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Forecasting of International Tourists' Expenditure in Thailand: Using ARFIMAX and ARFIMAX-GARCH Approach

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ABSTRACT

Based on an ARFIMAX (p,d,q)-GARCH (p,q) model, international tourist expenditures in Thailand during the period 2010-2011 are projected to decrease. These models were shown by statistical values consisting of AIC, BIC and HQC to help make a decision during the period of study. The results show that the international tourism industry has a large impact upon the Thai economy. International tourism can increase cooperation among world economies and help to integrate humanity through a single international tourism industry.

1. Introduction

Thailand's tourism industry underwent throughout 2009 a significant loss of revenue and jobs since somewhere in the middle of 2008 a severe worldwide recession dampened the desire to travel. Thailand furthermore has suffered from political instability, and a closure of Suvarnabhumi Airport.

The ARFIMA (p,d,q) model was used by Mahendran and Pauline (2003) to fit the modeling of tourist arrivals to Malaysia. Later, this model was employed by Chu (2008) to forecast the number of international tourist arrivals in Singapore. Moreover, this model was applied to the forecasting of international tourist arrivals to Thailand (Chaiboonsri *et al.* 2006, 2009 and 2010). The ARFIMAX (p,d,q)-GARCH (p,q) model has not previously been used to forecast international tourist expenditures in Thailand. Consequently, this paper proposes to test international tourist expenditures in Thailand based on both the ARFIMAX (p,d,q) model and ARFIMAX (p,d,q)-GARCH (p,q) models.

2. Research Objective

This research presents a methodology for using econometric analytical techniques to predict the expenditures of international tourists arriving in Thailand during the two-year period 2010-2011.

3. Scope of this research

The selected countries for forecasting the expenditure of international tourist arrivals to Thailand are all important to Thailand' international tourism industry (Source of Data: Immigration Bureau, Police Department.). Monthly secondary data, including the numbers of international tourist arrivals to Thailand from 1998-2009 and thei r expenditures from the same period, were collected to forecast the period 2010-2011.

4. The research framework and methodology

The research methodology was implemented to address the objectives in order to forecast the expenditures of arriving international tourists to Thailand during 2010-2011. Both ARFIMAX (p,d,q) model and ARFIMAX (p,d,q)-GARCH (p,q) were tested. ARFIMAX (p,d,q)-GARCH (p,q) model had never been used previously to forecast international tourists' expenditures in Thailand.

4.1 The general model of ARIMA, ARFIMA, ARFIMAX and ARFIMAX-GARCH

ARIMA models as discussed by Box and Jenkins (1976) are frequently applied to seasonal time series. A general multiplicative seasonal ARIMA model for a time series Z_t can be written

$$\text{Ø}(B)\Phi(B^S)(1-B)^d(1-B^S)^D Z_t = \theta(B)\rho(B^S)a_t \qquad (1J)$$

where

B = the backshift operator $(B_{zt} - Z_{t-1})$

S = the seasonal period

$\text{Ø}(B)$ = $(1- \text{Ø}_1B - \ldots\ldots - \text{Ø}_pB^p)$ is the non-seasonal AR operator

$\Phi(B^s)$ = $(1- \Phi_1B^s - \ldots\ldots - \Phi_pB^s)$ is the seasonal AR operator

$\theta(B)$ = $(1- \theta_1B - \ldots\ldots. - \theta_qB^q)$ is the non-seasonal moving average (MA) operator

$\rho(B)$ = $(1- \rho_1B^s - \ldots\ldots. - \theta_QB^{Qs})$ is the seasonal moving average (MA) operator

$(1-B)^d$ $(1-B^s)$ = non-seasonal differencing of order d and seasonal differencing of order D

ARFIMA models were proposed by Granger and Joyeux (1980), following which Hosking (1981)also proposed this method to fit long-memory data. An autoregressive fractionally integrated moving-average (ARFIMA) process is ARFIMA (p,d,q) model may be written by: (see equation 14E).

$$\text{Ø}(\beta)\Delta^d y_t=\delta+\theta(\beta)\varepsilon_t \qquad (14E)$$

with

$$\text{Ø}(\beta)=1-\text{Ø}_1\beta-\text{Ø}_2\beta^2-\ldots\ldots-\text{Ø}_p\beta^p$$

and

$$\theta(\beta)=1-\theta_1(\beta)-\theta_2(\beta)^2-\ldots\ldots.-\theta_q(\beta)^q$$

where

δ = constant term

$\theta(\beta)$ = moving-average operator at order q

ε_t = error term of equation 14E

$\text{Ø}(\beta)$ = The autoregressive operator at order p

$\Delta^d y_t$ = differencing operator at order d of time series data y_t

- For d within (0,0.5), the ARFIMA process is said to exhibit long memory or long range positive dependence
- For d within (-0.5, 0), the process exhibits intermediate memory or long range negative dependence
- For d within [0.5, 1) the process is mean reverting and there is no long run impact to future values of the process
- The process is short memory for d=0 corresponding to a standard ARMA process

Moreover, the fractionally integrated autoregressive moving average with exogenous variable (ARFIMAX) models were used by Granger and Joyeux (1980) and Hosking (1981) to model the long memory property of realized volatility. This same model also was subsequently used for forecasting in the context of realized volatility analysis (Degiannakis, Stavros (2008)).

The ARFIMAX model as follows: (see equation 1.1J)

$$y_t = c_t y_{t-1} + c_2 y_{t-2} + \ldots + c_k y_{t-k} + \varepsilon_t + d_1\varepsilon_{t-1} + d_2\varepsilon_{t-2} + \ldots + d_1\varepsilon_{t-1}, \quad (1.1J)$$

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

And L is the lag operator $\{\sum_{i=1}^{3}(L_i)y_t = y_{t-1}+y_{t-2}+y_{t-3}\}$ as well as the ARMA with exogenous variables, or ARMAX(k,l) : (see equation 1.2J)

$$c(L)(y_t - X_t^{/}\beta) = D(L)\varepsilon \quad (1.2J)$$

where

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

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

The ARFIMAX (p, d^*,q ,X) model {p=k, d^*=Fractional differencing operator, q=l} can be written in equation 1.3J

$$c(L)(1-L)^{d^*}(y - X^{/}\beta) = D(L)\varepsilon_t, \quad (1.3J)$$

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

The simplest GARCH model is the GARCH (1,1) model : (see equation number 4H)

$$\sigma_t^{\ 2} = \alpha_0 + \alpha_1 \mu^2_{\ t-1} + \lambda_1 \sigma^2_{\ t-1} \ (4H)$$

Now the variance of the error term has three components: a constant, last period's volatility (the ARCH term), and last period's variance (the GARCH term). In general could have any number of ARCH terms and any number of GARCH term and The GARCH (p,q) model refer to the following equation for $\sigma_t^{\ 2}$: (see equation 5H)

$$\sigma_t^2 = \alpha_0 + \alpha_1\mu^2_{t-1} + \ldots + \alpha_p\mu^2_{t-p} + \lambda_1\sigma^2_{t-1} + \ldots + \lambda_q\sigma^2_{t-q} \quad (5H)$$

4.2 The methods of Unit root test

4.2.1 DF-Test, ADF Test (1979)

The DF-Test uses three equations for the unit root test in Y_t in time series data.

$DY_t = \alpha Y_{t-1} + U_t$ (1B) [No Intercept Term]

$DY_t = \beta_t + \alpha Y_{t-1} + U_t$ (2B) [Intercept Term]

$DY_t = \beta_1 + \beta_t + \alpha Y_{t-1} + U_t$ (3B) [Intercept + Trend]

where

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

if $\alpha >$ Mackinnon statistics conclude that time series data are stationary or I (d) = I (0). Otherwise one rejects the null hypothesis that $\alpha = (\rho - 1) = 0$ or [$\rho = 1$] because if α has statistical significance at any level then $\alpha \neq 0$ ($\rho \neq 1$).

if $\alpha <$ Mackinnon, the statistical conclusion is that time series data are non- stationary or I (d) = I (d). We also accept the null hypothesis that $\alpha = (\rho - 1) = 0$ or [$\rho = 1$] because if α has no statistical significance at any level then $\alpha = 0$ ($\rho = 1$).

The ADF-Test is used for conducting unit root tests when higher order autocorrelation is found in time series data. Before using the ADF-Test, dw should be checked with statistics from DF-Test equation (2B) and (3B).

$$DY_t = \beta_1 + \beta_t + \alpha Y_{t-1} + \beta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \ (4B)$$

When the term ($\beta_i \sum_{i=1}^{m} \Delta Y_{t-i}$)is added in the equation (4B) then the t-statistics value of α before Y_{t-1} to be change as well as all t-statistics value of them to be change too. So The ADF-Test corrects for higher-order serial correlation by adding lagged differenced terms on the right-hand side. The hypothesis test for unit roots in time series data by ADF-Test method, as for the DF-test method, yields the same conclusion about time series data as stationary or non-stationary.

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

This test method for unit roots was developed by Phillips and Perron (1988), who proposed a nonparametric method for controlling for higher-order serial correlation in time series data.

$$DY_t = \alpha + \beta_t\ Y_{t-1} + \varepsilon_t \quad (5B)$$

The PP-test makes a correction to the t-statistic of the γ coefficient from the AR (1) regression to account for the serial correlation in equation (5B). The correction is nonparametric since it uses an estimate of the spectrum of equation (5B) at frequency zero that is robust to heteroskedasticity and autocorrelation of unknown form.

$$\gamma_j = (1/T)\, \Sigma^{T}_{t=j+1}\, \varepsilon^*_t\, \varepsilon^*_{t-j} \qquad (6B)$$

$$W^2 = \gamma_0 + 2\, \Sigma^{q}_{j=1} [\, 1 - j/(q+1)\,]\, \gamma_j \qquad (7B)$$

where

W^2 = Newey-west heteroskedasticity autocorrelation consistent estimation

γ_j = coefficient from AR (1) in equation (5B)

$\varepsilon^*_t \varepsilon^*_{t-j}$ = error term received from equation (5B)

q = floor $(4(T/100)^{2/9})$, [q is the truncation lag]

The PP-Test (t_{pp}) has a t-statistic computed as equation (8B), where t_b, s_b are the t-statistics and standard error of (β_t) received from regressors in equation (5B) and s* is the standard error received from regressors in the same equation.

where

$$\text{PP-Test}(t_{pp}) = [(\gamma_0^{1/2} t_b)/(W)] - [(W^2 - \gamma_0)\, T s_b/(2 W s^*)] \qquad (8B)$$

The asymptotic distribution of the PP-Test (t_{pp}) is the same as the ADF-Test. The hypotheses to be tested are:

H_0 : null hypothesis as time series data is non-stationary

H_1 : time series data is stationary

if PP-Test (t_{pp}) > Mackinnon statistic, it is concluded that the time series data are stationary; otherwise rejection of the null hypothesis implies non-stationary data.

if PP-Test (t_{pp}) < Mackinnon statistic, then one concludes that the time series data are non-stationary (acceptance of the null hypothesis).

4.3 The methods of Long memory test

4.3.1 Test for Long Memory: R/S Test

The Long Memory test based on R/S test was developed by Harold Edwin Hurst in 1960. The Mandelbrot & Wallis (1969) method allows computation of parameter H, which measures the intensity of long range dependence (long memory process) in a time series. The time series of length T is divided into *n* sub-series of length *m* and for each sub-series.

For each sub-series m = 1,…,n, we find the mean (E_m) and standard deviation ($S_m$and then subtract the sample mean $Z_{i,m} = X_{i,m} - E_m$, for i =1,…,m. After that we produce a time series taking the form of $W_{i,m} = \sum_{j=1}^{i} Z_{j,m}$ where i =1, …, m to find the range $R_m = \max\{W_{1,m}, \ldots, W_{n,m}\} - \min\{W_{1,m}, \ldots, W_{n,m}\}$.

The rescaling of range R_m by $\frac{Rm}{Sm}$ as well as the case of time series can define *R*, *S* and *H* follow formula below that:

- where R is the distance covered by the variable, k is a constant and T is the length of the time.

$$R = k \times T^{0.5}$$

- where *R/S* is the rescaled range, *m* is the number of observation, *k* is the constant and *H* is the Hurst exponent, can be applied to a bigger class of time series.

$$\frac{R}{S} = k \times m^H$$

- The Hurst exponent can be found as :

$$\log(R/S)m = \log k + H \log m$$

and define that:

- If *H* value = 0.5, then the time series follow a random walk and are independent.
- If *H* value = (0, 0.5) then the time series are anti-persistent processes that cover only a small distance compared to the random walk case.
- If *H* value = (0.5, 1), then time series are persistent processes covering a bigger distance than under a random walk (long memory process).

4.3.2 Test for Long Memory: Modified R/S Test

The modified R/S test was developed from the classical R/S test proposed by Hurst (1951) while studying hydrological time series of the River Nile. For a return series $\{x_1, x_2, \ldots, x_T\}$, Lo (1991) refined the classical test by defining (see equation (1))

$$Q_T = \hat{R} / \hat{\sigma}_T(q) \quad (1)$$

where

$$\hat{R} = \max_{o<i\le T} \sum_{t=1}^{i} (x_i - \bar{x}) - \min_{o<i\le T} \sum_{t=1}^{i} (x_i - \bar{x}),$$

$$\hat{\sigma}_T(q) = \hat{\sigma}^2 + 2\sum_{j=1}^{q} w_j(q)\hat{\gamma}_j,$$

and define that:

$w_j(q)$ = 1-|j/q|,

$\hat{\sigma}^2$ = the usual sample variance of data

$\bar{x}$ = the mean of data

$\hat{\gamma}_j$ = lag –j autocovariance for the data and the truncation lag q is determined by equation 2.

$$q = \text{int}\,[((3T)/2)^{1/3}((2\hat{\rho})/1-\hat{\rho}^2)^{2/3}] \quad (2)$$

where $\hat{\rho}$ is the first the first-order sample autocorrelation coefficient and int [ ] is the integer function. Under the null hypothesis of no long memory or no long range dependence, Lo (1991) advanced that the limiting distribution of the QT statistics in equation (1) is given by the distribution function of the difference between maximum and minimum of Brownian bridge on a unit interval. Therefore, it can easily obtain the p-value of the test.

4.3.3 Test for Long Memory: GPH Test

The GPH Test for Long Memory process was developed by Geweke and Porter-Hudak (1983), who proposed to estimate of the OLS estimator of d from the regression: (equation 3)

$$\ln[I(\xi)] = a - \hat{d}\ln[\sin^2(\frac{\xi}{2})] + e_\lambda, \lambda = 1,\ldots,v \quad (3)$$

where

$$I(\xi) = \frac{1}{2\pi T}\left|\sum_{t=1}^{T} e^{it\xi}(x_t - \bar{x})\right|^2 \quad (4)$$

And the equation 4 is Periodogram (estimator of spectral density) of x at a requency (ξ).

The bandwidth v is chosen such that for $T\to\infty$, $v\to\infty$ but $\frac{v}{T}\to 0$.

The Geweke and Porter-Hudak test considers that for non-rejection of the null hypotheses of no long memory process, the power of T has to be within (0.5,0.6) and the slope of regression d equal zero. The usual t-statistics can be employed to perform the test.

5. Data description

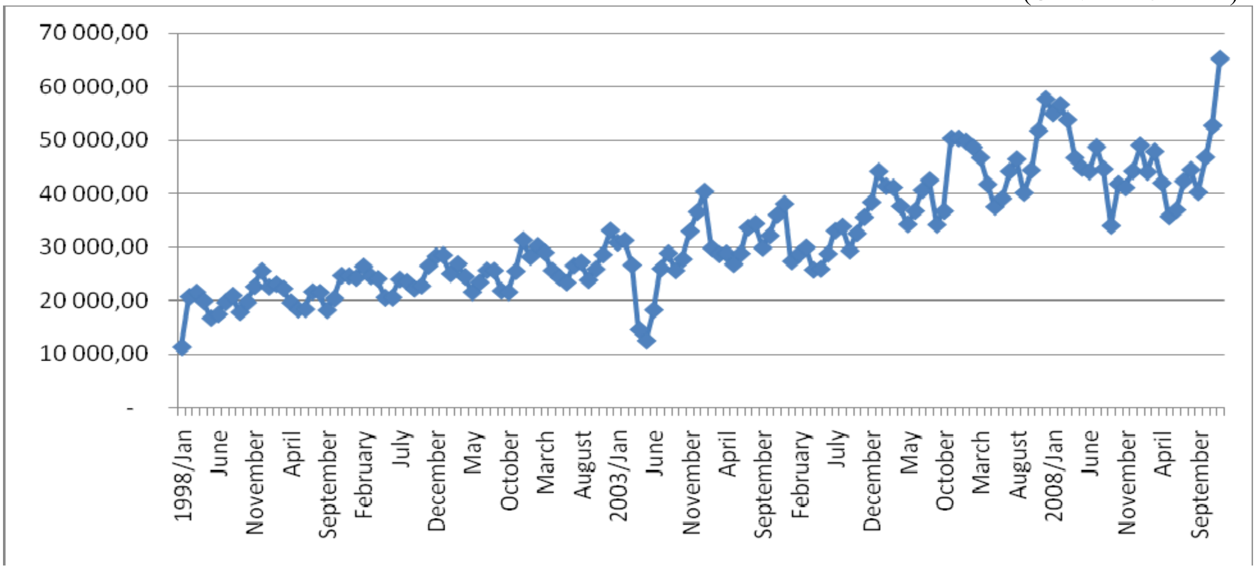
Figure (a) graphs nominal international tourist expenditures in Thailand for 1998-2009. In 1998, the value of international tourist expenditures in Thailand was 233.8 million baht; this figure rose stadily to 287.4 million baht in the year 2000, and then soared to 543.4 million baht in 2009.

From this graphical presentation we may conclude that the value of international tourists' expenditure in Thailand doubled during the period 1998-2009 but grew at an increasing rate.

In parallel fasion, figure (b) international tourist arrivals to Thailand during period 1998-2009. In 1998 the international tourist arrival to Thailand as about 7.4 million people and also in 2000 the international tourists arrival to Thailand grew up about 31% from 1998 to 2000. However, during 2008-2009 the Thai tourism industry suffered from negative impact factors such as the political instability of Thailand, the worldwide economic recession and the H1N1 epidemic. Consequently, international tourist arrivals to Thailand fell during this period. From this graphical presented that the number of international tourists arrival to Thailand still grew up more than 100% from period of 1998-2009.

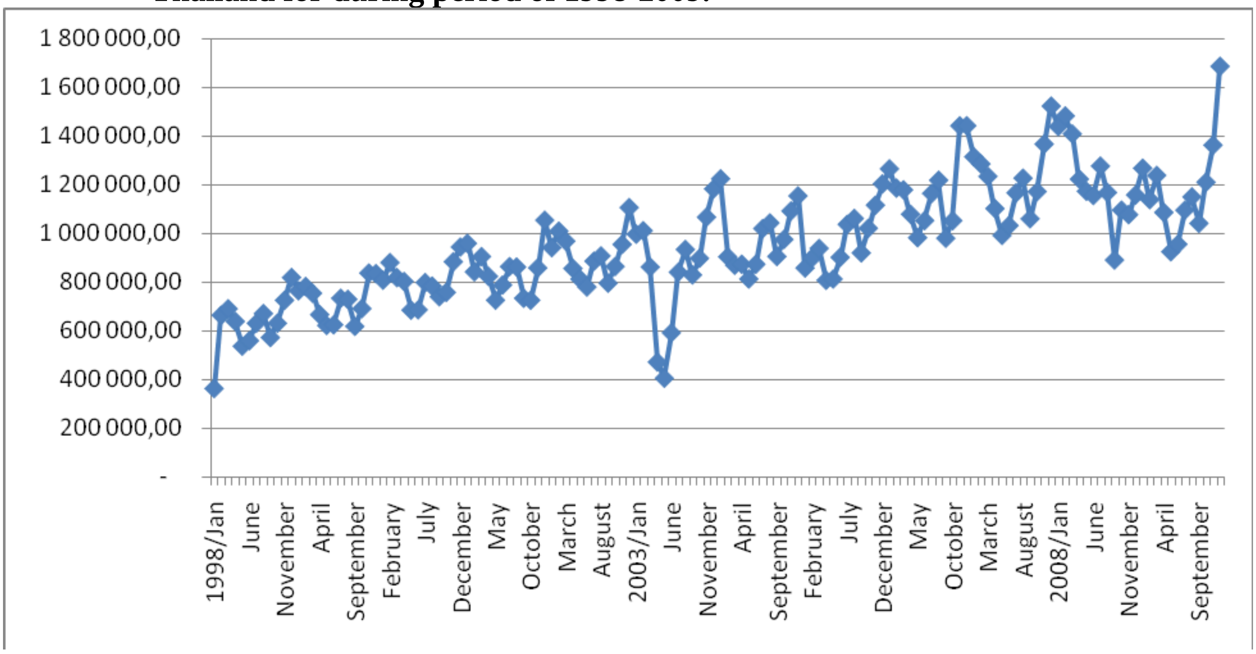
Figure (a): Graphical present the value of international tourists' expenditure in Thailand for during period of 1998-2009.

(Unit: Million Bath)



Source: Office of Tourism Development

Figure (b): Graphical present the number international tourists arrival to Thailand Thailand for during period of 1998-2009.



Source: Office of Tourism Development

6. The results of research

6.1 The results of various tests for unit root process

Table 1 (a) presents the results of both the ADF-unit root test (ADF-Test) and Phillip-Perron unit root test (PP-Test). Both tests confirm that both the expenditures of Thailand's international tourists and the number of international tourists arrivals to Thailand have no unit root; i.e., they represent stationary processes (see more detail at Table 1 (a)).

Table 1 (a): Results of the unit root tests

Variables	ADF-Test Constant with Trend	PP-Test Constant with Trend
Expenditure	-5.409050** [0.0001] I (0)	-4.598568** [0.0015] I (0)
Number of International Tourists arrival	-6.450534** [0.0000] I (0)	-5.410747** [0.0001] I (0)

Note: * : significant at 5% level, ** : significant at 1% level
Source : From computed

6.2 The results of various tests for Long Memory Process

This research conducted various long memory tests. All tests confirmed that international tourists' expenditure and the number of international tourist arrivals are stationary but exhibit long-memory process. Table 1 summarizes the results of various tests for long memory process based on R/S Test, Modified R/S Test and GPH Test of both international tourists' expenditure and the number of international tourist arrival to Thailand in during period of 1998-2009. (All data were collected from Tourism Authority of Thailand.)

Table 1: Results of Various Tests for Long Memory based on R/S Test, Modified R/S Test and GPH Test

The name of variables	R/S Test	Modified R/S Test	GPH Test
Expenditure	4.7891**	2.336**	3.1259**
The number of International Tourist Arrival to Thailand	4.2958**	2.2146**	2.3312*

Note: Null Hypothesis: no long-term dependence or no long memory process. For GPH test, Null Hypothesis: d = 0.
* : significant at 5% level, ** : significant at 1% level
Source : From computed

For each test, the test statistic and its corresponding statistical significant are given. If the values of the R/S Test, Modified R/S Test and GPH Test are significant at the 1% or 5% level, then we reject the null hypothesis of no long-term dependence or no long memory process in time series data. Otherwise, if the values of the R/S, Modified R/S and GPH tests are not statistically significant at the 5% level or better, then we accept the null hypothesis of no long-term dependence or no long memory process in the time series data. Because the statistical values of the R/S, Modified R/S and GPH tests are significance both the 1% level, all three tests confirm that both international tourist expenditures in Thailand and the number of international tourist arrivals to Thailand have long memory and a long-term dependence process.

6.3 The forecasting models' selection based on concept of the AIC (Akaike Information Criterion, 1973), BIC (Bayesian Information Criterion, 1978) and HQC (Hannan Quinn Criterion, 1979)

Table 2.1 shows the forecasting performance accuracy of each model based on an ARFIMAX (p,d,q) formulation for forecasting international tourist expenditures in Thailand during 2010 and 2011. The statistical values of model selection -- such as the Akaike Information Criterion (AIC), Bayesian Information Criteria (BIC) and HQC (Hannan Quinn Information Criteria)-- were used to select the best ARFIMAX (p,d,q) model for forecasting international tourists' expenditure in Thailand during specific period.

Table 2.1: Accuracy comparison in sample for different forecasting models based on ARFIMAX (p,d,q,X) models for during period of 1998 to 2009

	ARFIMAX (1,d,1)	ARFIMAX (1,d,0)	ARFIMAX (0,d,1)	ARFIMAX (0,d,0)	ARFIMAX (2,d,2)
Const	-28416.57	-18381.82	-10190.75***	-10721.58***	-4271.299
	[-0.161619]	[-0.254405]	[-10.56332]	[-12.29786]	[-1.376456]
d	0.093882***	0.071547***	-0.182033***	-0.199077***	0.093738***
	[3.569653]	[2.8396]	[-4.558471]	[-3.816576]	[3.268686]
X	0.030653***	0.031434***	0.044951***	0.045576***	0.030758***
	[30.4743]	[33.20335]	[42.20182]	[47.34331]	[27.36535]
AR (1)	1.002855***	1.004063***			1.857719***
	[62.11136]	[70.03725]			[33.94899]
MA (1)	0.164085*		0.80819***		-0.754281***
	[1.806694]		[17.48382]		[-7.524931]
AR (2)					-0.85545***
					[-15.42063]
MA (2)					-0.221394**
					[-2.27467]
log-likelihood	-1124.625	-1125.824	-1256.251	-1325.025	-1113.466
AIC	15.79895	15.80173	17.50348	18.44479	15.78122
BIC	15.90255	15.88461	17.58598	18.50666	15.92692
HQ	15.84105	15.83541	17.537	18.46993	15.84043

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

Source: From computed

We conclude from Table 2.1 that, during the specified period, the ARFIMAX (1, d, 0) model succeeds in achieving the minimum value of both the BIC and the HQC. Table 2.2 shows forecasting performance accuracy of each model based on ARFIMAX (p,d,q)-GARCH (p,q) model during the period

2010 to 2011. The statistical value of model selection criteria such as AIC, BIC and HQC were used to selected ARFIMAX (p,d,q)-GARCH (p,q) models for forecasting international tourist expenditures in Thailand.

Table 2.2: Accuracy comparison in sample for different forecasting models based onARFIMAX (p,d,q,X)-GARCH (p,q) models for during period of 1998 to 2009

	ARFIMAX (1,d,2)-GARCH (1,1)	ARFIMAX (1,d,0)-GARCH (1,1)	ARFIMAX (0,d,1)-GARCH (1,1)	ARFIMAX (0,d,0)-GARCH (1,1)	ARFIMAX (0,d,2)-GARCH (1,1)
Const	-11639.00***	-11624.06	-10457.94***	-10721.65***	-8118.407***
	[-3.499243]	[-0.093045]	[-15.63651]	[-10.29954]	[-5.661696]
d	-0.299603***	-0.077757***	-0.139717***	-0.252939***	-0.113173***
	[-3.043610]	[-8.964380]	[-6.216563]	[-4.275505]	[-3.002645]
X	0.047168***	0.041050***	0.045047***	0.045003***	0.042575***
	[13.14095]	[69.12065]	[55.56657]	[38.23065]	[28.32653]
AR (1)	0.789535***	1.001604***			
	[6.234810]	[36.90951]			
MA (1)	0.222118		0.845472***		1.222533***
	[0.793945]		[35.34642]		[19.12795]
AR (2)					
MA (2)	0.064702				0.697519***
	[0.618362]				[11.20008]
Const	3452980.00*	3452980.0***	3739494.0***	3739494.0***	2732834.0***
	[1.692988]	[6.679736]	[3.978046]	[2.657536]	[5.452617]
ARCH (1)	0.312908	-0.010108	-0.223546***	0.991874***	-0.023019
	[0.803551]	[-0.843111]	[-4.963567]	[2.842522]	[-0.666838]
GARCH (1)	-0.422453	-1.004197***	-0.268026	-0.373449***	-0.940958***
	[-0.632048]	[-268.4908]	[-0.928057]	[-2.798064]	[-9.948737]
log-likelihood	-1212.425	-1171.973	-1256.125	-1298.295	-1217.577
AIC	17.08287	16.48913	17.54341	18.11520	17.02191
BIC	17.26935	16.63417	17.68777	18.23895	17.18690
HQ	17.15865	16.54807	17.60207	18.16549	17.08895

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

Source: From computed

From table 2.2, we conclude from the minimum values of the AIC, BIC and HQC criteria that the ARFIMAX (1, d, 0)-GARCH (1,1) is the best model to forecast international tourist expenditures in Thailand during the specified period.

Table 3: Forecast the expenditure of international tourist arrivals to Thailand during period of 2010 to 2011 based on ARFIMAX (1,d,0) (MAE: Mean Absolute Error, MAPE (%): Mean Absolute Percentage Error)

(Unit: Million Bath)

Month/Year	2010 (Actual)P	2010 (Forecast)	MAE	MAPE (%)
January	62,470.76	47,976.74	14,494.02	23.20
February	62,834.15	44,493.97	18,340.18	29.19
March	56,007.60	47,637.57	8,370.03	14.94
April	43,120.80	42,633.52	487.28	1.13
May	31,303.07	36,732.20	5,429.13	17.34
June	36,727.48	37,142.42	414.94	1.13
July	48,651.75	41,832.61	6,819.14	14.02
August	48,698.48	44,131.27	4,567.21	9.38
September	46,371.60	40,718.53	5,653.07	12.19
October		46,235.43		
November		51,862.98		
December		63,558.97		
Total	**436,185.68**	**544,956.21**	**12,915.00**	**13.61**
Month/Year	**2011 (Actual)**	**2011 (Forecast)**	**MAE**	**MAPE (%)**
January		47,890.64		
February		43,599.79		
March		47,985.52		
April		42,534.64		
May		37,424.74		
June		38,018.33		
July		41,923.23		
August		43,623.74		
September		40,491.22		
October		46,534.84		
November		51,262.57		
December		62,597.37		
Total	-	**543,886.63**	-	-

Source: From computed

Table 4: Forecast the expenditure of international tourist arrivals to Thailand during period of 2010 to 2011 based on ARFIMAX (1,d,0)-GARCH (1,1) (MAE: Mean Absolute Error, MAPE (%): Mean Absolute Percentage Error)

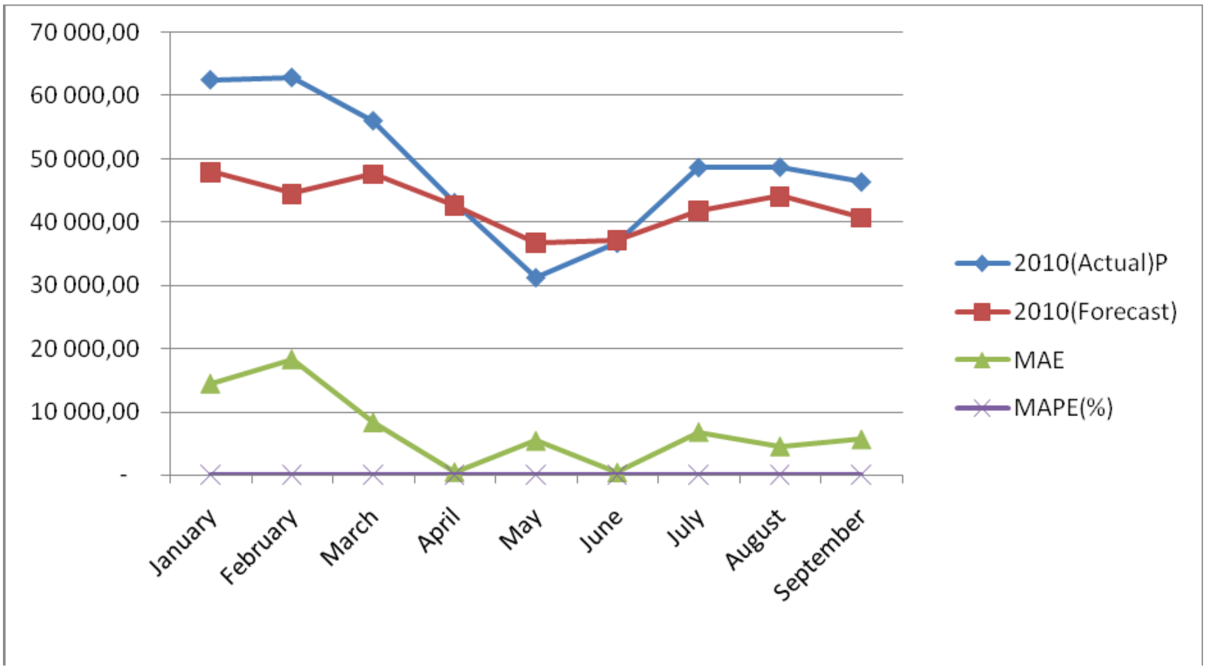
Month/Year	2010 (Actual)P	2010 (Forecast)	MAE	MAPE (%)
January	62,470.76	48,445.12	14,025.64	22.45

February	62,834.15	44,311.76	18,522.39	29.48
March	56,007.60	47,664.71	8,342.89	14.90
April	43,120.80	42,204.89	915.91	2.12
May	31,303.07	35,640.99	4,337.92	13.86
June	36,727.48	36,628.36	99.12	0.27
July	48,651.75	42,221.09	6,430.66	13.22
August	48,698.48	44,600.25	4,098.23	8.42
September	46,371.60	40,430.42	5,941.18	12.81
October		46,543.52		
November		52,795.25		
December		65,245.82		
Total	**436,185.68**	**546,732.18**	**12,542.79**	**13.06**
Month/Year	**2011 (Actual)**	**2011 (Forecast)**	**MAE**	**MAPE (%)**
January		48,447.24		
February		44,017.94		
March		47,939.52		
April		42,276.10		
May		36,066.66		
June		36,534.91		
July		41,885.39		
August		44,580.58		
September		40,810.33		
October		46,647.68		
November		52,580.95		
December		65,264.34		
Total	-	**547,051.64**	-	-

Source: From computed

Figure 1: Graphical presentation of forecasting international tourists' expenditure in Thailand for during period of 2010 based on ARFIMAX (1,d,0,)

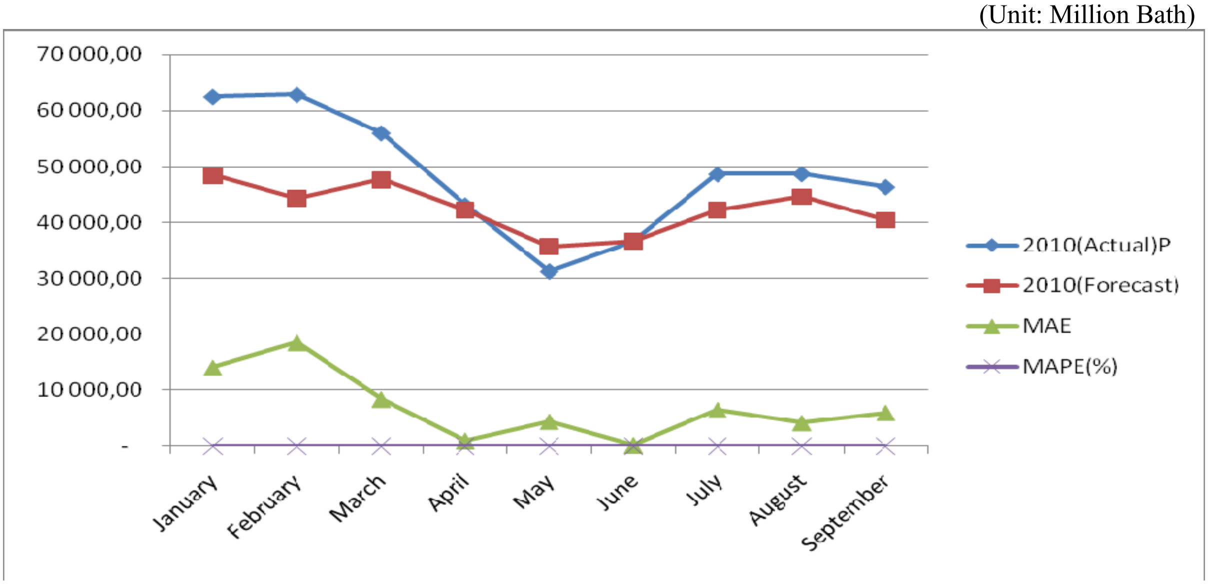
(Unit: Million Bath)



Source: From computed

Figure 2: Graphical presentation of forecasting international tourists' expenditure in Thailand for during period of 2010 based on ARFIMAX (1,d,0,)-GARCH (1,1)

(Unit: Million Bath)



Source: From computed

7. Conclusion

The conclusion of this research shows that during the next one and a half years (2010-2011) the expenditure by international tourists in Thailand will decline, as predicted by the Tourism Council of Thailand (TCT) because of negative factors effecting to tourism industry of Thailand such as the world economic slowdown, and the instability of Thailand's political conflicts. Even though the the tourist industry has helped the Thailand economy, it is not yet benefiting its poor people. Inequalities in terms of sharing of affluence should be minimized and the country should implement more effective tourism strategies in order to help this service sector. This will help reduce the poverty levels and increase economic development as considered by international tourist expenditures. It will also contribute to improving the economic performance of Thailand as compared to other Asian economies.

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