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Yaovarate Chaovanapoonphol
Chiang Mai University

Christine Lim
University of Waikato

Michael McAleer
Erasmus University Rotterdam

Aree Wiboonpongse
Chiang Mai University

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Yaovarate Chaovanapoonphol[1], Christine Lim[2], Michael McAleer[3] and Aree Wiboonpongse[4]

[1] Department of Agricultural Economics, Faculty of Agriculture, Chiang Mai University, Thailand
email: agivchvn@chiangmai.ac.th

[2]Waikato Management School, University of Waikato, New Zealand,
email: clim@waikato.ac.nz

[3] Econometric Institute, Erasmus School of Economics, Erasmus University Rotterdam
email: michael.mcaleer@gmail.com

\[4]Department of Agricultural Economics, Faculty of Agriculture, Chiang Mai University, Thailand
email: aree@chiangmai.ac.th

Abstract

Even though tourism has been recognized as one of the key sectors for the Thai economy, international tourism demand, or tourist arrivals, to Thailand have recently experienced dramatic fluctuations. The purpose of the paper is to investigate the relationship between the demand for international tourism to Thailand and its major determinants. The paper includes arrivals from the USA, which represents the long haul inbound market, from Japan as the most important medium haul inbound market, and from Malaysia as the most important short haul inbound market. The time series of tourist arrivals and economic determinants from 1971 to 2005 are examined using ARIMA with exogenous variables (ARMAX) models to analyze the relationships between tourist arrivals from these countries to Thailand. The economic determinants and ARMA are used to predict the effects of the economic, financial and political determinants on the numbers of tourists to Thailand.

1. Introduction

Thailand is one of the most important tourism destinations in Asia. The numbers of tourist arrivals from different countries of origin has been increasing continuously over the last few decades. The USA, Japan and Malaysia are Thailand's major tourist source markets, representing long haul, medium haul and short haul tourism markets to Thailand, with market shares of 7.21%, 10.35% and 11.88% of total international tourist arrivals to Thailand in 2005, respectively (Tourism Authority of Thailand, 2005). The average annual growth rates during the period 1971-2005 were 4.74%, 10.42% and 8.03%, respectively, for the USA, Japan and Malaysia.

The USA is the most important long haul inbound tourism market to Thailand, and is considered to be one of the highest potential growth markets to Thailand. This market has had strong growth rate since 1996, driven by strong economic growth. However, the market has slowed down and has faced a serious decrease in 2003 because of the Iraq conflict, as well as the SARS outbreak, but resumed its normal growth pattern in 2004. In 2005, there were 639,658 American visitors, or 7.21% of international visitor arrivals. Most Americans visited

Thailand in non-group tours, and consider Thailand a holiday destination. The average length of stay of American visitors to Thailand was 11.46 days, and the average amount spent was 3,804.64 baht/person/day, which earned Thai tourism income of 25,257.39 million baht (Tourism Authority of Thailand, 2005).

Japan is the most crucial medium haul inbound market to Thailand. This market had a strong growth rate during 1994-1996 because of the strong economy and the strength of the Japanese yen. The market has continuously slowed down since 2001 because of 9/11, the SARS outbreak, and Japan's economic crisis in 2003, but returned to its normal growth trend in 2004. In 2005, there were 1,196,654 Japanese visitors to Thailand, or 10.35% of total international visitor arrivals. Most Japanese tourists travelled to Thailand in non-group tours, and consider Thailand a holiday destination. The average length of stay of Japanese visitors to Thailand was 8.09 days, and the average amount spent was 4.205.25 baht/person/day, which earned Thai tourism income of 40.209.18 million baht, the highest of all source countries (Tourism Authority of Thailand, 2005).

Malaysia is the most crucial short haul inbound market to Thailand. The Malaysian tourist market is a high sharing market, and the growth rate is always encouraging as the Malaysian border is connected to southern Thailand, and transportation can be by air, land or sea. During 1996-1997, the market slowed down and faced a serious decrease in 1998 because of the Malaysian economic crisis. In 1999, the Malaysian economy recovered, and the Malaysian tourist market subsequently prospered. In 2003, SARS caused a decrease in the number of Malaysian tourists, but the problem was soon resolved. In 2005, there were 1,373,946 Malaysian visitors to Thailand, equal to 11.88% of total international visitor arrivals. Most Malaysian tourists were on non-group tours, and considered Thailand a holiday destination. The average length of stay of Malaysian visitors in Thailand was 3.68 days and the average amount spent was 3,666.72 baht/person/day, which made Thai tourism income 18,102.07 million baht (Tourism Authority of Thailand, 2005).

The purpose of this paper is to investigate the relationship between the demand for international tourism to Thailand and economic determinants, specifically the consumer price index. Autoregressive moving average with exogenous variables (ARMAX) models are used to analyze the relationships between tourist arrivals from the different countries to Thailand and the consumer price index, and to examine the effects of economic variables on the numbers of tourists to Thailand. We examine monthly tourist arrivals from three major countries of origin, namely the USA, Japan and Malaysia, which represent Thailand's largest long haul, medium haul and short haul tourism markets, respectively.

The structure of the remainder of the paper is as follows. In Section 2, the methodologies used in the paper are given. Section 3 provides the empirical results from seasonal unit root tests and ARIMA/ARIMAX models. Some concluding remarks are presented in Section 4.

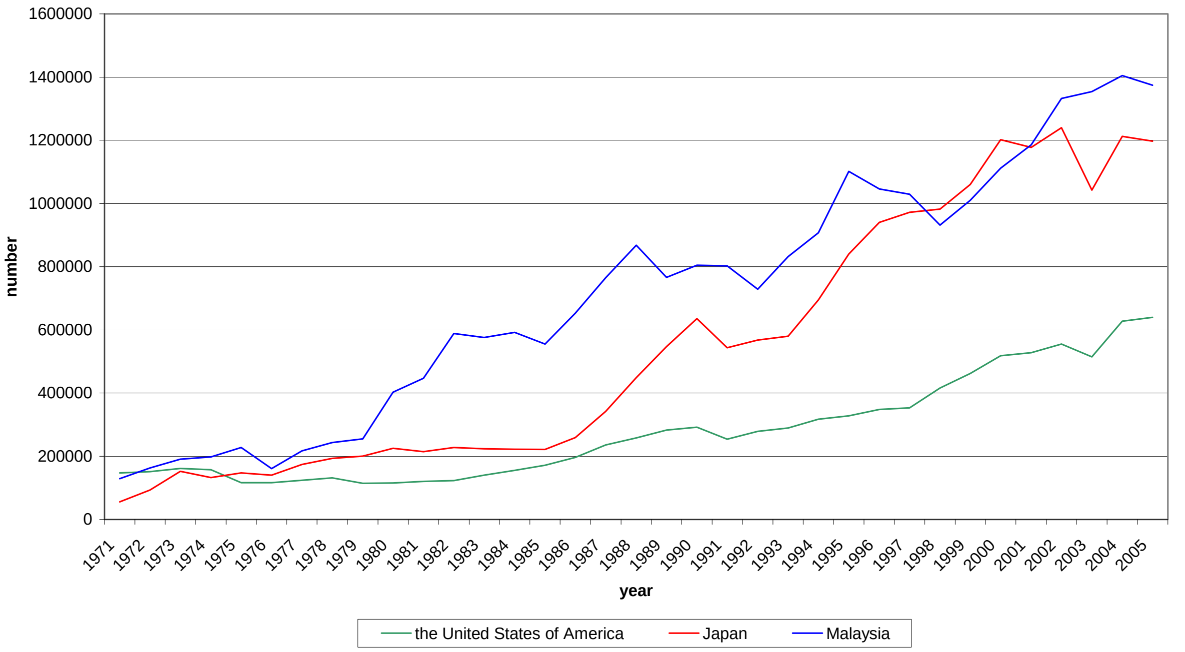

Figure 1: Numbers of tourist arrivals from the USA, Japan and Malaysia to Thailand, 1971-2005

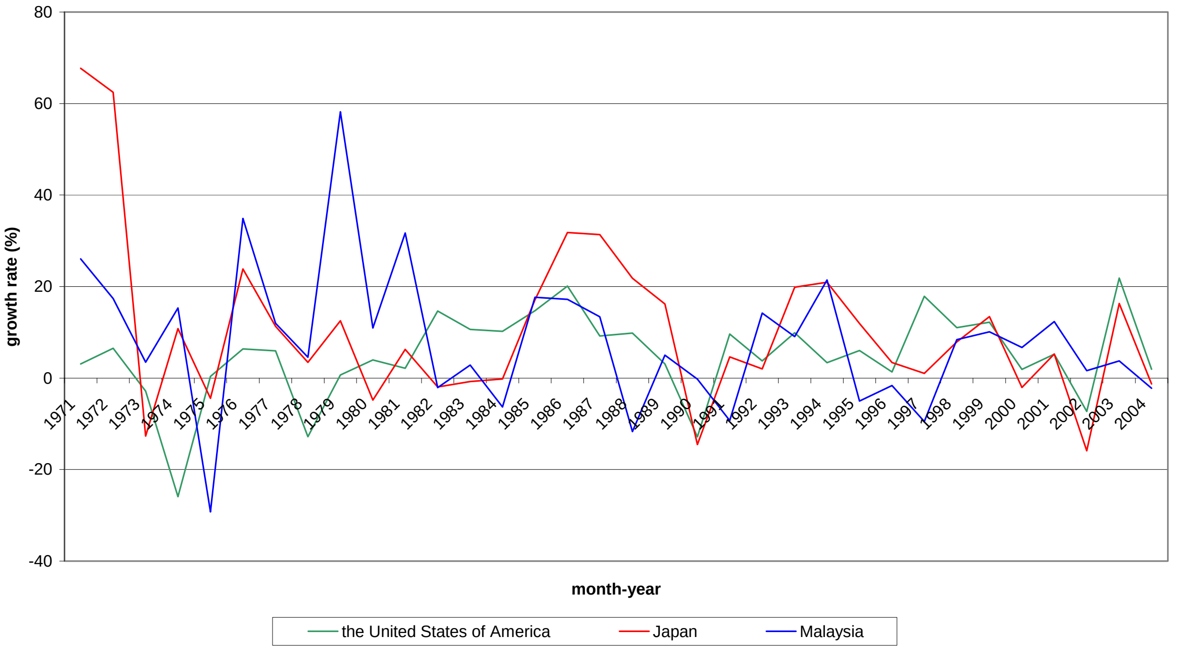

Figure 2: Annual growth rate of tourist arrivals from the USA, Japan and Malaysia to Thailand, 1971-2005.

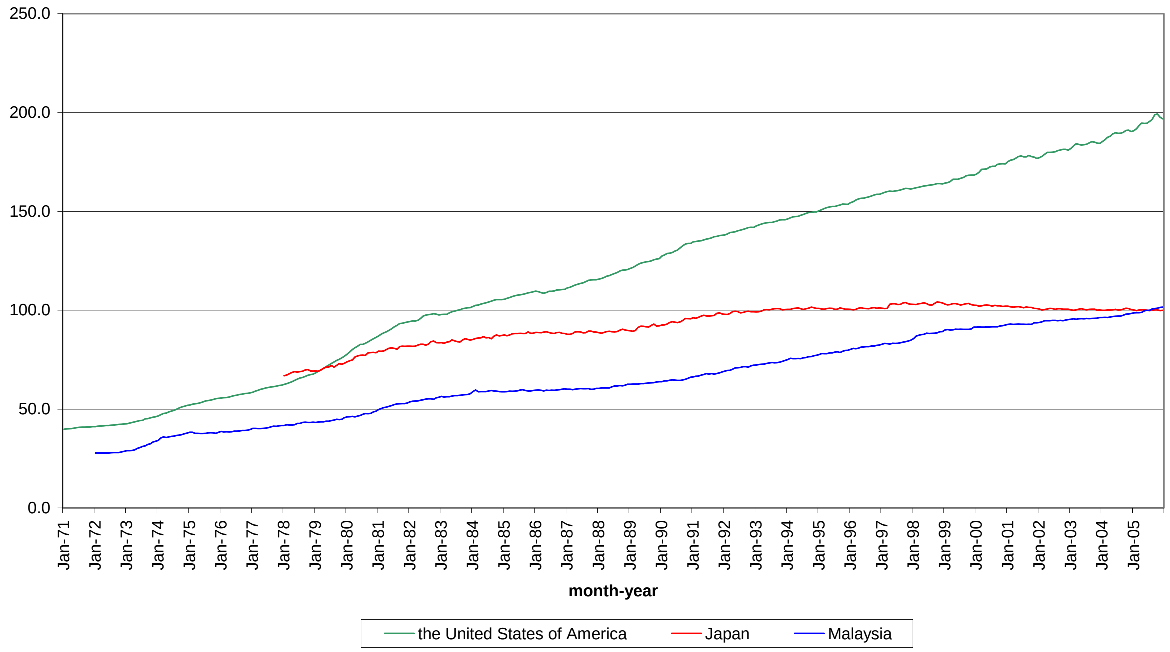

Figure 3: Consumer price index of the USA, Japan and Malaysia, 1971-2005.

2. Methodology

2.1 Seasonal unit root test

As the monthly data series demonstrate varying seasonal patterns, before estimating the tourism demand of Thailand model, it is necessary to test for the presence of seasonal unit roots. In this section, the seasonal unit root test (see Franses (1991) and Beaulieu and Miron (1993)) is applied for seasonal and non-seasonal unit roots in the logarithm of tourist arrivals from three different destinations. The differencing operator, Δ_{12}, will have 12 roots on the unit circle, as follows (see, for example, Maddala and Kim (1998)):

$$
\begin{aligned}
1 - L^{12} \;=\;& (1-L)(1+L)(1-iL)(1+iL)\,\mathbf{x}\left[1+\left(\sqrt{3}+i\right)L/2\right]\left[1+\left(\sqrt{3}-i\right)L/2\right] \\
& \mathbf{x}\left[1-\left(\sqrt{3}+i\right)L/2\right]\left[1-\left(\sqrt{3}-i\right)L/2\right]\;\mathbf{x}\left[1+\left(\sqrt{3}+i\right)L/2\right]\left[1-\left(\sqrt{3}-i\right)L/2\right] \\
& \mathbf{x}\left[1-\left(\sqrt{3}+i\right)L/2\right]\left[1+\left(\sqrt{3}-i\right)L/2\right]\;,
\end{aligned} \tag{1}
$$

where all terms other than $(1-L)$ denote seasonal unit roots.

Testing for unit roots in monthly time series is equivalent to testing for the significance of the parameters in the auxiliary regression model estimated by Ordinary Least Squares (OLS):

$$
\begin{aligned}
\varphi^{*}(L)y_{8,t} \;=\;& \pi_1 y_{1,t-1} + \pi_2 y_{2,t-1} + \pi_3 y_{3,t-2} + \pi_4 y_{3,t-1} + \pi_5 y_{4,t-2} \\
&+ \pi_6 y_{4,t-1} + \pi_7 y_{5,t-2} + \pi_8 y_{5,t-1} + \pi_9 y_{6,t-2} + \pi_{10} y_{6,t-1} \\
&+ \pi_{11} y_{7,t-2} + \pi_{12} y_{7,t-1} + \mu_t + \varepsilon_t
\end{aligned} \tag{2}
$$

where μ_t, the determinantal part, consists of a constant, a time trend and 11 seasonal dummy variables. Applying OLS to equation (2) gives estimates of the π_i parameters. The null hypothesis of unit roots is tested by a t-test of the separate π 's in $\pi_3 ... \pi_{12}$. If the null hypothesis is rejected, one can treat the variable of interest as seasonally stationary. The tests involve the use of the t-test for the first twelve hypotheses and an F-test for the last six hypotheses, as follows:

(1) H_0: $\pi_1 = 0$, H_1: $\pi_1 < 0$ (if this hypothesis is not rejected, there is a unit root at the zero frequency);
(2) H_0: $\pi_i = 0$, H_1: $\pi_i < 0, i = 2,3,...,12$ (if these hypotheses are not rejected, there are no seasonal unit roots);
(3) H_0: $\pi_i = \pi_{i+1} = 0$, H_1: $\pi_i \neq 0$ and/or $\pi_{i+1} \neq 0$, $i = 3,5,7,9,11$ (if pairs of $\pi's$ are equal to zero, it allows for all pairs of conjugate complex roots (see Aguirre, 2000), and H_0: $\pi_3 ... \pi_{12} = 0$, H_1: $\pi_3 ... \pi_{12} \neq 0$ (if the joint hypothesis is not rejected, unit roots are present at all the seasonal frequencies).

If all the estimated coefficients in the auxiliary test regression are statistically different from zero, the series present a stationary seasonal pattern and the appropriate procedure to model the series would use seasonal dummies. If there are no seasonal unit roots, first differences are applied to the data. On the other hand, when seasonal unit roots are found to be present, the Δ_{12} filter is applied to the data (see Maddala and Kim (1998)).

2.2 ARMAX model

The ARMAX model is an extension of the autoregressive moving average (ARMA) model with explanatory variables (X). It has been applied to analyse the dynamic correlation between variables in economics, marketing, and other areas in the physical and social sciences (see, for example, Lim et al., 2008). This approach is based on Box-Jenkins (1970) models, which comprise two models for representing the behaviour of observed time series processes, namely the autoregressive (AR) and moving average (MA) models. Lim et al. (2008) showed that the AR and MA processes can be applied to capture the current pattern of tourist arrivals from particular tourism markets based on its own past arrivals and the random error from previous periods, that is AR and MA processes of orders *p* and *q*, respectively, which are given by:

$$A_t = \sum_{i=1}^{p} \phi_i A_{t-1} + \varepsilon_t \qquad (3)$$

and

$$A_t = \varepsilon_t - \sum_{j=1}^{q} \theta_j \varepsilon_{t-j} \, . \qquad (4)$$

The general formulation of an ARIMA (*p,d,q*) model can be written as:

$$\left(1 - \phi_1 L - .. - \phi_p L^p\right) A_t = C + \left(1 - \theta_1 L - ... - \theta_q L^q\right) \varepsilon_t, \; t = 1,...,n \qquad (5)$$

and

$$C = \left(1 - \phi_1 - ... - \phi_p\right) \mu,$$

where A_t = number of tourist arrivals from one of the three countries to Thailand at time t;
μ = constant mean;
φ_i = autoregressive parameter ($i = 1,\ldots,p$);
θ_j = moving average parameter ($j = 1,\ldots,q$);
L = backward shift operator;
ε_t = normally and independently distributed random error term.

The ARMA model is based on stationary time series processes. A tourist arrivals series is stationary if the mean, variance and covariance of the series remain constant over time. The unit root test is a formal method of testing for the stationarity of a series. If a time series, A_t, is not stationary, it can be transformed into a stationary series by taking first differences to obtain autoregressive integrated moving average models (ARIMA). The formulation of ARIMA (*p,d,q*) models can be written as:

$$\left(1 - \phi_1 L - .. - \phi_p L^{p+q}\right)A_t = C + \left(1 - \theta_1 L - ... - \theta_q L^q\right)\varepsilon_t, t = 1,..., n \tag{6}$$

or

$$A_t = C + \phi_1 A_{t-1} + ... + \phi_{t-p} A_{t-p-d} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \theta_q \varepsilon_{t-q}. \tag{7}$$

where

$$1 - \phi_1 L - ... - \phi_{p+d} = \left(1 - \phi_1 L - ... - \phi_p L^p\right)\left(1 - L\right)^d,$$

and d is the number of times the data are differenced to obtain stationarity, p is the lag length of the autoregressive error term, and q is the lag length of the moving average error term. The ARMAX model is an extension of ARIMA modelling, which contains lagged dependent and explanatory variables, and a moving average disturbance.

An extension of equation (7) to include a single explanatory, such as (CPI) variable, results in the following single equation ARMAX model:

$$A_t = C + \phi_1 A_{t-1} + ... + \phi_{t-p} A_{t-p-d} + \beta_0 x_t + \beta_1 x_{t-1} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \theta_q \varepsilon_{t-q}, \tag{8}$$

where x_t and x_{t-1} are the current and one-period lagged CPI in the original country, respectively. This model also assumes that the errors are independently and identically distributed, with zero mean, constant variance and zero covariance.

The most commonly used explanatory variables included in a model of international tourism demand are income, population, relative prices, exchange rates and transportation costs (see, for example, Munoz, 2007; Chang and McAleer, 2009; and Chang et al., 2009). In this paper, the consumer price index (CPI) is considered as the appropriate explanatory variable as it reflects the purchasing power of a particular country. Higher consumer price indexes tend to lower the purchasing power of people, which leads to a decrease in tourism demand. The other reason is that other variables, such as gross domestic product and income, are unavailable as monthly data series.

In the analysis of international tourism demand from the USA, Japan and Malaysia to Thailand, the logarithm of tourist arrivals and CPI are selected as proxies for international travel demand and purchasing power, respectively. The sample period for each country is different due to the limited availability of monthly CPI data. The data used here comprise monthly international tourist arrivals and the CPI for different time periods due to the limited availability of monthly data series, namely 1971-2005 for the USA, 1978-2005 for Japan, and 1972-2005 for Malaysia. Tourism demand data for Thailand are obtained from the Tourism Authority of Thailand (TOT), and CPI data are obtained from the Reuters 2007 database. The data series are tested for the existence of seasonal unit roots, and are expressed and analyzed in terms of the logarithmic first differences (log differences) and logarithmic annual differences.

3. Empirical results

3.1 Seasonal unit root test

Before the ARMAX model is used to estimate the relationship between tourist arrivals from the USA, Japan and Malaysia and CPI, tourist arrivals and the CPI are tested for stationarity. Tests of the null hypothesis that monthly international tourist arrivals and the CPI have seasonal unit roots are given in Tables 1 and 2. Testing for seasonal unit roots involves an intercept, seasonal dummies, trend and the lag length of the series. The empirical results are compared with the 5% critical values given in Franses (1991). The Wald test is applied for the first twelve hypotheses to obtain the calculated t statistics, and the last six hypotheses are used to obtain the calculated F statistic. It appears there is evidence for the presence of seasonal unit roots in tourist arrivals from some countries, and in the CPI of some countries.

The empirical results of the unit root tests of tourist arrivals, as given in Table 1, reveal that the joint null hypothesis, H_0: $\pi_3 ... \pi_{12} = 0$, indicating that the presence of a unit root at all the seasonal frequencies of tourist arrivals from Japan, cannot be rejected at the 5% significance level. The seasonal unit root null hypotheses of tourist arrivals from the USA and Malaysia are both rejected, implying that a non-seasonal unit root is present in the series.

Taking first differences of the logarithm of CPI, and applying the seasonal unit root tests, is also considered. In Table 2, the estimates reveal that the joint null hypothesis, H_0: $\pi_3 ... \pi_{12} = 0$, indicating the presence of a unit root at all the seasonal frequencies for the CPI of Japan, cannot be rejected at the 5% significance level. The seasonal unit root null hypotheses of CPI in the USA and Malaysia are both rejected at the 5% significance level, implying that a non-seasonal unit root appears in the series for both countries. These results suggest that the seasonal filter, $(1 - L^{12})$, differencing operation, Δ_{12}, should be applied for the Japanese tourist arrivals series, while the non-seasonal filter, $(1 - L)$, is used for American and Malaysian tourist arrivals data.

Table 1: Estimates of seasonal unit roots testing of tourist arrivals from three major source countries to Thailand

Null Hypotheses	USA (2)	Japan (12)	Malaysia (2)
$\pi_1 = 0$	-2.58	-1.86	-2.27
$\pi_2 = 0$	-4.77**	0.08	-6.20**
$\pi_3 = 0$	-5.19**	0.14	-4.70**
$\pi_4 = 0$	-0.35	-1.02	-0.91
$\pi_5 = 0$	0.33**	0.51**	-7.02**
$\pi_6 = 0$	0.21**	-0.13	-6.15**
$\pi_7 = 0$	0.38	-1.48**	-3.33**
$\pi_8 = 0$	-0.36	1.74**	1.13**
$\pi_9 = 0$	-0.15	-0.57	-5.46**
$\pi_{10} = 0$	-0.27	-0.48	-2.98
$\pi_{11} = 0$	0.58	-0.76	-5.71**
$\pi_{12} = 0$	-0.34	1.01**	1.04**
$\pi_3 = \pi_4 = 0$	13.53**	0.21	11.54**
$\pi_5 = \pi_6 = 0$	0.06	0.81	24.68**
$\pi_7 = \pi_8 = 0$	0.10	1.42	12.18**
$\pi_9 = \pi_{10} = 0$	0.04	0.21	16.14**
$\pi_{11} = \pi_{12} = 0$	0.17	0.57	18.44**
$\pi_3 = \ldots = \pi_{12} = 0$	5.01**	0.71	18.62**

Notes: 1. ** denotes the seasonal unit root null hypothesis is rejected at the 5% significance level.
2. Numbers in parentheses denote the number of lagged values of the dependent variable.

Table 2: Estimates of seasonal unit root tests of CPI

Null Hypotheses	USA (2)	Japan (2)	Malaysia(1)
$\pi_1 = 0$	-3.42**	-2.49	-2.28
$\pi_2 = 0$	-4.86**	-3.07**	-4.51**
$\pi_3 = 0$	-3.75**	-2.43**	-4.54**
$\pi_4 = 0$	-5.78**	-3.82**	-4.92**
$\pi_5 = 0$	-1.25	-1.38	2.37**
$\pi_6 = 0$	0.43**	-0.56	0.09**
$\pi_7 = 0$	-0.21**	-0.80**	-0.29**
$\pi_8 = 0$	-0.77	-0.28	-1.43
$\pi_9 = 0$	1.34**	1.15**	0.33
$\pi_{10} = 0$	1.90**	1.58**	-1.11
$\pi_{11} = 0$	0.14	-2.25**	-1.01
$\pi_{12} = 0$	0.53**	0.65**	-1.86
$\pi_3 = \pi_4 = 0$	25.13**	10.53**	22.48**
$\pi_5 = \pi_6 = 0$	1.10	0.97	2.95
$\pi_7 = \pi_8 = 0$	0.45	0.53	1.09
$\pi_9 = \pi_{10} = 0$	2.40	1.67	0.77
$\pi_{11} = \pi_{12} = 0$	0.25	2.68	2.65
$\pi_3 = \ldots = \pi_{12} = 0$	6.28**	3.01	7.90**

Notes: 1. ** denotes the seasonal unit root null hypothesis is rejected at the 5% significance level.
2. Numbers in parenthesis denote the number of lagged values of the dependent variable.

3.2 ARIMA models for tourist arrivals

Monthly tourist arrivals data (in logarithms) from the three major countries, namely the USA, Japan and Malaysia, are used to capture the patterns in the data series. Various autoregressive (AR), moving average (MA), and autoregressive integrated moving average (ARIMA) models have been estimated using OLS to determine whether the tourist arrivals series can be described by AR, MA or ARIMA processes. The appropriate models are selected for tourist arrivals based on significant *t*-statistics at the 5% significance level for the AR and MR coefficients, with no serial correlation at the 5% level, using the Lagrange Multiplier (LM) test for serial correlation. In particular, the estimated models are tested for serial correlation as serial correlation leads to bias in the estimates and invalid inferences. Diagnostic checking of the residuals, based on the correlograms of the estimated residuals of the ARIMA models, provide further support for the results of LM tests for serial correlation, which means there is no serial correlation in the residuals. In addition, the models are selected using model selection criteria, including the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC), whereby smaller values are preferred.

In the ARIMA process, the tourist arrivals variable for the USA and Malaysia use the non-seasonal filter, $(1-L)$, while the seasonal filter, $(1-L^{12})$, is applied to tourist arrivals from Japan. Table 3 presents the results of the various fitted ARIMA models for the logarithm of tourist arrivals from the three major source countries to Thailand using the EViews 4.1 econometric software package. The fitted models in this paper show the ARIMA models and seasonal patterns for seasonal ARIMA (SARIMA) models. Additionally, the best fitting ARIMA model for each country is chosen to have the lowest values of AIC and SBC. After empirical examination, the most appropriate ARIMA models are determined to be the ARIMA(1,1,1) $(12,1,12)_{12}$, ARIMA(1,1,12) and ARIMA(12,1,12) models for the USA, Japan and Malaysia, respectively.

The empirical specification for tourist arrivals from the USA for the period 1971-2005 is given as follows:

$$\Delta y_t = 0.01 + u_t ,$$

$$\underset{(4.31)}{(1-0.27L)}\underset{(59.64)}{(1-0.96L^{12})}u_t = \underset{(-25.67)}{(1-0.85L^{1})}\underset{(-18.26)}{(1-0.74L^{12})}\varepsilon_t .$$

The best fitting ARIMA model for the relationship between the logarithm of tourist arrivals from the USA is determined as having significant estimates but with no serial correlation at the 5% significance level (with Durbin-Watson value of 2.02).

Table 3: Estimates of the best fitting ARIMA models for inbound tourists from the USA, Japan and Malaysia to Thailand

Variable	Coefficient	*t*-Statistics	AIC/SBC	LM(SC)
The United States of America				
C	0.01	0.94		
AR(1)	0.27	4.31	AIC = -1.08	F = 148.60
SAR(12)	0.96	59.64	SC = -1.03	p = 0.00
MA(1)	-0.85	-25.67		
SMA(12)	-0.74	-18.26		
Japan				
C	0.07	4.72	AIC = -1.79	F = 344.44
AR(1)	0.85	28.33	SC = -1.76	p = 0.00
MA(12)	-0.60	-13.12		
Malaysia				
C	0.01	2.39		
AR(6)	-0.10	-2.62		
AR(7)	-0.11	-2.66	AIC = -0.39	F = 70.88
AR(12)	0.57	11.53	SC = -0.33	p = 0.00
MA(1)	-0.65	-17.32		
MA(12)	-0.21	-4.78		

Notes: 1. AIC and SBC are the Akaike information criterion and Schwarz Bayesian criterion, respectively.
2. LM(SC) refers to the Lagrange multiplier test for serial correlation.

For the Japanese tourist arrivals series during 1978-2005, the appropriate ARIMA model, in which the estimated parameters are significant and with no serial correlation at the 5 % significance level, is the ARIMA(1,1,12) model. The best fitting model for tourist arrivals from Japan can be expressed as follows:

$$\Delta_{12} y_t = 0.07 + u_t,$$

$$\underset{(28.33)}{\left(1 - 0.85L^1\right)} u_t = \underset{(-13.12)}{\left(1 - 0.60L^{12}\right)} \varepsilon_t .$$

The selected model indicates that the autocorrelations are within the 95 % confidence interval (with Durbin-Watson value of 2.06), which implies that there are no significant residual autocorrelations.

For the Malaysian tourist arrivals series during 1972-2005, the ARIMA models are presented in Table 6, in which the estimated parameters are significant and with no serial correlation at the 5% significance level, which is ARIMA(12,1,12). The empirical results show that ARIMA(12,1,12) is the most appropriate model to describe tourist arrival patterns from Malaysia as it has the smallest AIC and SBC values. The best fitting model for tourist arrivals from Malaysia can be expressed as follows:

$$\Delta y_t = 0.01 + u_t,$$

$$\underset{(-2.62)}{\left(1 + 0.10L^6\right)} \underset{(-2.66)}{\left(1 + 0.11L^7\right)} \underset{(11.53)}{\left(1 - 0.57L^{12}\right)} u_t = \underset{(-17.32)}{\left(1 - 0.65L^1\right)} \underset{(-4.78)}{\left(1 - 0.21L^{12}\right)} \varepsilon_t .$$

The selected model indicates that the autocorrelations are within the 95 % confidence interval (with Durbin-Watson value of 2.00), which implies that there are no significant residual autocorrelations in the appropriate model.

*3.3 ARIMAX model*s

According to the results from the seasonal unit roots tests for each variable in the ARMAX process, the tourist arrivals variables for the USA and Malaysia are used in the non-seasonal filter, $(1-L)$, while the seasonal filter, $(1-L^{12})$, is applied for tourist arrivals from Japan. For the consumer price index (CPI), the non-seasonal filter, $(1-L)$, is applied for tourist arrivals from the USA and Malaysia, and the seasonal filter, $(1-L^{12})$ is used for tourist arrivals from Japan.

The initial regressions of the ARMAX models for the USA, Japan and Malaysia are given in Tables 4-6. The empirical results reveal that the explanatory variable considered, namely the logarithm of CPI, do not have a significant impact on international tourist arrivals from Japan and Malaysia at the 5% significance level. Moreover, the constant term was not different from zero for the initial ARMAX models for tourist arrivals from the USA and Malaysia. The CPI indicates the negative and significant impact on tourist arrivals from the USA to Thailand, with a coefficient of -1.99, while the constant term has a significant impact only on tourist arrivals from Japan to Thailand, with a coefficient of 0.079. Additionally, the Lagrange multiplier test, LM(SC), indicates that the errors are not serially correlated at the 5% significance level for all the ARMAX models. After estimating the initial models, the ARMAX models for the three countries are re-estimated, and the results of the final models are presented in Tables 7-9.

Table 4: ARMAX model of log difference of tourist arrivals from the USA, 1971-2005

Sample(adjusted): 1972(3)-2005(12) and 406 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011489	0.007242	1.586357	0.1134
DLOG(CPIUSA)	-1.992614	0.641219	-3.107542	0.0020
AR(1)	0.292335	0.059673	4.898931	0.0000
SAR(12)	0.956943	0.015971	59.91766	0.0000
MA(1)	-0.889082	0.028954	-30.70683	0.0000
SMA(12)	-0.742024	0.040583	-18.28418	0.0000
R-squared	0.605011	Mean dependent var		0.004713
Adjusted R-squared	0.600074	S.D. dependent var		0.219612
S.E. of regression	0.138882	Akaike info criterion		-1.095713
Sum squared resid	7.715310	Schwarz criterion		-1.036506
Log likelihood	228.4297	F-statistic		122.5375
Durbin-Watson stat	2.027509	Prob(F-statistic)		0.000000

Table 5: ARMAX model of log seasonal difference of tourist arrivals from Japan, 1978-2005

Sample(adjusted): 1979(2)-2005(12) and 323 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.078776	0.019088	4.127020	0.0000
DLOG(CPIJP,0,12)	-0.535034	0.968870	-0.552225	0.5812
AR(1)	0.849038	0.030262	28.05649	0.0000
MA(12)	-0.598050	0.046419	-12.88368	0.0000
R-squared	0.683118	Mean dependent var		0.068149
Adjusted R-squared	0.680138	S.D. dependent var		0.173833
S.E. of regression	0.098314	Akaike info criterion		-1.788999
Sum squared resid	3.083325	Schwarz criterion		-1.742217
Log likelihood	292.9233	F-statistic		229.2280
Durbin-Watson stat	2.062109	Prob(F-statistic)		0.000000

Table 6: ARMAX model of log difference of tourist arrivals from Malaysia, 1972-2005

Sample(adjusted): 1973(2)-2005(12) and 395 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.63E-05	0.003515	0.018869	0.9850
DLOG(CPIMY)	1.950104	1.078522	1.808126	0.0714
AR(6)	-0.108329	0.040140	-2.698789	0.0073
AR(7)	-0.109425	0.039692	-2.756850	0.0061
AR(12)	0.563050	0.048748	11.55033	0.0000
MA(1)	-0.672224	0.036407	-18.46415	0.0000
MA(12)	-0.213958	0.042986	-4.977372	0.0000
R-squared	0.480666	Mean dependent var		0.005792
Adjusted R-squared	0.472635	S.D. dependent var		0.271161
S.E. of regression	0.196917	Akaike info criterion		-0.394504
Sum squared resid	15.04524	Schwarz criterion		-0.323992
Log likelihood	84.91448	F-statistic		59.85167
Durbin-Watson stat	1.978456	Prob(F-statistic)		0.000000

The empirical results obtained for the final ARMAX models for the USA, Japan and Malaysia, as presented in Tables 7-9, indicate that the insignificant variables at the 5% level of the initial models (as shown in Tables 4-6) are excluded from the final models. In other words, it is possible to obtain more parsimonious models by excluding the exogenous variables which are not significant. The empirical estimates show that the ARMAX model for the USA confirms that changes in the consumer price index (CPI) have a negative and significant impact on tourist arrivals from the USA to Thailand, with a coefficient of -1.99. This implies that increases in the CPI in the USA lead to decreases in the numbers of tourist arrivals from the USA to Thailand. The reason for this outcome is that the USA is a long haul travel market for Thailand, so the purchasing power of Americans is likely to affect their travel demand to Thailand. However, Japan and Malaysia are medium haul and short haul tourism markets for Thailand, respectively, so the CPI in these countries has little or no effect on the numbers of tourist arrivals from these countries to Thailand. In short, the empirical results are consistent with the fact that travelling from Japan and Malaysia to Thailand does not cause high expenditures in the cost of travel and living allowances.

According to these results, the CPI is important in explaining the U.S. demand for tourism to Thailand. The estimated effect of this variable is negative and greater than one, implying that changes in the cost of living in the USA affect demand for tourism to Thailand. The major implication of this finding for the tourism industry is that provision of high quality services is important for earning a strong reputation and for attracting new and repeat tourists, as tourists from the USA tend to be high income and repeat tourists. For Japanese and Malaysian tourists, the cost of living in each country does not have a statistically significant impact on the demand for tourism to Thailand as these two countries are not sufficiently far from Thailand. However, developed infrastructure, such as roads, quality of hotels and cooking, should be considered as tourists from these countries, and particularly from Japan, are high income tourists.

Table 7: ARMAX model of log difference of tourist arrivals from the USA, 1971-2005

Sample(adjusted): 1972(3)-2005(12) and 406 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(CPIUSA)	-1.987887	0.685126	-2.901493	0.0039
AR(1)	0.282228	0.061150	4.615319	0.0000
SAR(12)	0.966194	0.013457	71.79885	0.0000
MA(1)	-0.877621	0.030976	-28.33214	0.0000
SMA(12)	-0.749281	0.038262	-19.58289	0.0000
R-squared	0.603219	Mean dependent var		0.004713
Adjusted R-squared	0.599261	S.D. dependent var		0.219612
S.E. of regression	0.139023	Akaike info criterion		-1.096111
Sum squared resid	7.750322	Schwarz criterion		-1.046772
Log likelihood	227.5106	Durbin-Watson stat		2.024894

Table 8: ARMAX model of log seasonal difference of tourist arrivals from Japan, 1978-2005

Sample(adjusted): 1979(2)-2005(12) and 323 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.072730	0.015405	4.721119	0.0000
AR(1)	0.848784	0.029963	28.32766	0.0000
MA(12)	-0.601763	0.045850	-13.12473	0.0000
R-squared	0.682814	Mean dependent var		0.068149
Adjusted R-squared	0.680832	S.D. dependent var		0.173833
S.E. of regression	0.098207	Akaike info criterion		-1.794233
Sum squared resid	3.086279	Schwarz criterion		-1.759147
Log likelihood	292.7687	F-statistic		344.4366
Durbin-Watson stat	2.062039	Prob(F-statistic)		0.000000

Table 9: ARMAX model of log difference of tourist arrivals from Malaysia, 1972-2005

Method: Least Squares

Sample(adjusted): 1973(02)-2005(12) and 395 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(6)	-0.092477	0.039787	-2.324305	0.0206
AR(7)	-0.091011	0.039367	-2.311872	0.0213
AR(12)	0.582046	0.050658	11.48969	0.0000
MA(1)	-0.621270	0.038623	-16.08541	0.0000
MA(12)	-0.202207	0.047616	-4.246609	0.0000
R-squared	0.471270	Mean dependent var		0.005792
Adjusted R-squared	0.465847	S.D. dependent var		0.271161
S.E. of regression	0.198180	Akaike info criterion		-0.386700
Sum squared resid	15.31744	Schwarz criterion		-0.336334
Log likelihood	81.37327	Durbin-Watson stat		2.030710

4. Concluding Remarks

This paper analysed the impact of changes in the consumer price index on tourism demand from the USA, Japan and Malaysia to Thailand using an ARMAX model. Tourist arrivals and the consumer price index of these three countries, which represent long haul, medium haul and short haul inbound tourism markets for Thailand, respectively, were tested and transformed to obtain a stationary process. The sample periods under consideration for each country were 1971-2005 for the USA, 1978-2005 for Japan, and 1972-2005 for Malaysia. The differences are due to the limited data availability of monthly consumer price index from the Reuters database. After testing for seasonal unit roots, the ARIMA model was estimated to capture the time series behaviour of tourist arrivals based on historical data. The empirical results indicated that the best fitting models to explain tourist arrivals of the three major countries were ARIMA and seasonal ARIMA models.

The initial ARMAX models were estimated for the three countries to test for the existence of appropriate variables and models. The consumer price index was found to have a significant impact on the number of tourist arrivals only for long haul tourism from the USA. Alternative ARMAX models were estimated in order to obtain the best fitting models to explain the factors affecting tourism demand from the three different countries of origin.

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