AN INVESTIGATION ON THE INTERNATIONAL TOURISTS' EXPENDITURES IN THAILAND: A MODELLING APPROACH

Songsak Sriboonchitta*, Chukiat Chaiboonsri, Prasert Chaitip*, Arreyah Chaitip**, Sándor Kovács*** & Péter Balogh*****

**Assoc. Prof., Faculty of Economics, Chiang Mai University, Chiang Mai, Thailand*
***Faculty of Economics, Chiang Mai University, Chiang Mai, Thailand*
****Faculty of Applied Economics and Rural Development, University of Debrecen*

Abstract: As a result of the increase in both the international tourists' expenditures and tourist arrivals to Thailand, there is a growing interest in determining the trend of international tourists' expenditures based on time-series modelling. In our article secondary data were used to produce forecasts of the international tourists' expenditures in Thailand between 2009 and 2010. The forecasting method is based on the ARFIMAX (0, 0.197, 0, 0.033) model. Furthermore, this method predicted that international tourists' expenditures in Thailand between 2009 and 2010 will have to contract and slow down. This paper seeks to determine whether the international tourists' expenditures are affected by other circumstances. The results of this study revealed that the international tourist arrivals to Thailand will also have to slow down. However, from the results, there is solid evidence to support such a claim.

Key words: Thailand; ARFIMAX (p,d,q,X) method; International Tourists' Expenditures

Introduction

Tourism was identified as important role for future economic growth and important industry to Thailand's economy. It contributes to Thailand's gross domestic product (GDP), affecting employment, investment, and foreign exchange earnings (TAT, 2006). In 2003, Thailand ranked the 15th in international tourism receipts (US$7.9 billion), accounting for 1.7% of the world total or 4.4% of the country's national product (WTO, 2005). International tourism is the fastest growing industry in Thailand (Chaitip and Chaiboonsri, 2009). The country has continuously experienced the growth in the number of tourists and revenues from the industry. The number of international tourists in Thailand was increased from 7.22 million in 1997 to 13 million in 2005. The revenues were increased from 299 billion baht in 1997 to 450 billion baht in 2005. During 1997-2005, Thailand faced many challenges. For example, the Asian Economic Crisis in 1997, the effect of September 11, 2001, the outbreaks of Severe Acute Respiratory Syndrome (SARS), the US-Iraqi War in 2003, and the Avian Influenza (Bird Flu), the Tsunami in 2004, and high oil prices in 2005. However, the ARFIMA(p,d,q) model was used by Mahendran and Pauline (2003) to model the tourist arrivals to Malaysia. This model was also used by Fong-Lin Chu (2008) to forecast the number of international tourists arrivals to Singapore. Based on these articles we might claim that that the ARFIMAX (p,d,q,X) model has not been used to forecast the international tourists expenditures in Thailand before. Consequently, this paper seeks to determine the trend of the international tourists' expenditures based on the so called ARFIMAX (p,d,q,X) model.

Research aim and objective

This research aims to develop and validate a predictive model that supports the forecasting of the international tourists' expenditures during the period of 2009-2010. On the other hand, we would like to measure the forecasting performance of the developed model.

Data of the research

The scope of this research based on secondary data between 2000 and 2010. Data about the international tourists' arrivals to Thailand and expenditures has also been collected from the period of 2000 and 2008. All data were collected from Tourism Authority of Thailand (Tourism Council of Thailand, 2009).

The research framework and methodology

Our research focuses on a multivariable analysis of the number of international tourists' arrivals to Thailand and the

expenditures between 2000 and 2008. An ARFIMAX (p, d, q, X) model was used in forecasting the international tourists' expenditures and arrivals to Thailand during the period of 2009-2010. However, this econometric technique has never been used in the previous studies in Thailand.

The general model of ARFIMAX (p, d, q, X)

The ARFIMAX model as follows: (see equation 1)

$$y_t = c_1 y_{t-1} + c_2 y_{t-2} + \ldots + c_k y_{t-k} + \varepsilon_t + d_1\varepsilon_{t-1} + d_2\varepsilon_{t-2} + \ldots + d_l\varepsilon_{t-l},$$

or

$$\left(1 - \sum_{i=1}^{k} C_i L^i\right) y_t = \left(1 + \sum_{i=1}^{l} d_i L^i\right)\varepsilon_t \quad (1)$$

And L is the lag operator $\{\Sigma^3_{i=1}(L^i)y_t = y_{t-1} + y_{t-2} + y_{t-3}\}$ as well as the ARMA with exogenous variables (Hurvich, and Tsay, 1989), or ARMAX (k,l) : (see equation 2)

$$c(L)(y_t - X_t'\beta) = D(L)\varepsilon_t, \quad (2)$$

where

$$c(L) = \left(1 - \sum_{i=1}^{k} C_i L^i\right)$$

$$D(L) = \left(1 + \sum_{i=l}^{l} d_i L^i\right)\varepsilon_t$$

The ARFIMAX (p, d*, q, X) model{p=k, d*=Fractional differencing operator, q=l} can be written (Degiannakis, 2008) in equation 3.

$$c(L)(1-L)^{d^*}(y_t - X_t'\beta) = D(L)\varepsilon_t, \quad (3)$$

where $(1\text{-}L)^{d^*}$ is the fractional differencing operator and d* Є (–0.5, 0.5) is the fractional differencing parameter.

The results of research

The results of various tests for unit root process

The Table 1 presents the result of both the ADF-unit root test (ADF-Test) and Phillip-Perron unit root test (PP-Test) (Phillips and Perron, 1988). Based on both ADF-Test and PP-Test (Doornik and Ooms, 2006) confirmed that both the expenditures and the number of international tourists have no unit root or stationary (see more detail at Table 1).

The results of various tests for long memory process

Table 2 shows the results of various tests (Torre and Lemoine, 2007) for long memory process based on R/S Test, Modified R/S Test and GPH Test of both international tourists' expenditures and the number of the international tourist arrivals to Thailand between 2000-2008. The test results are summarized in Table 2. For each test, the test statistics and its corresponding statistics are given. If the statistics value of R/S Test, Modified R/S Test and GPH Test is significant at 1% level or at 5% level then we can rejected the Null Hypothesis of no long-term dependence or no long memory process in time series data (Granger, 1980). Otherwise, if the value of a given test is not significant at 1% level or at 5% level then the Null Hypothesis of no long-term dependence or no long memory process in time series data can be accepted. Based on both the R/S Test and the Modified R/S Test, it can be confirmed that the time series of the international tourist's expenditures have a long-term dependence in itself, but the number of the international tourist arrivals to Thailand has no a long-term dependence or it is not a long memory process. The statistics value of the GPH Test of for this data was not significance at 1% or at 5% level. However, both the R/S Test and the Modified R/S Test confirmed that the data of international tourist's expenditures in Thailand has a long-term dependence in itself.

Table 1. Results of the unit root tests

Variables	ADF-Test			PP-Test		
	Constant with Trend			Constant with Trend		
				Level		
Expenditures	-4.75266	[1]**			-3.83786	[0]**
	I(0)				I(0)	
Number of international tourists				Level		
	-5.85744	[1]**			-4.33053	[0]**
	I(0)				I(0)	

* : significant at 5% level,
** : significant at 1% leve

From: own calculation

Table 2. Results of the various tests for long memory

The name of variables	R/S Test	Modified R/S Test	GPH Test
International Tourists' Expenditures	4.3473**	2.0872*	2.7637**
The number of International Tourist Arrival to Thailand	3.754**	1.9691*	1.6046

From: own calculation

Null Hypothesis : no long-term dependence or no long memory process.
For GPH test, Null Hypothesis: **d = 0** (d is the differencing parameter)
*: significant at 5% level, **: significant at 1% level

The forecasting models' selection based on concept of both the AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion)

Table 3 shows the forecasting accuracy of all the models based on ARFIMAX (p,d,q,X) between 2009 and 2010. The values of both Akaike Information Criteria (AIC) and Bayesian Information Criterion (BIC) were used for selecting the best model for forecasting the international tourists' expenditures. It can be seen from Table 3 that the best model is the ARFIMAX (0, 0.197, 0, 0.033) because both values (of AIC and BIC) are less than in the case of other models. Consequently ARFIMA (0, 0.197, 0 , 0.033) model was selected as the best predictive model for forecasting international tourists' expenditures in Thailand during the analyzed period (see more detail at Table 4. and Figure 1.).

Table 3. Accuracy comparison of the different forecasting models based on arfimax (p,d,q,x) model between 2009 and 20

	ARFIMAX (0,d,0)	**ARFIMAX (1,d,0)**	**ARFIMAX (0,d,1)**	**ARFIMAX (0,d,0)**
Const	-	-	-	-4532.62
				[-1.07]
d	0.197***	0.28***	0.33**	0.17**
	[2.69]	[2.71]	[2.33]	[2.11]
X	0.033***	0.034***	0.0342***	0.038***
	[22.5]	[17.19]	[15.40]	[9.05]
AR	-	-0.15	-	-
		[-1.08]		
MA	-	-	-0.22	-
			[-1.14]	
AIC	20.3473709	20.3576992	20.3542351	20.3581646
BIC	27.97854	30.53088	30.5278	30.53166

From: own calculation

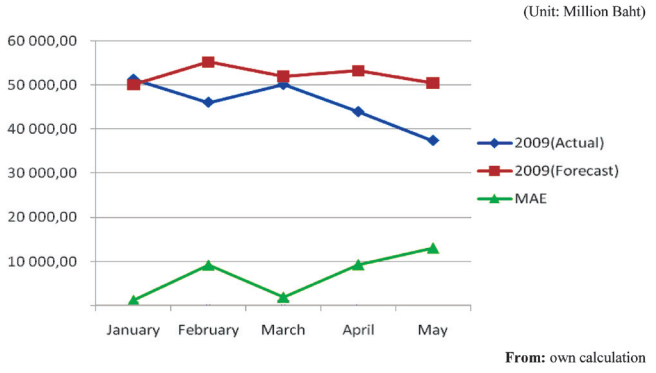
* : significant at 10% level, ** :significant at 5% level, *** :significant at 1% level, X: Number of International Tourists Arrival to Thailand. Endogenous variable : Expenditures of International tourists in Thailand.

Table 4. Forecast of the expenditures of international tourist arrivals to thailand between 2009 and 2010 based on arfimax (0, 0.197, 0, 0.033) (unit: million baht)

Month/Year	**2009 (Actual)**	**2009 (Forecast)**	**MAE***	**MAPE* (%)**
January	51,289.33	50,112.01	1,177.32	2.30
February	46,069.96	55,233.29	9,163.33	19.89
March	50,094.28	52,005.99	1,911.71	3.82
April	43,935.01	53,232.02	9,297.01	21.16
May	37,400.20	50,488.53	13,088.33	35.00
June		43,964.59		
July		42,104.59		
August		41,383.02		
September		45,396.30		
October		41,576.69		
November		32,016.56		
December		38,932.68		
Total	**228,788.79**	**546,446.27**	**6,927.54**	**16.43**
Month/Year	**2010 (Actual)**	**2010 (Forecast)**	**MAE**	**MAPE (%)**
January		38,235.52		
February		40,936.21		
March		44,644.74		
April		40,178.21		
May		43,531.02		
June		38,277.93		
July		32,710.70		

From: own calculation

*: (MAE: Mean Absolute Error, MAPE (%): Mean Absolute Percentage Error)



From: own calculation

Figure 1. Forecast of the international tourists' expenditures in Thailand for 2009 based on arfimax (p,d,q,x) (unit: million baht)

Concluding remarks

This study presents the basic features of the unit root process and long memory process along with the ARFIMAX (p,d,q,X) models including a selection of significant extensions and applications. Consequently, the procedures are used in an original way to demonstrate the flexibility of the approach and the applicability to the tourism industry. In our article we also investigated the fractionally integrated behavior of the international tourists' expenditures and the number of international tourists arrivals which was stationary but exhibits long-memory process over the year 2000 to year 2009. The empirical results showed that the inclusion of the time-varying volatility in the absolute return performed better in one-year-ahead forecast and estimation of the international tourists' expenditures in Thailand during the specified period. An integrated approach to tourism policy analysis and problem resolution is also required, in which the relationship among tourism establishments, tourists, the environment and rural development are openly considered. The number of international tourists' arrivals to Thailand will significantly affect the international tourists' expenditures and tourism development. These developments demand a long-drawn-out possibility of analysis across tourism disciplines. Social scientists can catch the lead in expansion the scope and providing a meaningful investigative framework for interdisciplinary analysis. The issues involved should be high on the agendas of the tourism establishment and education systems. More education about tourism is needed for further enhancing the public understanding. The results of the tourism research and education will have a broader applicability and provide benefits to a number of firms or organizations.

Acknowledgements

The authors would like to gratefully acknowledge the financial support from Faculty of Economics, Chiang Mai University, Chiang Mai, Thailand.

References

Chaitip, P. and Chaiboonsri, C. (2009): "An Application of the LISERL Model for International Tourism Demand in Thailand.", *Humanity, Development and Cultural diversity, The 16 World Congress of The International Union of Anthropological and Ethnological Sciences (IUAES 2009) ,Yunnan University-Kunming , China: – July 27-31-2009*

Degiannakis, Stavros (2008): "ARFIMAX and ARFIMAX-TARCH realized volatility modeling", *Journal of Applied Statistics*, 35(10), 1169-1180.

Doornik J. A. and Ooms, M. (2006): A package for estimating, forecasting and simulating ARFIMA models, ARFIMA Package 1.04 for Ox. Nuffield College, *Oxford,Working Paper*

Fong-Lin Chu (2008): " A fractionally integrated autoregressive moving Average approach to forecasting tourism demand", *Tourism Management* 29, 79–88. www.elsevier.com/locate/tourman

Granger, C.W.J. (1980): Long memory relationships and the aggregation of dynamic models, *Journal of Econometrics* 14, 227–238.

Hurvich, C.M. and Tsay, C.L. (1989): 'Regression and time series modelling in small samples,' *Biometrika*, 76, 297-307.

Mahendran and Pauline (2003): ARAR and Long Memory Modeling of Tourist Arrivals to Malaysia, *Proceedings of National Conference on Management Science and Operations Research,* 1, 258-271., 24-25 June, 2003.

Phillips, P.C.B. and Perron, P. (1988): Testing for a unit root in time series regression, *Biometrika*, 75(2), 335-346.

Torre, D. and Lemoine. (2007): " Detection of long-range dependence and estimation of fractal exponents through ARFIMA modeling ", *British Journal of Mathematical and Statistical Psychology*, 60, 85–106.

Tourism Council of Thailand (TCT) (2009): http:// www. thailandtourismcouncil.org/ home.php