpretation equilibrium as meaning the variables become constant as well as to impose that $Y_t = Y_{t-1} = Y_{t-2} = \ldots = Y_{t-n}$ and $X_t = X_{t-1} = X_{t-2} = \ldots = X_{t-n}$. So suppose that the value of $Y_t$ in equilibrium was dictated by equation (30) and equation (31).

$$\Delta Y_t = B \Delta X_t + \phi (Y_{t-1} - \lambda X_{t-1}) + u_t \quad (30)$$

$$\Delta Y_t = B \Delta X_t + \phi Y_{t-1} - \phi \lambda X_{t-1} + u_t \quad (31)$$

defined:

$EC_t = Y_t - \lambda X_t$, [EC = error correction]

$EC_{t-1} = Y_{t-1} - \lambda X_{t-1}$

$\phi EC_{t-1} = \phi(Y_{t-1} - \lambda X_{t-1})$

$\phi EC_{t-1} = \phi Y_{t-1} - \phi \lambda X_{t-1}$, [see equation (31)]

The simply of ECM model form can be used the equation (32) or (33) as well as this equation can be show below that:

$$\Delta Y_t = B \Delta X_t + \phi EC_{t-1} + u_t \quad (32)$$

$$\Delta Y_t = \text{lagged} (\Delta X_t, \Delta Y_t) + \phi EC_{t-1} + u_t \quad (33)$$

And if $Y_t$ and $X_t$ are cointegrated, there is a long-run relationship between of them then the short-run dynamics can be described by ECM model. This is known as the Granger representation theorem. Furthermore the ECM model must has a negative value of $\phi$ and it is statistically significant (Granger (1986)).

5. THE RESULTS OF THE RESEARCH

5.1. The results of the Unit-Root Test

This paper determines the order of integration of the variables by 6 standard method tests for unit root. Namely ADF-Test (1979), PP-Test (1987, 1988), KPSS-Test (1992), DF-GLS Test (1996), The ERS Point Optimal Test and Ng and Perron Test (2001). And if variable are integrated of the same order than apply the Johansen-Juselius (1990,1992,1994) maximum likelihood method to obtain the number of cointegrating vector(s) for the long-run and use the ECM model for the short-run. The results of unit root test based on the 6 standard method tests are shown in table 1.

**Table 1. Results of Unit Root Test based on 6 method tests for all variables**

<table>
<thead>
<tr>
<th>variables</th>
<th>Malaysia</th>
<th>China</th>
<th>England</th>
<th>German</th>
<th>France</th>
<th>America</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
</tr>
<tr>
<td>GDP</td>
<td>I(0)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
</tr>
<tr>
<td>Po</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
</tr>
<tr>
<td>RP</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
</tr>
<tr>
<td>ER</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
</tr>
<tr>
<td>RER</td>
<td>I(d)</td>
<td>I(0)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
<td>I(d)</td>
</tr>
</tbody>
</table>

*Form: computed*
All variables were used in the international tourism demand model of Thailand and were integrated of order (d) except both GDP of Malaysia and RER of China which were integrated of order (0).

And when first differencing or second differencing in all variables (except both GDP of Malaysia and RER of China) were used in this model as well as the order of integrated in all variables changed. The results of unit root test based on 6 methods after first differencing or second differencing showed in table 2.

Table 2. Results of Unit Root Test based on 6 methods test for all variables after first or second differencing

<table>
<thead>
<tr>
<th>variables</th>
<th>Malaysia</th>
<th>China</th>
<th>England</th>
<th>German</th>
<th>France</th>
<th>America</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>I(0)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
</tr>
<tr>
<td>Po</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
</tr>
<tr>
<td>RP</td>
<td>I(1)</td>
<td>I(2)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
</tr>
<tr>
<td>ER</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
</tr>
<tr>
<td>RER</td>
<td>I(1)</td>
<td>I(0)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

From: computed

After first differencing or second differencing in all variables were used in international tourism demand model of Thailand were integrated of order (1) excepted the RP of China, the RP German, the RP of France, the RP of America and the RP of Canada were integrated of order (2).

5.2. The results of the analysis of Modelling International Tourism Demand in Thailand

5.2.1. The results of the analysis of Modelling International Tourism Demand in Thailand as in long-run

Estimates of long-run cointegrating vectors of modelling international tourism demand in Thailand are given in table 3 and this method is based on Johansen and Juselius (1990). In Malaysia as in long-run cointegrating vectors suggested that ln(PO_t), ln(RP_t) and ln(ER_t) have positive impact on international tourism demand model excepted ln(RER_t) has negative impact on this model. The results imply that in the long-run when ln(PO_t) increases 1% then the number of Malaysian tourists arriving in Thailand increases 0.16%, ln(RP_t) increases 1% then the number of Malaysian tourists arriving in Thailand increases 1.79% and when ln(ER_t) increases 1% then the number of Malaysian tourists arriving in Thailand increases 3.93%. Otherwise when ln(RER_t) increases 1% then the number of Malaysian tourists arriving in Thailand decreases 4.98%. In China as the long-run cointegrating vectors suggested that both ln(GDP_t) and ln(ER_t) have positive impact on international tourism demand model otherwise ln(PO_t) has negative impact on this model. The results imply that in the long-run when ln(GDP_t) increases 1% then the number of Chinese tourists arriving in Thailand increases 1.01% and ln(ER_t) increases 1% then the number of Chinese tourists arriving in Thailand increases 1.11%. Otherwise when ln(PO_t) increases 1%
then the number of Chinese tourists arriving in Thailand decreasing 0.75%. In England as in long-run cointegrating vectors suggested that $\ln(GDP_t)$, $\ln(PO_t)$, $\ln(RP_t)$ and $\ln(ER_t)$ have positive impact on international tourism demand model excepted $\ln(RER_t)$ has negative impact on this model. The results imply that in the long-run when $\ln(GDP_t)$ increases 1% then the number of English tourists arriving in Thailand increases 1.12%, $\ln(PO_t)$ increases 1% then the number of English tourists arriving in Thailand increases 0.03%, $\ln(RP_t)$ increases 1% then the number of English tourists arriving in Thailand increases 0.005% and $\ln(ER_t)$ increases 1% then the number of English tourists arriving in Thailand increases 0.86%. Otherwise when $\ln(RER_t)$ increases 1% then the number of English tourists arriving in Thailand decreases 1.22%.

Table 3. Results of the Long-Run relationship in international tourism demand of Thailand based on the Johansen and Juselius (1990) methodology (international tourist arrivals is the dependent variable (1997(Q1)) to 2005(Q2))

<table>
<thead>
<tr>
<th>Country</th>
<th>$\ln(GDP_t)$</th>
<th>$\ln(PO_t)$</th>
<th>$\ln(RP_t)$</th>
<th>$\ln(ER_t)$</th>
<th>$\ln(RER_t)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-</td>
<td>0.16</td>
<td>1.79</td>
<td>3.93</td>
<td>-4.98</td>
</tr>
<tr>
<td>China</td>
<td>1.01</td>
<td>-0.75</td>
<td>-</td>
<td>1.11</td>
<td>-</td>
</tr>
<tr>
<td>England</td>
<td>1.12</td>
<td>0.03</td>
<td>0.005</td>
<td>0.86</td>
<td>-1.22</td>
</tr>
<tr>
<td>German</td>
<td>2.10</td>
<td>-0.10</td>
<td>-</td>
<td>-3.99</td>
<td>4.05</td>
</tr>
<tr>
<td>France</td>
<td>3.37</td>
<td>-2.52</td>
<td>-</td>
<td>-23.63</td>
<td>22.78</td>
</tr>
<tr>
<td>America</td>
<td>1.71</td>
<td>-0.06</td>
<td>-</td>
<td>-5.79</td>
<td>3.63</td>
</tr>
<tr>
<td>Canada</td>
<td>7.37</td>
<td>0.01</td>
<td>-</td>
<td>1.52</td>
<td>7.91</td>
</tr>
</tbody>
</table>

In Germany as in the long-run cointegrating vectors suggested that both $\ln(GDP_t)$ and $\ln(RER_t)$ have a positive impact on the international tourism demand model otherwise both $\ln(PO_t)$ and $\ln(ER_t)$ have a negative impact on this model. The results imply that in the long-run when $\ln(GDP_t)$ increases 1% then the number of German tourists arriving in Thailand increases 2.10% and when $\ln(RER_t)$ increases 1% then the number of German tourists arriving in Thailand increases 4.05%. Otherwise when $\ln(PO_t)$ increases 1% then the number of German tourists arriving in Thailand decreases 0.10% and when $\ln(ER_t)$ increases 1% then the number of German tourists arriving in Thailand decreasing 3.99%. In France as in long-run cointegrating vectors suggested that both $\ln(GDP_t)$ and $\ln(RER_t)$ have positive impact on international tourism demand model otherwise both $\ln(PO_t)$ and $\ln(ER_t)$ have negative impact on this model. The results imply that in the long-run when $\ln(GDP_t)$ increases 1% then the number of French tourists arriving in Thailand increases 3.37% and when $\ln(RER_t)$ increases 1% then the number of French tourists arriving in Thailand increases 22.78%. Otherwise when $\ln(PO_t)$ increases 1% then the number of French tourists arriving in Thailand decreases 2.52% and when $\ln(ER_t)$ increases 1% then the number of French tourists arriving in Thailand decreases 23.63%. In America as in long-run cointegrating vectors suggested that both $\ln(GDP_t)$ and $\ln(RER_t)$ have a positive impact on international tourism demand model otherwise both $\ln(PO_t)$ and $\ln(ER_t)$ have a negative impact on this model. The results imply that in the long-run when $\ln(GDP_t)$ increases 1% then the number of American tourists arriving in Thailand increases
1.71\% and ln(RER_t) increases 1\% then the number of American tourists arriving in Thailand increases 3.63\%. Otherwise when ln(PO_t) increases 1\% then the number of American tourists arriving in Thailand decreases 0.06\% and when ln(ER_t) increases 1\% then the number of American tourists arriving in Thailand decreases 5.79\%. And finally Canada as in long-run cointegrating vectors suggested that ln(GDP_t), ln(PO_t), ln(ER_t) and ln(RER_t) have positive impact on international tourism demand model. The results imply that in long-run when ln(GDP_t) increases 1\% then the number of Canadian tourists arriving in Thailand increases 7.37\%, ln(PO_t) increases 1\% then the number of Canadian tourists arriving in Thailand increases 0.01\%, ln(ER_t) increases 1\% then the number of Canadian tourists arriving in Thailand increases 1.52\% and when ln(RER_t) increases 1\% then the number of Canadian tourists arriving in Thailand increases 7.91\%.

5.2.2. The results of the analysis of Modelling International Tourism Demand in Thailand as in the short-run

The results of the error correction model for each of the 7 countries (Malaysia, China, England, German, France, America and Canada) is presented in table 4 (Results of the Short-Run relationship in international tourism demand of Thailand based on the ECM model). The results in the short-run indicate that growth in income of the origin countries (except Malaysia) has a positive impact on visitors coming to Thailand. The results imply that in the short-run when ln(GDP_t) in China, England, German, France, America and Canada increases 1\% then the number of Chinese tourists arriving in Thailand increases 0.22\%, the number of English tourists arriving in Thailand increases 1.24\%, the number of German tourists arriving in Thailand increases 5.91\%, the number of French tourists arriving in Thailand increases 1.16\%, the number of American tourists arriving in Thailand increases 16.05\% and the number of Canadian tourists arriving in Thailand increases 3.74\%. The results in the short-run indicate that an increase in the world price of jet fuel (except for England and France) has a positive impact on the number of visitors coming to Thailand. The results imply that in the short-run when the world price of jet fuel increases 1\% then the number of Malaysian tourists arriving in Thailand increases 0.49\%, the number of Chinese tourists arriving in Thailand increases 0.93\%, the number of German tourists arriving in Thailand increases 0.32\%, the number of American tourists arriving in Thailand increases 0.49\%, the number of Canadian tourists arriving in Thailand increases 0.18\%.

The results in the short-run indicate that an increase in the exchange rate between the country of origin (England, Germany, France) and Thailand has a negative impact on visitors coming to Thailand. The results imply that in the short-run when the exchange rates between the country of origin and Thailand increases 1\% then the number of English tourists arriving in Thailand decreasing 0.58\%, the number of German tourists arriving in Thailand decreasing 1.82\% and the number of French tourists arriving in Thailand decreasing 1.40\%. The results in the short-run indicate that an increase in the real exchange rate between the country of origin (England, German and America) and Thailand has a negative impact on the number of visitors’ coming to Thailand. Except France in the short-run indicated that an increase in the
real exchange rate between France and Thailand has a positive effect on the number of Franch visitors coming to Thailand. The results imply that in the short-run when real exchange rates increase 1% then the number of English tourists arriving in Thailand decreasing 0.44%, the number of German tourists arriving in Thailand decreasing 1.90% and the number of American tourists arriving in Thailand decreasing 1.84%.

Table 4. Results of the Short-Run relationship in international tourism demand of Thailand based on ECM model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Malaysia</th>
<th>China</th>
<th>England</th>
<th>German</th>
<th>France</th>
<th>America</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.06</td>
<td>-0.16***</td>
<td>0.06**</td>
<td>-0.08**</td>
<td>0.01</td>
<td>-0.02</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.92)</td>
<td>(-3.02)</td>
<td>(2.08)</td>
<td>(-2.37)</td>
<td>(0.79)</td>
<td>(0.37)</td>
<td>(0.48)</td>
</tr>
<tr>
<td>(\Delta \ln(GDP_t))</td>
<td>-0.22a***</td>
<td>1.24**</td>
<td>5.97*</td>
<td>1.16b***</td>
<td>16.05b***</td>
<td>3.74**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.07)</td>
<td>(2.23)</td>
<td>(1.90)</td>
<td>(12.66)</td>
<td>(2.79)</td>
<td>(2.17)</td>
<td></td>
</tr>
<tr>
<td>(\Delta \ln(PO_t))</td>
<td>0.49*</td>
<td>0.93***</td>
<td>-0.05</td>
<td>0.32a**</td>
<td>-0.03</td>
<td>0.49b*</td>
<td>0.18*</td>
</tr>
<tr>
<td></td>
<td>(1.68)</td>
<td>(3.25)</td>
<td>(2.41)</td>
<td>(6.65)</td>
<td>(2.13)</td>
<td>(1.73)</td>
<td></td>
</tr>
<tr>
<td>(\Delta \ln(RP_t))</td>
<td>93.34b</td>
<td>0.49*</td>
<td>0.93*</td>
<td>-0.05</td>
<td>0.32a**</td>
<td>-0.03</td>
<td>0.49b*</td>
</tr>
<tr>
<td></td>
<td>(1.34)</td>
<td>(1.59)</td>
<td>(3.36)</td>
<td>(6.65)</td>
<td>(2.13)</td>
<td>(1.73)</td>
<td></td>
</tr>
<tr>
<td>(\Delta \ln(ER_t))</td>
<td>-85.99</td>
<td>-0.44*</td>
<td>-1.90a*</td>
<td>1.40**</td>
<td>-1.82a*</td>
<td>1.34</td>
<td>-0.40a</td>
</tr>
<tr>
<td></td>
<td>(1.22)</td>
<td>(2.40)</td>
<td>(1.95)</td>
<td>(2.14)</td>
<td>(1.88)</td>
<td>(1.44)</td>
<td>(0.48)</td>
</tr>
<tr>
<td>(\Delta \ln(RER_t))</td>
<td>-3.74**</td>
<td>-0.45***</td>
<td>-0.05***</td>
<td>-0.78***</td>
<td>-1.80*</td>
<td>-0.92***</td>
<td>-0.09*</td>
</tr>
<tr>
<td></td>
<td>(-1.19)</td>
<td>(-4.12)</td>
<td>(-12.29)</td>
<td>(-37.64)</td>
<td>(-1.71)</td>
<td>(-5.51)</td>
<td>(-2.55)</td>
</tr>
<tr>
<td>EC_{t-1}</td>
<td>-1.66*</td>
<td>-15.51***</td>
<td>-0.95***</td>
<td>-0.78***</td>
<td>-1.80*</td>
<td>-0.92***</td>
<td>-0.09*</td>
</tr>
<tr>
<td></td>
<td>(-5.89)</td>
<td>(-4.12)</td>
<td>(-12.29)</td>
<td>(-37.64)</td>
<td>(-1.71)</td>
<td>(-5.51)</td>
<td>(-2.55)</td>
</tr>
<tr>
<td>R²</td>
<td>0.58</td>
<td>0.63</td>
<td>0.88</td>
<td>0.97</td>
<td>0.93</td>
<td>0.72</td>
<td>0.95</td>
</tr>
<tr>
<td>R²^2</td>
<td>0.44</td>
<td>0.54</td>
<td>0.84</td>
<td>0.96</td>
<td>0.92</td>
<td>0.62</td>
<td>0.93</td>
</tr>
<tr>
<td>DW</td>
<td>2.03</td>
<td>2.12</td>
<td>2.01</td>
<td>1.96</td>
<td>1.83</td>
<td>1.72</td>
<td>1.52</td>
</tr>
<tr>
<td>F-statistics</td>
<td>4.18***</td>
<td>6.73***</td>
<td>20.83***</td>
<td>112.66***</td>
<td>38.99***</td>
<td>7.34***</td>
<td>64.84***</td>
</tr>
<tr>
<td>J-B(Normal)</td>
<td>0.44</td>
<td>26.14</td>
<td>0.79</td>
<td>0.24</td>
<td>0.17</td>
<td>0.01</td>
<td>9.92</td>
</tr>
<tr>
<td>(Prob.)</td>
<td>(0.79)</td>
<td>(0.00)</td>
<td>(0.67)</td>
<td>(0.88)</td>
<td>(0.91)</td>
<td>(0.99)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>LM-test</td>
<td>0.62</td>
<td>0.87</td>
<td>0.29</td>
<td>3.02</td>
<td>1.69</td>
<td>1.97</td>
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<td>(Prob.)</td>
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\(a=\text{lag 1 period, } b=\text{lag 2 period, } *=\text{Sig. at 90\%}, **=\text{Sig. at 95\%}, ***=\text{Sig. at 99\%}\).

From: computed

On the other hand the results imply that in the short-run when real exchange rate increases 1% then French tourists arriving in Thailand increase 1.40%. Perception the R² of international tourism demand model of Thailand was very different between each other. Such as the European countries (England, German and France) and the North American countries (America and Canada) have very high R² values, higher than the Asia countries (Malaysia and China). The error correction term (EC_{t-1}) in every model used in this research showed disequilibrium (see table 4) or showed the speed of adjusted short-run to long of them too. The disequilibrium of Canada was very short, more than other countries. And the disequilibrium of China was a very long time, more than other countries. Also the speed of adjusted short-run to long-run of other countries was similar with each other (the total average values were not more than -2.00).

Furthermore this paper applied a number of diagnostic tests to the error correction model (table 4). The model passed the Jarque-Bera normality test,
suggesting that the errors are normally distributed except that the models for China and Canada not pass this test because the data used in this paper were from a sample size which was too small for the Jarque-Bera normality test. Hence, it should not be used with the Jarque-Bera statistics for normality test in error term (Gujarati 2003). There is no evidence of autocorrelation in the disturbance of the error term (see value of L.M.-test in same table). The RESET test indicates that every model was correctly specified (excepted China, German and Canada). The White-test suggested that the error is homoskedastic and independent of the regressors.

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 seven main source markets, Malaysia, China, England, Germany, France, America and Canada. In this article, six standard unit root test were used test for all variables. Namely, ADF-Test (1979), PP-Test (1987, 1988), KPSS-Test (1992), DF-GLS Test (1996), The ERS Point Optimal Test and Ng and Perron (2001). And in this paper the bounds testing approach to cointegration (Johansen-Juselius approach (1990, 1992, 1994) was used to investigate long-run equilibrium relationships between the number of international tourists arriving in Thailand with economics variables. The economic variables such as the GDP of major countries of international tourists coming to Thailand, the world price of kerosene-type jet fuel, the relative price of Thailand with the countries of international tourism and the exchange rate of Thailand compared with that of the countries of origin of international tourists. The existence of cointegration allowed for the application of error correction models to depict the short-run elasticities.

The conclusion of the research and policy recommendations has three important conclusions and recommendations that emerge from the empirical analysis of the research. First, a 1% increase in income (GDP) in the long-run in main source markets, China, England, German, France, America and Canada leads to an increase in international visitor traveling to Thailand by 1.01%, 1.12%, 2.10%, 3.37%, 1.71% and 7.37%, respectively. This result is consistent with economic theory and the result was similar with the results of previous empirical studies of tourist demand (Lim & McAleer(2003), Kafono & Gounder(2004) and Narayan(2004). The long-run result for Thailand’s international tourism demand implies that Thailand received increased international visitors with a growth in income (GDP) in major markets during that period. If this can be generalized for future years, then it argues well for the continued development of the Thai tourism industry. Secondly, a 1% increase in transportation costs (price of jet fuel) in the long-run in mostly major source markets such as China, Germany, France and America leads to decreased international tourist arrivals from those countries in Thailand of 0.75%, 0.10%, 2.52% and 0.06%, respectively. This result is consistent with economic theory and this result was similar with the results of previous empirical studies of tourism demand (Lim & McAleer(2001) Narayan(2004)). If a generalization can be made for future years, then
it suggests that the Thai government should increase support for international low cost airlines or reduce the cost for international airlines arriving in Thailand because the Thai government cannot control the price of jet fuel in future. Thirdly, in the long-run the exchange rate is an important determiner of international tourist’s behavior and a 1% increase in the value of the exchange rate of Thailand against the currency of the major tourist markets of Malaysia, England, German, France and America leads to a decrease in international visitor arrivals from these countries to Thailand of 4.98%, 1.22%, 3.99%, 23.63% and 5.79%, respectively. This results is consistent with economic theory and it suggests that the Reserve bank of Thailand should be careful when using any policy that impacts on Thai currency because when the Thai currency is very strong, it not only negatively impacts on export goods and services (Anderson and Garcia 1989, Pick 1990, Chukiat 2003) but it also decreases international visitor arrivals to Thailand (Lim & McAleer 2003).

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Table 1. Results of Unit Root test based on standard test (6 methods)

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In = intercept, INT = intercept + trend, a = Sig. 99%.
Con = Conclusion of status of order integrated by 6 standard unit root test.
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