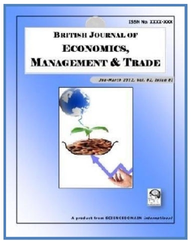

British Journal of Economics, Management & Trade
2(2): 125-166, 2012

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Border Tourism Demand from GMS Countries to Thailand: X12ARIMA and TRAMO/SEAT Model

Jintanee Jintranun[1&2*], Songsak Sriboonchitta[1], Peter Calkins[1] and Chukiat Chaiboonsri[1]

[1]Faculty of Economics, Chiangmai University, Thailand.
[2]School of Management Walailak University, Thailand.

Research Article

Received 1st February 2012
Accepted 29th March 2012
Online Ready 19th May 2012

ABSTRACT

Aims: To find out suitable tourism forecasting models of each border checkpoints under the concern of seasonal adjustment.
Study Design: Time series study.
Place and Duration of Study: We used secondary time series data from immigration Bureau office 2004-2010.Three GMS countries of origin (Myanmar, Laos PDR and Cambodia) for border tourists to Thailand with 12 immigration border checkpoints, selected on the basis of the number of tourists. The time series from January 2004 to December 2010 that is 84 observations per border checkpoint.
Methodology: The first stage of this methodology applies unit roots test in Thailand border tourism demand and the second stage develops a forecasting model to estimate the number of border tourists' demand in each border check point by X12ARIMA and TRAMO/SEAT.
Results: The results reveal that there are existences of unit root in data series. And we require X12ARIMA to modeling six from twelve data series and TRAMO/SEAT model also shows the suitable model for each border.
Conclusion: However both X12ARIMA and TRAMO/SEAT are seasonal adjustment models, the results still have difference in some data series. The user should concern about using the most suitable model or use together by weighting the result.

Keywords: Tourism demand; GMS; Thailand; X12ARIMA; TRAMO/SEAT.

**Corresponding author: Email: jintanee@hotmail.com;*

1. INTRODUCTION

Tourism is one of the most important potential sectors for economic development in poorer nations. The case of Thailand, where 6.5 % of GDP came from the tourism sector in 2009, proves the importance of that sector. It has been essential not only for growth in GDP but also for building the labour market, where tourism generated employment for about 5,486,700 employees in 2008. The figure has increased from 1.6 million to 5.6 million employees in 2010, or it took about 15.3% of Thai labor force. [1]Among many groups, one group of tourists comes from border countries. Time series data shows that border tourists are increasing over the year (Figure 1). The data reflection can presume the importance of border tourism in Thailand. In the era of regional integration such as ASIAN and GMS, there exists the investment in infrastructure that supports many economic sectors including border tourism.

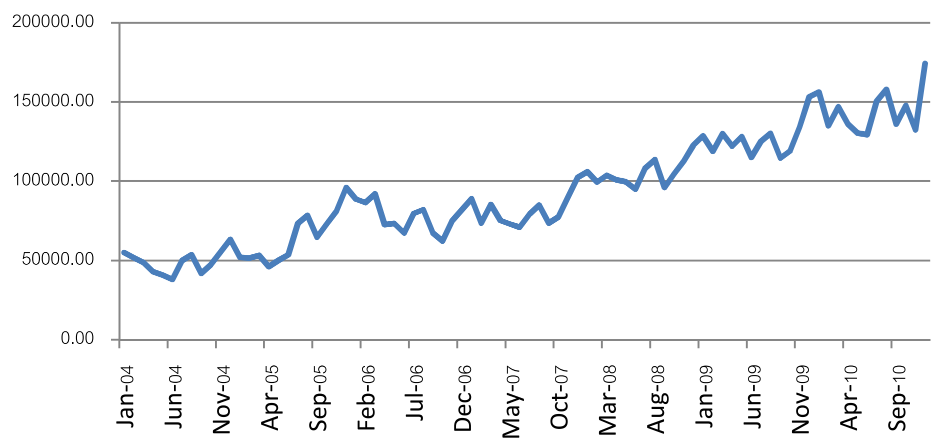

Fig. 1. Border tourists' arrival to 12 main immigration border checkpoints of Thailand
Source: http://www.immigration.go.th/nov2004/base.php?page=stat

The Greater Mekong Sub-region or GMS was launched in 1992, through the support of the Asian Development Bank (ADB), to create a new economic area covering the watershed of the Mekong River and comprising Cambodia, Laos, Myanmar, Thailand, Vietnam and two provinces of southern China - Yunnan and Guangxi (Figure 2). The program is designed to improve economic relations among the countries by promoting economic growth and development in the sub-region that cover transportation, trade, investment, energy, telecommunication, the environment, human resources, tourism and agriculture.

The GMS countries in the border of Thailand are Myanmar, Laos PDR and Cambodia that have immigration checkpoints in the border. Road, bridge and water transportation lead to different forms of data, needed for separate model. Figure 2 and Table (1) gives us more clear understanding for the border tourism behavior. The figure and table have presented the physical background of each immigration border checkpoint for both border countries and the kinds of transportation mode.

[1]Source: http://www.dsd.go.th, 2010

Fig. 2. Thailand map and border countries
Source: http://depdcblog.wordpress.com/

Table 1. Immigration checkpoints and transportation infrastructure

Border Country	Immigration border checkpoint/boundary post	Transportation Infrastructure
Cambodia	AranyaPrathed	Road
	KlongYai	Road
	Pong Nam Ron	Road
Laos PDR	PiboonMungsaharn	Bridge/boat
	NongKhai	Bridge/boat
	Mukdahan	Bridge/boat
	NakhonPhanom	Boat
	Chiang Khong	Boat
	Chiang San	Boat
Myanmar	Ranong	Boat
	Mae Sai	Bridge
	Tak	Road

Source: From observation

Regarding forecasting of international tourism for a particular country, lots of articles have been observed. Many economists and researchers are working with time series data on tourism. Among them, some of authors are as follows; Witt et al. (2003), Turner et al. (2001), Kulendran and Shan (2002), Chu (2004), Kim (2001) and Lim and McAleer (2000), Goh, and Law (2002) Chan et al. (2005), Chen & Wang (2007) and Rangaswamy et al. (2006).

Authors were finding the best way of forecasting international tourism. Witt (2003) used CI/ECM Naïve1 ADLM ARIMA SR VAR TVP and tested for forecasting accuracy and directional change, Lim and McAleer used MA technique to estimate seasonal components. On the other hand, Chan et al. applied ARIMA GARCH Modelling multivariate tourism demand and volatility while Chen and Wang Forecasting with GA-SVR in China.

For seasonal adjustment method, X12ARIMA and TRAMO/SEAT are the worldwide well known methods in financial sector such as TRAMO/SEAT by Maravall (2002) in Japan and Rufino (2010) in Philippines. In tourism sector, there was research by Chaitip et al. (2009). They employed X12ARIMA to adjusted seasonal effect and forecast overall Thailand and India tourism demand. Therefore, our paper contributes the most updated method for forecasting international tourism demand in tourism sector.

Even though the previous researchers in tourism sector applied only one method, we had tried to apply TWO methods of seasonal adjustment model: X12ARIMA and TRAMO/SEATS in our study so as to find out the suitable forecasting model for tourists' arrival at border immigration checkpoints in Thailand.

Section 2 of this paper presents the aim and objective of this research. In section 3, we introduce the technical model for seasonal unit root and forecasting model. Sections 4 and 5 give the empirical results, conclusions and policy implications of the findings.

2. MATERIALS AND METHODS

2.1 Unit Root Test

As usual of time series data forecasting model, we have started with stationary tests. ADF test (1979) and PP test (1987, 1988) have applied to test the unit root of time series data. In addition, KPSS Test (1992), ERS Point Optimal Test and Ng and Perron (2001) also fill up to get the accuracy of decision making the data.

ADF Test: An augmented Dickey-Fuller test is an augmented version of Dickey-Fuller test. The testing procedure for ADF is

$$\Delta yt = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

Where α is a constant, β the coefficient on a time trend and *p* the lag order of the autoregressive process. Imposing the constraints α = 0 and β = 0 corresponds to modelling a random walk and using the constraint β = 0 corresponds to modelling a random walk with a drift.

Null hypothesis of ADF test is there are existence of unit root (α<Mackinnon statistics; time series data has unit root, α>Mackinnon statistics; time series data is stationary)

DF-GLS test that was proposed by Elliott, Rothenberg and Stock (ERS, 1996) is the alternative way that has a good performance in terms of small sample size and power with following proceed.

$$\Delta y_t^d = \alpha + \gamma t + \rho y_{t-1}^d + \sum_{i=1}^{m} \rho_i \Delta y_{t-i}^d + \varepsilon_t$$

Null hypothesis of DF-GLS test: there are existence of unit root (α< Critical value for DF-GLS test; time series data has unit root, α>Critical value for DF-GLS test; time series data is stationary)

KPSS test: The alternative test which was proposed by Kwiatkowski Phillips Schmidt and Shin (1992) has been presented as follows;

From $Y_t = X_t + \varepsilon_t$

Y_t is time series data

X_t is random walk $X_t = X_{t-1} + \varepsilon_t$

ε_t is stationary random error

$KPSS = T^2 SS_t^2 / (s^2(L))$

T is Sample size

$S_t = \sum_{i=1}^{t} \varepsilon_t$, t=1, 2, ….T

W(s,L) = (1-s)/(L+1) is estimation

L = the number of truncation is chosen

Null hypothesis of KPSS is there are no existence of unit root or stationary and we reject Ho when KPSS statistics > Quantities of distribution of KPSS statistics table.

ERS point optimal test was proposed by Elliott, Rothenberg, and Stock (1996) and is based on quasined differencing regression. The test starts by following equation;

$$d(Y_t|a) = d(X_t|a)'\delta(a) + \varepsilon_t$$

Where $d(Y_t|a)$ and $d(X_t|a)'$ are quasined difference data for Y_t and X_t

ε_t is error term that is independent and identify distribute

Y_t is time series data

X_t contain constant only or constant and time trend

And $P_{(T)}$ statistic for test is

$P_{(T}$ statistics = ((SSR(a^*))-(a^*)SSR(1))/f_0

Where SSR is sum square residual from equation

$F_0 = \sum^{T-1} j = T - 1\gamma^*(j).k(j/t)$ is frequency zero spectrum estimation

J= the jth sample autocovarience of ε_t

T is truncation lag in covariance weighting

$$\gamma^*(j) = \sum_{t=j+1}^{T} (\varepsilon_t \, \varepsilon_{t-j}) \;/T \,, \qquad T = the\ number\ of\ observation$$

K= the kernel function

And where,

Bartlett k(x) = $[1 - |x| if |x| < or = 1, 0\ 0therwise]$

Parzen k(x) =$\left[1 - 6x^2 + 6|x|^3 if\ 0 < or = \ |x| or = (\frac{1}{2})\right]$

$[2(1 - |x|^3)$ if ½ $< |x| < or = 1$, 0 otherwise$]$

Quardratic spectral

k(x) = 25/(12p²x²)*(sin(6px/5)/(6px/5)) – cos(6px/5))

Null hypothesis of ERS is there are unit root when $P_{(T)}$ statistic > critical ERS test statistic provided by ERS (1996)

NP Test proposed by Ng and Perron (2001) as four statistics was used for testing unit root that are MZ^d_a, MZ^d_t, MSB^d,MP^d_t

Where $MZ^d_a = (T^{-1}(Y^d_t)^2 - f_0)/(2k)$

,$MZ^d_t = MZ^d_a - MSB^d$

$MSB^d = (k/f_0)^{1/2}$

$$MP^d_t = \left\{ \frac{\left(c^{*2}k - c^* T^{-1}\left(Y^d_t\right)^2\right)}{f_0} if x_t = 1\ or z^* = 1, \frac{\left(c^{*2}k - (1-c^*) T^{-1}\left(Y^d_t\right)^2\right)}{f_0} if x_t = (1,t) or z^* = (1,t) \right\}$$

Where

$C^* = \{-7\ if x_t = 1\ or z^* = 1, -13.5\ if x_t = (1,t) or z^* = (1,t)\}$

$$f_{0 = \sum_{j=-(T-1)}^{T-1} \gamma^*(j).k(\frac{j}{t})}$$

Where j = the j-th sample autocovarience of the ε_t

T = a truncation lag in the covariance weighting

$\gamma^*(j) = \frac{\sum_{t=j+1}^{T}(\varepsilon_t \varepsilon_{t-j})}{T}$, T =The number of observation or f_0 = kernel or some of covariance estimator and auto regressive spectral density estimators.

The null hypothesis of NP test is there are existence of unit root when MZ^d_a, MZ^d_t> critical value of NP test and MSB^d, MP^d_t< critical value of NP test.

2.2 Seasonal Adjustment Model

2.2.1 X12 ARIMA

The package seasonal adjustment is X-12-ARIMA developed by the Census Bureau in the United States. It is the primary method used for seasonal adjustment of government and economic time series in the United States, Canada, and the European Union (Miller and Williams, 2003) and especially used in Central bank. It consists of three steps that are built upon one another (Chaitip et al., 2009)

“1. A regress-ARIMA model is built for the time series as well as this technique combines the tools of regression analysis with the ARIMA approach to pre-adjust various effects such as outliers, trading day and holiday effects.

2. Carries out the actual seasonal adjustment which decomposes the pre-adjusted series, i.e. the output from the reg-ARIMA step, into three elements – trend, seasonal, and irregular components.

3. And the final step of the program tests the quality of seasonal adjustment.”

The general model is following;

$$\emptyset(B)\emptyset(B^s)(1-B)^d(1-B^s)^D Z_j = \theta(B)\rho(B^s)a_t$$

Where B is the backship operator ($B_{zt} - Z_{t-1}$)

S = Seasonal period

$\emptyset(B) = \left(1 - \emptyset_{\mathbf{1}}\boldsymbol{B} - \cdots \emptyset_{\boldsymbol{p}}\boldsymbol{B}^{\boldsymbol{p}}\right)$ is the non seasonal AR operator

$\Phi(B^s)$=(1- Φ_1B-….. $\Phi_p B^s$) is the seasonal AR operator

$\theta(B) = \left(1 - \boldsymbol{\theta}_{\mathbf{1}}\boldsymbol{B} - \cdots \boldsymbol{\theta}_{\boldsymbol{q}}\boldsymbol{B}^{\boldsymbol{q}}\right)$ is the non seasonal moving average (MA) operator

$\rho(B) = \left(1 - \boldsymbol{\rho}_{\mathbf{1}}\boldsymbol{B}^{\boldsymbol{s}} - \cdots \boldsymbol{\theta}_{\boldsymbol{Q}}\,\boldsymbol{B}^{\boldsymbol{Q_s}}\right)$ is the seasonal moving average operator

$(1-B)^d(1-B^s)$ = non seasonal differencing of order d and seasonal differencing of orderD
From linear regression equation

$$Y_t = \sum_i \beta_i x_{i,t} + Z_t$$

Where,

Y_t = the (dependent) time series

$X_{i,t}$= regression variables observed concurrently with Y_t

β_i = regression parameters

$$Z_t = Y_t - \sum_i \beta_i x_{i,t}$$

Then, the model can rewrite to

$$\emptyset(B)\Phi(B^s)(1-B)^d(1-B^s)^D\left(Y_t - \sum_i \beta_i x_{i,t}\right) = \theta(B)\rho(B^s)a_t$$

When the error series Z_t is difference to get a stationary series, w_t is assumed to the stationary ARIMA model.

$$\emptyset(B)\Phi(B^s)w_t = \theta(B)\rho(B^s)a_t$$

And another way to write ARIMA regression model is

$$(1-B)^d(1-B^s)^D Y_t = \sum_i \beta_i(1-B)^d(1-B^s)^D x_{i,t} + w_t$$

2.2.2 TRAMO/SEAT model

The alternative model which was used in our study for forecasting is TRAMO and SEATS. TRAMO is Time series Regression with ARIMA noise, Missing observation and Outlier and SEATS is Signal Extraction in ARIMA Time series. Both programs are widely used in European central bank.

The process starts from TRAMO which is the program for estimation and forecasting model with possibly ARIMA noise and any sequence of missing value.

The general multiplicative model is

$$\emptyset_p(B)\Phi_p(B^s)x_t = \theta_q(B)\boldsymbol{\Theta_Q}(B^s)a_t$$

The following model is default called Airline model, popularized by Box-Jenkins (1970).

$$\Delta\Delta_s x_t = (1+\theta_1 B)(1+\theta_s B^s)a_t, -1 \le (\theta_1, \theta_s) \le 1$$

When the process of TRAMO is finished, the next step is SEATS which is the program for decomposing a time series into its unobserved component and also ARIMA is the base method of SEATS which was originally proposed by Berman for the bank of England.

The SEATS composes the following steps in the model;

$$\emptyset_r(B)\Phi_s(B^s)\Delta^d {\Delta_s}^D x_t = \theta_r(B)\theta_s(B^s)a_t + c$$

If we set $\Phi(B) = \emptyset(B)\delta(B)$ then $\Phi(B)x_t = \theta(B)a_t + c$

If p denotes the order of $\emptyset(B)$ and q the order of $\theta(B)$ then the order of $\Phi(B)$is P = p+d+D_s
And $x_t = \sum_i x_{it}$ where x_{it} represents components that are trend-cycle, seasonal, transitory and irregular.

3. RESULTS AND DISCUSSION

Table 2 presents the data description of tourists' arrival at 12 border immigration checkpoints. The data period covers from January 2004 to December 2010. The result shows that NongKhai has the highest tourist arrivals and followed by Aranyan Phrades and Mukdahan. When tourist arrival has been considered by country, border of Laos PDR (NongKhai, Mukdahan, Nakhon Panom, Chiang San and Chiang Khong) have taken highest tourists arrivals. However tourist arrivals in the borders of Cambodia (Aranya Phrades, Klongyai, Pong Numron and Piboon Mungsaharn) took only moderate among three countries while the borders of Myanmar have the lowest tourist arrival (Ranong, Maesai, Tak).

This result explains the relationship of tourism attraction and government stability. In Laos PDR, there is an attractive place (both heritage and natural) in border that attracts tourists to border. Moreover, infrastructure in border is convention for tourists to across country. Though there is an attraction place in Laos, there might not be the highest tourist arrivals if the border city is not charming to the tourists. However, in our case, NongKhai is the famous city in the world as the 7th Best Living Town in the World (ranked by Modern Maturity Magazine). As a result, tourist arrival in that city is higher than that of other immigration checkpoints.

When the standard deviation has been checked, we have presented that NongKhai has highest standard deviation followed by Mukdahan and Aranya Phrades. One of the reasons of Mukdahan has the high standard deviation is there is a bridge foundation name Thai-Laos friendship bridge number 2. This project leads to have more convention transportation and increasing border tourist arrivals. The other statistic of data description has been shown in table 2.

3.1 Unit Root Test

The first step to find out the suitable forecasting model is checking the stationary of data series. Since we have applied five methods of unit root testing to test the stationary in the each data series, the Table 3 shown in this section reports the results of those tests.

Table 3 presents the results of the unit root test at level *I (0)* from various methods. ADF test shows that there are unit root in 6 data series from 12, ERS has unit root in 8 data series, KPSS, NP and PP have the existence of unit root in 4 data series and DF test find only 3 data series. The results reveal that only Aranya Phrades data series has unit root in every standard test. While data for Klong Yai, Nakhon Phanom and Tak do not exist unit root in all test. The data for Pong Nam Ron, Piboon Mungsaharn, NongKhai, Mukdahan, Chiang Khong, Chiang San, Ranong and Mae Sai are probably to have unit root. Table 3 shows the result after difference I(1). However, almost all data series have stationary at the 1^{st} differential I(1) but some data need to be checked in higher difference. That is ERS test for Aranya Phrades, NongKhai, Mukdahan and Chiang Khong, KPSS and DF test for Aranya Phrades and NP test for Aranya Phrades and Mukdahan.

According to the result, we can conclude that only Klong Yai, Nakhon Phanom and Tak have no unit root while there is the existence of unit root in the other data series. When we compare with the previous study that focused on checking unit root for Thailand international tourists, we found that most of papers show the existence of unit root in data series.

Table 2. Data description

	Aranya Phrades	**KlongYai**	**Pong Nam Ron**	**Piboon Mungsaharn**	**NongKhai**	**Mukdahan**	**Nakhon Phanom**	**Chiang Khong**	**Chiang San**	**Ranong**	**Mae Sai**	**Tak**
Mean	22,678.17	2,516.91	3,484.25	4,556.41	34,424.47	11,362.91	2,706.57	2,626.17	187.26	3,848.89	5,567.12	438.81
Median	22,567.00	2,250.00	3,398.00	4,128.00	26,380.00	6,316.00	2,849.00	2,304.00	187.00	3,379.00	5,125.00	442.00
Maximum	42,630.00	5,068.00	9,589.00	10,972.00	80,963.00	72,685.00	5,932.00	5,815.00	442.00	9,790.00	11,120.00	727.00
Minimum	11,880.00	74.00	44.00	409.00	9,893.00	230.00	248.00	664.00	11.00	53.00	2,949.00	53.00
Std. Dev.	5,031.26	1,074.18	2,089.22	2,709.65	19,899.69	16,579.36	1,283.47	1,358.20	84.04	1,812.16	2,080.25	133.83
Skewness	0.60	0.39	0.08	0.37	0.52	2.85	-0.21	0.46	0.31	1.05	0.83	0.00
Kurtosis	4.75	2.26	2.68	2.16	2.01	10.07	2.46	2.16	3.36	4.26	2.81	3.05
Jarque-Bera	15.29	3.86	0.45	4.27	6.94	277.88	1.55	5.22	1.77	20.30	9.32	0.01
Probability	0.00	0.15	0.80	0.12	0.03	0.00	0.46	0.07	0.41	0.00	0.01	1.00
Sum	1,836,932.00	203,870.00	282,224.00	369,069.00	2,788,382.00	920,396.00	219,232.00	212,720.00	15,168.00	311,760.00	450,937.00	35,544.00
Sum Sq. Dev. (1,000)	2,030,000.00	92,309.76	349,000.00	587,000.00	31,700,000.00	22,000,000.00	132,000.00	148,000.00	564.95	263,000.00	346,000.00	1,432.81

Source: From Calculation

Table 3. Unit root test at I(0)

Immigration border checkpoint	ADF H0 : Unit Root	DF H0 : Unit Root	PP H0 : Unit Root	KPSS H0 : stationary	ERS H0 : Unit Root	NP H0 : Unit Root			
						MZa	MZt	MSB	MPT
Aranya Phrades	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)
Klong Yai	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Pong Nam Ron	I(d)	I(0)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)
Piboon Mungsaharn	I(0)	I(0)	I(0)	I(0)	I(d)	I(0)	I(0)	I(0)	I(d)
NongKhai	I(d)	I(d)	I(0)	I(0)	I(d)	I(d)	I(d)	I(d)	I(d)
Mukdahan	I(d)	I(d)	I(0)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)
Nakhon Phanom	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Chiang Khong	I(d)	I(0)	I(0)	I(d)	I(d)	I(0)	I(0)	I(0)	I(0)
Chiang San	I(0)	I(0)	I(0)	I(0)	I(d)	I(0)	I(d)	I(0)	I(d)
Ranong	I(d)	I(0)	I(d)	I(0)	I(d)	I(d)	I(d)	I(d)	I(d)
Mae Sai	I(0)	I(0)	I(d)	I(d)	I(0)	I(0)	I(0)	I(0)	I(0)
Tak	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)

Source: From Calculation

Table 4. Unit root test at I(1)

Immigration border checkpoint	ADF H0 : Unit Root	DF H0 : Unit Root	PP H0 : Unit Root	KPSS H0 : stationary	ERS H0 : Unit Root	NP H0 : Unit Root			
						MZa	MZt	MSB	MPT
Aranya Phrades	I(1)	I(d)	I(1)	I(d)	I(d)	I(d)	I(d)	I(d)	I(d)
KlongYai	I(1)	I(1)	I(1)	I(1)	I(0)	I(0)	I(0)	I(0)	I(0)
Pong Nam Ron	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Piboon Mungsaharn	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(0)	I(0)	I(0)
NongKhai	I(1)	I(1)	I(1)	I(1)	I(d)	I(1)	I(1)	I(1)	I(1)
Mukdahan	I(1)	I(1)	I(1)	I(1)	I(d)	I(d)	I(d)	I(d)	I(d)
Nakhon Phanom	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Chiang Khong	I(1)	I(1)	I(1)	I(1)	I(d)	I(1)	I(1)	I(1)	I(1)
Chiang San	I(1)	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)	I(1)	I(1)
Ranong	I(1)	I(1))	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Mae Sai	I(0)	I(0)	I(1))	I(1)	I(0)	I(0)	I(0)	I(0)	I(0)
Tak	I(1)	I(1))	I(1))	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Source: From Calculation

3.2 Seasonal Adjustment Model Forecasting

Since most of tourism demand studies concern with seasonal effect, our study also takes a seasonal adjustment model for forecasting. However, not only X12ARIMA but also TRAMO/SEAT has been applied.

3.2.1 X12ARIMA model

Firstly we employ X12ARIMA model to find out the suitable model with seasonal adjustment. According to previous studies, there mostly exist of seasonal affect in tourism demand model (Chaiboonsri, 2009; Chang, 2009). The result from X12ARIMA model presents in Table 5.

The result reveals that six of twelve data series can be employed in X12ARIMA for forecasting Aranya Phrades, KlongYai, Chiang Khong , Ranong, Mae Sai and Tak. That means 50% of border checkpoint needs seasonal adjustment model. Since the left 6; Pong Nam Ron, Piboon Mungsaharn, NongKhai, Mukdahan, Nakhon Phanom and Chiang San don't have seasonal effect, there is no need to be adjusted seasonal in their series (The models were rejected).

When we consider six border immigration checkpoints that can be employed, X12ARIMA model is to forecast and consider AAPE (Average Absolute Percentage Error) to choose the most suitable model. The result shows that X12ARIMA (2,1,0)(0,1,1) is the best model for Aranya Phrades in 2011, 2012 and 2013. And it is also the best model for Klong Yai in 2011 and 2012 but for 2013 X12ARIMA (0,2,2)(0,1,1) is more preferable one as same as Chiang Khong in 2011.

While X12ARIMA(2,1,2)(0,1,1) is suitable to forecast Mae Sai data series in 2011 2012 and 2013, Ranong in 2011 and 2012, Tak 2011 and Chiang Khong in 2012. ARIMA(0,1,1)(0,1,1) is the best model for Tak 2012 and 2013, Chiang Khong 2011. ARIMA(0,1,2)(0,1,1) is for Ranong 2013. We have Table 5. for the detail result so as to get more clear understanding of the model . The forecasting value of 6 border data series presents in Table 6.

3.2.2 TRAMO/SEAT model

The alternative method of our research selects to forecast border tourism demand is TRAMO/SEAT. As we presented in previous literature, this method has ability to forecast data series which composes missing data and outlier. The result from this method has been shown in Table 7.

The results in Table 7 are from the best models that automatically choose by TRAMO/SEAT. The result points out that two of three series of Cambodia have same frequency which are Aranya Phrades, KlongYai (0,1,0)(0,1,1) while Pong Nam Ron is the differ one (1,1,0)(0,0,0). For data series, it can be said at borders of Laos PDR have the same frequency in four of six. Those are Piboon Mungsaharn, NongKhai, Chiang Khong and Chiang San. While Mukdahan and Nakhon Phanom have non seasonal effect and need only ARIMA Model that are (2,1,0)(0,0,0) and (0,1,1)(0,0,0) respectively. In the group of Myanmar border series, the model has seasonal adjustment but different. The best model for Ranong is (1,1,0)(0,1,1), whereas Mae Sai is (0,1,0)(0,1,1) and Tak is (1,0,0)(0,1,1).

Table 5. X12 ARIMA Forecasting model

Border country	immigration border checkpoint	Forecasting Model for 2011	Forecasting Model for 2012	Forecasting Model for 2013
Cambodia	Aranya Phrades	X12ARIMA (2,1,0)(0,1,1)	X12ARIMA (2,1,0)(0,1,1)	X12ARIMA (2,1,0)(0,1,1)
	Klong Yai	X12ARIMA (2,1,0)(0,1,1)	X12ARIMA (2,1,0)(0,1,1)	X12ARIMA (0,2,2)(0,1,1)
	Pong Nam Ron	The model was reject	The model was reject	The model was reject
	Piboon Mungsaharn	The model was reject	The model was reject	The model was reject
	NongKhai	The model was reject	The model was reject	The model was reject
Laos PDR	Mukdahan	The model was reject	The model was reject	The model was reject
	Nakhon Phanom	The model was reject	The model was reject	The model was reject
	Chiang Khong	X12ARIMA(0,2,2)(0,1,1)	X12ARIMA(2,1,2)(0,1,1)	X12ARIMA(0,1,1)(0,1,1)
	Chiang San	The model was reject	The model was reject	The model was reject
Myanmar	Ranong	X12ARIMA(2,1,2)(0,1,1)	X12ARIMA(2,1,2)(0,1,1)	X12ARIMA(0,1,2)(0,1,1)
	Mae Sai	X12ARIMA(2,1,2)(0,1,1)	X12ARIMA(2,1,2)(0,1,1)	X12ARIMA(2,1,2)(0,1,1)
	Tak	X12ARIMA(2,1,2)(0,1,1)	X12ARIMA(0,1,1)(0,1,1)	X12ARIMA(0,1,1)(0,1,1)

Source: From Calculation

Table 6. X12ARIMA forecasting Result

	Aranya Phrades	KlongYai	Chiang Khong	Ranong	Mae Sai	Tak
2011						
Jan	24393.12	4239.47	5705.76	5392.75	5976.40	542.97
Feb	34704.89	4120.21	5690.14	4654.23	4750.93	460.26
Mar	29616.98	3299.57	5242.17	4257.19	3993.41	462.45
Apr	26809.98	2372.23	5061.85	3236.87	3764.44	363.49
May	26858.63	1710.50	4773.71	1957.17	2761.45	347.13
Jun	26959.12	1224.35	4631.82	1524.53	2375.52	313.62
Jul	31111.15	1951.05	5139.67	2448.72	3196.74	335.01
Aug	32752.10	2258.20	5335.13	2559.25	3823.49	407.32
Sep	28509.48	1506.87	4636.97	2262.27	2524.09	223.31
Oct	29460.38	1674.40	5031.10	2315.93	2725.67	314.21
Nov	22254.31	2724.18	6074.71	2733.27	3953.16	436.45
Dec	38184.34	3220.05	6257.39	3993.79	4943.31	471.98
2012						
Jan	31132.82	4142.03	6429.84	4458.65	5611.43	533.48
Feb	34743.57	4030.30	6408.86	3956.21	4265.66	452.90
Mar	33060.37	3214.42	5962.96	3653.21	3665.80	451.36
Apr	28764.33	2289.41	5780.35	2723.10	3503.60	352.57
May	29320.81	1629.48	5490.83	1415.34	2322.32	336.66
Jun	29318.84	1145.96	5347.90	1016.99	1857.22	302.97
Jul	33437.11	1868.62	5853.00	2102.34	2901.60	323.72
Aug	35136.43	2176.77	6046.35	2272.85	3573.75	396.37
Sep	30843.31	1426.06	5347.16	1969.08	2062.38	212.84
Oct	31826.38	1593.35	5737.44	2051.60	2226.57	303.76
Nov	24548.08	2641.77	6778.52	2459.18	3678.81	425.60
Dec	40549.51	3140.39	6957.28	3710.60	4698.16	461.17
2013						
Jan	33416.96	4078.74	7124.99	4113.01	5168.52	515.94
Feb	37084.43	3985.43	7103.05	3688.97	3807.59	438.61
Mar	35377.76	3188.47	6655.54	3439.07	3400.81	439.14
Apr	31108.68	2282.22	6467.49	2537.91	3215.52	335.23
May	31669.59	1641.09	6174.17	1196.43	1834.61	321.72
Jun	31658.77	1176.64	6028.45	804.99	1393.51	291.82
Jul	35746.49	1916.71	6529.06	1995.24	2658.31	324.88
Aug	37444.04	2243.53	6719.23	2198.67	3279.31	390.36
Sep	33142.84	1511.43	6018.74	1883.71	1561.14	195.92
Oct	34102.61	1697.1	6404.5	1982.28	1788.69	286.31
Nov	27030.61	2763.61	7443.19	2379.61	3448.12	417.82
Dec	42765.14	3281.39	7618.13	3603.87	4394.59	460.26

Source: From Calculation

Table 7. The best model for TRAMO/SEATS

Border country	Immigration border checkpoint	Forecasting Model
Cambodia	Aranya Phrades	(0,1,0)(0,1,1)
	KlongYai	(0,1,0)(0,1,1)
	Pong Nam Ron	(1,1,0)(0,0,0)
Laos PDR	Piboon Mungsaharn	(0,1,1)(0,1,1)
	NongKhai	(0,1,1)(0,1,1)
	Mukdahan	(2,1,0)(0,0,0)
	Nakhon Phanom	(0,1,1)(0,0,0)
	Chiang Khong	(0,1,1)(0,1,1)
Myanmar	Chiang San	(0,1,1)(0,1,1)
	Tak	(1,0,0)(0,1,1)
	Ranong	(1,1,0)(0,1,1)
	Mae Sai	(0,1,0)(0,1,1)

Source: From Calculation

The TRAMO/SEAT forecasting result also has been shown in Table 8. This is a 24-month forecasting that automatically choose the appropriate frequency by TRAMO/SEAT.

In Figure 3 we have presented for comparing result between X12ARIMA and TRAMO/SEAT model in each data series. The result reveals that series of Klong Yai, Chiang Khong, and Mae Sai have similar results between X12ARIMA and TRAMO/SEAT while the results of Aanya Phrades, Ranong and Tak seem to differ.

3.2.3 Compare the result from X12ARIMA and TRAMO/SEAT model

Table 9 shows forecasting error from X12ARIMA and TRAMO/SEAT model. The result presents error from two series; seasonal adjustment and trend and cycle series. We compute forecasting error indicators such as Mean Error (ME), Mean Absolute Deviation (MAD), Mean Square Error (MSE), Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE).

The result demonstrates that X12ARIMA has a smaller error than TRAMO/SEAT model although X12ARIMA can only forecast 6 from 12 data series. The results confirm the same answer in all indicators and consistent between series (seasonal adjustment series and trend and cycle series).

Table 8. TRAMO/SEATS Forecasting Result

	Aranya Phrades	Klong Yai	Pong Nam Ron	Piboon Mung saharn	NongKhai	Mukdahan	Nakhon Phanom	Ching Khong	Chiang SAN	Ranong	Mae Sai	Tak
2011 Jan	44818.9	4212.6	9984.6	10446.0	76318.3	10220.6	4474.2	5969.9	299.6	5284.6	5899.5	593.2
Feb	43054.0	3982.2	10066.4	9570.6	68999.7	9901.9	4474.2	5980.3	200.2	5279.0	5151.1	473.8
Mar	43748.5	3365.7	10083.3	9835.6	77371.6	9705.5	4474.2	5891.0	170.2	5022.8	4480.0	490.8
Apr	38924.1	2385.4	10086.8	10940.9	76248.9	9569.3	4474.2	5651.7	153.7	4156.0	4128.1	414.3
May	39742.0	1848.3	10087.6	11013.3	77042.2	9469.1	4474.2	5260.8	242.5	3235.5	3231.2	368.3
Jun	39537.5	1449.3	10087.7	9704.6	75405.6	9400.1	4474.2	4914.1	228.1	2853.0	3196.6	320.9
Jul	42785.4	1872.9	10087.7	10621.1	79270.9	9352.3	4474.2	5520.0	235.2	3056.6	3730.1	455.0
Aug	44324.2	2140.7	10087.7	10830.1	82453.9	9318.5	4474.2	5677.5	289.3	3277.9	4089.3	383.9
Sep	39715.8	1467.5	10087.7	9311.4	75647.8	9294.8	4474.2	4843.4	230.2	2776.0	3062.0	265.8
Oct	40183.4	1612.2	10087.7	9367.8	79891.2	9278.3	4474.2	5320.8	282.8	3066.6	3541.5	359.3
Nov	44017.4	2575.0	10087.7	9674.4	81177.3	9266.7	4474.2	6333.2	359.0	3457.9	4436.2	440.8
Dec	47226.0	3175.7	10087.7	10387.6	87047.7	9258.6	4474.2	6584.9	396.1	4703.2	5107.0	477.2
2012 Jan	49414.9	4073.2	10087.7	11912.5	83211.5	9253.0	4474.2	6789.5	340.7	5262.4	5849.1	593.7
Feb	47650.0	3842.8	10087.7	11037.2	75924.3	9249.0	4474.2	6788.9	241.3	5176.9	5107.1	474.0
Mar	48344.5	3226.3	10087.7	11302.1	84318.3	9246.2	4474.2	6691.8	211.3	4951.1	4441.7	491.0
Apr	43520.1	2246.0	10087.7	12407.5	83211.0	9244.3	4474.2	6447.0	194.7	4072.7	4092.9	414.3
May	44338.0	1709.0	10087.7	12479.8	84015.1	9242.9	4474.2	6052.3	283.6	3156.6	3203.6	368.3
Jun	44133.5	1310.0	10087.7	11171.1	82386.1	9242.0	4474.2	5703.0	269.2	2772.5	3169.3	320.9
Jul	47381.4	1733.5	10087.7	12087.6	86256.7	9241.3	4474.2	6307.0	276.3	2976.7	3698.2	455.0
Aug	48920.2	2001.4	10087.7	12296.7	89443.4	9240.8	4474.2	6463.2	330.4	3197.8	4054.4	383.9
Sep	44311.8	1328.1	10087.7	10778.0	82639.8	9240.5	4474.2	5628.2	271.3	2696.0	3035.8	265.8
Oct	44779.4	1472.9	10087.7	10834.4	86885.0	9240.3	4474.2	6104.9	323.9	2986.5	3511.3	359.3
Nov	48613.4	2435.6	10087.7	11140.9	88172.5	9240.1	4474.2	7116.9	400.1	3377.8	4398.3	440.8
Dec	51822.0	3036.3	10087.7	11854.2	94043.7	9240.0	4474.2	7368.3	437.2	4623.1	5063.4	477.2

Source: From Calculation

Table 9. Comparison of Forecasting Series with Actual Series

			Aranya Phrades	Klongyai	Pong Numron	Piboon Mungsaharn	Nongkhai	Mukdahan	Nakhorn Panom	Chiang Khong	Chiang San	Ranong	Maesai	Tak
Trend and cycle	X12ARIMA	ME	-30.02	-26.74						-8.73		-204.50	-12.95	-4.10
		MAD	2,532.88	702.90						459.82		1,025.10	1,010.26	85.88
		MSE	12,067,008.14	709,465.00						292,652.77		1,962,549.24	1,514,822.76	11,805.21
		RMSE	3,473.76	842.30						540.97		1,400.91	1,230.78	108.65
		MAPE	11.86	59.22						21.96		113.07	18.99	29.39
	TRAMO/SEAT	ME	-71.82	-31.79	-38.70	-47.73	-28.67	156.68	4.61	-9.94	2.41	-204.79	-0.93	-2.87
		MAD	2,565.53	808.27	204.35	758.16	2,929.80	1,936.52	247.18	467.04	55.64	985.48	1,003.35	93.25
		MSE	13,688,952.60	891,372.99	224,150.66	1,799,662.44	50,495,120.76	48,889,636.40	117,805.42	299,841.35	4,863.08	1,490,858.76	1,420,034.79	13,009.69
		RMSE	3,699.86	944.13	473.45	1,341.51	7,105.99	6,992.11	343.23	547.58	69.74	1,221.01	1,191.65	114.06
		MAPE	12.66	71.38	46.84	44.61	12.62	38.51	12.34	22.69	60.28	40.66	19.30	31.42
Seasonal Adjustment	X12ARIMA	ME	-5.68	-5.10						-5.30		-209.88	-4.48	1.15
		MAD	2,202.75	618.62						445.94		949.67	984.43	68.70
		MSE	6,023,618.63	569,048.38						268,315.82		1,560,000.52	1,462,071.19	6,511.73
		RMSE	2,454.31	754.35						517.99		1,249.00	1,209.16	80.70
		MAPE	9.87	27.48						20.31		20.83	18.42	17.10
	TRAMO/SEAT	ME	-6.75	-0.89		-65.55	32.67			-2.20	0.52	-213.21	-0.93	-1.80
		MAD	2,206.65	790.35		490.41	1,751.81			438.06	43.37	960.63	995.28	78.73
		MSE	6,092,960.09	819,505.38		397,685.75	5,237,994.95			240,851.62	2,605.98	1,343,492.23	1,385,501.13	8,258.00
		RMSE	2,468.39	905.27		630.62	2,288.67			490.77	51.05	1,159.09	1,177.07	90.87
		MAPE	10.13	71.53		14.47	6.54			22.68	42.01	35.91	19.26	21.13

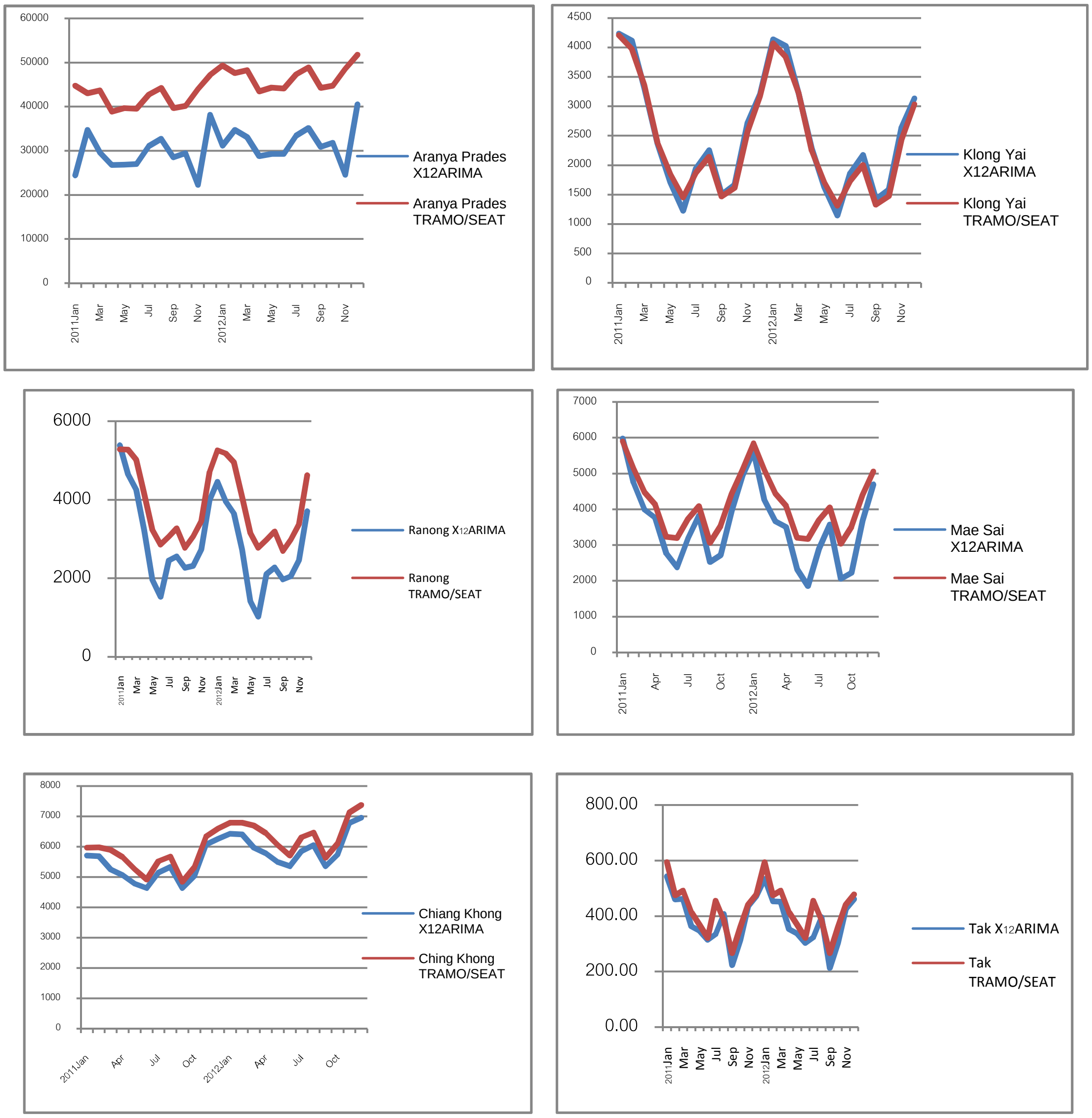

Fig. 3. Comparison of forecasting result from X12ARIMA and TRAMO/SEAT

4. CONCLUSION

We have presented the method for forecasting tourism demand. As usually we found out the seasonal effect in data series. The paper started from standard unit root and found that 3 data series had no existence of unit root in all tests that are Klong Yai, Nakhon Phanom and Tak.

In order to get the suitable forecasting model, we are very much concerned with seasonality.

We employed two seasonal adjustment model such as X12ARIMA and TRAMO/SEAT model to find out the suitable model for forecasting. X12ARIMA result revealed that there are six of twelve data series needed to employ seasonal adjustment model while the other one were rejected to employ this method. When we compared our result with previous study of Chaitip (2009) that employed this model with international tourism demand data series, we observed that X12ARIMA is more suitable with Thailand international tourism demand forecasting. But for border tourism content, X12ARIMA needed to apply only half of twelve data series and TRAMO/SEAT is the alternative way for seasonal adjustment. The result revealed that the nine of twelve data series need to have seasonal adjustment. The result also showed similarity within group of countries in Cambodia and Laos PDR. However in Myanmar, the result was different within group.

Those models are useful for policy implementation by giving practical strategic suggestions for both the *tourist industry* and *government* to construct seasonal and long run planning.

- *For the tourism business*, the result served more predictable patterns of tourist arrivals, it could help to manage labour capacity in each season and offer special promotions in the low season.

- *For the government,* the result could help to predict taxes and tourism revenue in each month and each season.

Moreover it would be very helpful information for government planning to promote border tourism in each period.

The government and private business may plan to produce tourism activity and infrastructure as follows;

When we consider immigration checkpoints, Nongkhai, Aranya Pharadej and Mukdahan have highest tourist arrivals. The places are also attractive tourism activities with full of heritage and natural, duty free shopping markets as the attractive tourism activities are settled in both side of border, such as Casino in Cambodia-Thai Border which attracts tourist across to shopping at Aranya Phrades and Casino in Sawannaket (Laos-Thai border) attracts tourists across to Mukdahan. Moreover, the transportation infrastructure is the essential one in tourism industry. Nongkhai and Mukdahan have Thai-Laos Relationship Bridge and the tourists arrival data show that tourist arrivals to Mukdahan is more increased when the bridge has opened in the end of 2007 (see APPENDIX B).

However in the historical data, small sizes of tourist' arrivals from Myanmar have been found out in years .Currently, there is a positive sign to open Myanmar economy. The sign leads to attract more adventure tourists group. Additionally tourists who are interested in natural scenery will be increased as the place is combining with the beautiful natural place along the border of Thai and Myanmar. If the government and tourism business promote border tourism and persuade international tourists from Myanmar the tourists' arrival from/to Myanmar will increase sharply.

Lastly, tourism database is necessary in case the countries are much paying attention on the tourist attraction/demand. According to observation, few of border tourism information can be counted compared with the plenty of tourists within the country. It should have projected to arrange and create Thailand border tourism information centres and publish by printing and online network.

ACKNOWLEDGEMENTS

For financial support, the first author is grateful to the Office of Higher Education Commission, Ministry of Education, Thailand, for a CHE-PhD 2550 scholarship.

REFERENCES

Balog, P., Kovacs, S., Chaiboonsri, C., Chaitip, P., Forecasting with X-12-ARIMA: International tourist arrivals to India and Thailand Applied Studies in Agribusiness and Commerce, Agroinform Publishing House, Budapest.

Chaiboonsri, C., Chaitip, P., Rangaswamy, N. (2009). Modelling International Tourism Demand in Thailand.' Annals of the University of Petrosani, Economics, University of Petrosani, Romania, 9(3), 22.

Chu, F.L. (2004). Forecasting tourism demand: A cubic polynomial approach. Tourism Management, 25, 209-218.

Dicky, D.A., Fuller, W.A. (1979). Distribution for the estimates for Auto regressive Time series with a unit root. Journal of the American Statistic Association, 74, 427-431.

Elliott,G., Rothenberg, T. Stock, J. (1996). Efficient tests for an Autoregressive Unit Root. Econometrica, 64(4), 813-836.

Franses, P.H. (1991). Seasonality, non-stationary and the forecasting of monthly time series. International Journal of Forecasting, 7, 199–208.

Ghysels, E., Lee, H.S., Noh, J. (1994). Testing for unit roots in seasonal time series: Sometheoretical extensions and a Monte Carlo investigation. Journal of Econometrics, 62, 415–442.

Goh, C., Law, R. (2002). Modeling and forecasting tourism demand for arrivals with stochastic nonstationary seasonality and intervention. Tourism Management, 23(5), pp. 499-510.

Hylleberg, S., Engle, R.F., Granger, C.W.J., Yoo, B.S. (1990). Seasonal integration and cointegration. Journal of Econometrics, 44(1-2), 215-238.

Johansen, S., Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration – with Applications to the Demand for Money, Oxford Bulletin of Economics and Statistics, 52,169-210.

Lim, C., McAleer, M. (2000). A seasonal analysis of Asian tourist arrivals to Australia. Applied Economics, 32, 499-509.

Kim, J. H., Moosa, I.A. (2001). Seasonal behavior of monthly international tourist flows: specification and implications for forecasting models. Tourism Economics, 7, 381-396.

Kulendran, N., Shan, J. (2002). Forecasting China's monthly inbound travel demand. Journal of Travel & Tourism Marketing, 13, 5-19.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P, Shin, Y. (1992). Testing the null hypothesis of Stationary against the alternative of a Unit Root: How sure are we that the Economics Time Series Have a Unit Root? Journal of Econometrics, 54, 159-175.

Lim, C., Chan, F. (2009). Forecasting tourist accommodation demand in New Zealand *18th World IMACS / MODSIM Congress,* 13-17 July, Cairns, Australia. Available on Website. http://mssanz.org.au/modsim09.

Maddala, G.S. (2002). Introduction to Econometrics. Third Edition, India, John Eiley&Sons, Ltd.

Maravall, A. (2002). An application of TRAMO-SEATS: Automatic Procedure and Sectoral Aggregation. The Japanese Foreign Trade Series, Working Paper 0207, Research Department, Banco de España.

Ng, S., Perron, P. (2001). Lag length Selection and Construction of Unit Root Test with Good size and Power. Econometrics, 69, 1519-1544.

Rufino, C.C. (2010). Forecasting Philippine Monthly Inflation using TRAMO/SEATS. Business and Economics Review, 20(1), 1-11.

Time Series Staff Statistical Research Division. (2002). X12ARIMA Reference Manual version 0.2.10., U.S. Census Bureau, Washington D.C.

Turner, L.W., Witt, S.F. (2001). Forecasting tourism using univariate and multivariate structural time series models. Tourism Economics, 7, 135-147.

Witt, S.F., Song, H., Louvieris, P. (2003). Statistical testing in forecasting model selection. Journal of Travel Research, 42, 151-158.

APPENDIX A

Table A. Result from X12ARIMA for AranyaPhrades, Klongyai and Chiang Khong

	AranyaPhrades			Klongyai			ChiangKhong		
	Actual	Forecast		Actual	Forecast		Actual	Forecast	
		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment
Jan-04	21500	17632	17813	3259	2987	2897	1673	1202	1254
Feb-04	19834	17688	17759	3146	2850	2883	1554	1174	1150
Mar-04	18416	17860	17398	2994	2675	2797	1547	1158	1185
Apr-04	16620	18081	18335	2056	2459	2363	1071	1147	1117
May-04	16833	18365	18518	1655	2225	2278	861	1143	1135
Jun-04	17191	18765	18566	1241	2008	1948	664	1146	966
Jul-04	19240	19368	18774	1842	1837	1799	1012	1166	1130
Aug-04	21757	20184	20519	2035	1692	1810	1282	1201	1338
Sep-04	17213	21050	20632	1192	1542	1447	725	1242	1154
Oct-04	18613	21812	22062	1448	1383	1558	778	1288	1172
Nov-04	22875	22332	22681	2250	1211	1861	1896	1334	1530
Dec-04	26063	22560	23590	2945	1053	2274	1666	1372	1362
Jan-05	23971	22622	19932	74	963	64	1787	1394	1335
Feb-05	24307	22796	21703	0	992	65	1912	1397	1428
Mar-05	24510	23232	23102	89	1179	80	1878	1389	1453
Apr-05	21089	23908	23276	1446	1561	1635	1311	1371	1362
May-05	22707	24719	24937	1479	2111	2029	947	1356	1244
Jun-05	24194	25411	26162	1139	2778	1766	942	1342	1364
Jul-05	27533	25722	26915	3806	3476	3889	1291	1332	1429
Aug-05	26068	25582	24519	4143	4057	3886	1281	1337	1339

Table A continues………

Sep-05	21360	25218	25543	3616	4407	4638	777	1361	1209
Oct-05	21345	24926	25323	3900	4441	4537	939	1400	1369
Nov-05	23885	24919	23747	4766	4193	4075	1801	1448	1463
Dec-05	25577	25228	23166	5068	3787	3939	1896	1503	1568
Jan-06	31422	25680	26334	4028	3365	3171	2037	1559	1529
Feb-06	30508	26039	27254	3804	3055	3007	2177	1602	1656
Mar-06	28155	26153	26335	3433	2858	2897	1954	1622	1541
Apr-06	23578	26031	26101	2455	2711	2712	1586	1626	1633
May-06	22943	25687	25014	1880	2518	2564	1350	1623	1742
Jun-06	20841	25293	22527	1509	2246	2355	970	1614	1380
Jul-06	25458	25014	24950	1704	1974	1911	1418	1604	1550
Aug-06	26633	24833	24911	1622	1801	1656	1520	1602	1601
Sep-06	20861	24593	24727	1333	1779	1869	1138	1613	1700
Oct-06	20056	24148	23799	1389	1905	1830	1147	1641	1577
Nov-06	24142	23465	24324	2465	2127	2209	1935	1688	1607
Dec-06	24710	22562	22531	2950	2385	2287	2210	1739	1850
Jan-07	25287	21507	21288	3791	2609	2626	2336	1786	1770
Feb-07	20225	20356	18053	3955	2710	2796	2327	1836	1813
Mar-07	23622	19206	21832	3480	2646	2767	2412	1892	1967
Apr-07	16812	18117	18708	2172	2448	2362	1868	1955	1910
May-07	15547	17115	16894	1548	2229	2144	1528	2026	1907
Jun-07	14844	16285	16121	1305	2077	2125	2304	2116	3201
Jul-07	16025	15717	15711	1532	1994	1897	1734	2207	1874
Aug-07	16886	15494	15645	2005	1962	2172	2123	2294	2235
Sep-07	12734	15663	14801	1135	1972	1760	1964	2384	2794
Oct-07	13347	16176	15790	1199	2052	1754	1463	2470	1879

Table A continues………

Nov-07	17292	16880	17785	2365	2198	2235	3413	2555	2913
Dec-07	19240	17610	17632	3076	2354	2355	2735	2647	2311
Jan-08	21133	18275	17922	3987	2462	2509	3879	2737	3007
Feb-08	21825	18800	19516	4170	2484	2725	3448	2813	2771
Mar-08	20574	19169	18892	3118	2453	2404	3259	2875	2751
Apr-08	17156	19432	19144	2228	2392	2392	3032	2929	3092
May-08	18378	19657	19904	1706	2314	2388	2474	2992	2986
Jun-08	18394	19864	20063	1273	2274	2200	2145	3077	2864
Jul-08	20255	20082	19792	1725	2281	2260	3055	3175	3268
Aug-08	22116	20357	20309	1999	2310	2251	3048	3268	3206
Sep-08	18175	20628	20693	1564	2346	2554	2509	3321	3412
Oct-08	17779	20881	20842	1491	2394	2280	3123	3334	3771
Nov-08	22567	21164	23931	2418	2450	2344	3751	3324	3288
Dec-08	23962	21614	22039	3398	2507	2593	3702	3327	3165
Jan-09	25433	22396	21655	4568	2553	2738	4254	3394	3358
Feb-09	24895	23501	22212	3970	2587	2508	4068	3537	3358
Mar-09	27592	24809	25304	3316	2619	2553	4340	3728	3796
Apr-09	22998	26097	25750	2537	2683	2705	3915	3919	3989
May-09	26711	27146	28954	1957	2772	2794	3634	4068	4252
Jun-09	25636	27755	28122	1895	2814	3447	3254	4148	4215
Jul-09	27013	27785	26253	1890	2807	2465	3758	4187	3998
Aug-09	30846	27379	28121	2498	2780	2806	4033	4207	4207
Sep-09	24276	26757	27035	1575	2753	2629	3165	4235	4169
Oct-09	22867	26169	26468	1922	2719	2893	3800	4286	4395
Nov-09	22548	25749	24646	2697	2687	2609	4712	4340	4199
Dec-09	26926	25496	24712	3441	2667	2657	5365	4373	4623

Table A continues………

Jan-10	31098	25230	26648	4373	2675	2625	5177	4378	4177
Feb-10	27167	24979	24288	4412	2694	2756	5415	4375	4564
Mar-10	28602	24793	26338	3535	2707	2728	3772	4397	3374
Apr-10	21764	24754	24429	2553	2703	2703	4144	4455	4222
May-10	21743	25013	23511	1830	2707	2639	3972	4548	4554
Jun-10	22325	25613	24497	1156	2731	2168	3755	4656	4732
Jul-10	28975	26484	27993	2228	2760	2839	4555	4767	4837
Aug-10	29910	27352	27172	2424	2782	2729	4759	4851	4941
Sep-10	26776	28074	29349	1687	2788	2796	3666	4902	4754
Oct-10	29708	28548	33935	1828	2767	2726	4363	4903	4930
Nov-10	11880	28759	13379	2997	2724	2836	5440	4870	4905
Dec-10	42630	28859	39122	3315	2663	2605	5815	4829	5015

Table B: Results from X12ARIMA for Ranong, Maesai and Tak

	Ranong			Maesai			Tak		
	Actual	Forecast		Actual	Forecast		Actual	Forecast	
		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment
Jan-04	4738	4031	3857	7433	5625	5595	601	472	490
Feb-04	4909	4014	4020	6783	5674	5604	580	460	495
Mar-04	4803	3955	3934	6281	5723	5748	503	453	445
Apr-04	3871	3859	4061	5498	5776	5896	349	449	397
May-04	3022	3712	3894	4296	5833	5832	401	453	455
Jun-04	2251	3517	3310	4275	5901	5737	397	462	468
Jul-04	2844	3314	3404	6142	5991	6036	464	477	472
Aug-04	2747	3162	3035	5834	6093	5999	613	493	541
Sep-04	2648	3103	3046	4502	6192	6370	296	503	463
Oct-04	2802	3144	3025	5425	6279	6195	282	503	352
Nov-04	3448	3248	3330	7474	6341	6494	727	497	685
Dec-04	4464	3350	3415	7765	6389	6368	693	490	563
Jan-05	0	3411	3551	8399	6455	6268	508	483	408
Feb-05	0	3444	3588	8080	6559	6641	535	478	459
Mar-05	0	3500	3641	7299	6703	6689	560	472	496
Apr-05	0	3694	4667	6297	6867	6739	420	463	474
May-05	53	4175	68	5301	7039	7221	430	456	486
Jun-05	0	4988	77	5426	7208	7283	382	454	455
Jul-05	6938	6055	8401	7377	7379	7291	368	460	373
Aug-05	8564	7134	9612	7265	7562	7480	487	474	433
Sep-05	7253	7908	8527	5386	7750	7639	350	498	550

Table B continues………

Oct-05	8424	8158	9338	7148	7929	8180	425	524	529
Nov-05	7933	7868	7819	9100	8100	7950	613	549	578
Dec-05	9790	7226	7560	10640	8262	8759	661	570	543
Jan-06	7096	6513	5415	11120	8416	8198	719	585	567
Feb-06	6860	5968	5355	10350	8589	8422	692	599	597
Mar-06	7166	5703	5779	9660	8794	8879	696	613	614
Apr-06	5704	5641	5923	8378	8999	8931	604	623	670
May-06	4579	5584	5885	6722	9144	9150	503	623	567
Jun-06	3822	5380	5522	6943	9188	9318	522	610	627
Jul-06	4101	4994	5048	9290	9105	9334	616	585	627
Aug-06	4016	4493	4614	8562	8895	8831	593	551	535
Sep-06	3016	4034	3666	5898	8593	8353	149	514	235
Oct-06	3080	3705	3542	7127	8224	8199	420	475	518
Nov-06	3530	3528	3577	9185	7806	8102	457	437	432
Dec-06	4192	3469	3274	8603	7343	7085	487	401	404
Jan-07	5111	3469	3743	9691	6827	7047	482	370	374
Feb-07	4688	3459	3547	7706	6269	6225	399	344	346
Mar-07	4259	3394	3385	6281	5715	5796	365	325	320
Apr-07	3219	3277	3279	3953	5229	4160	206	316	225
May-07	2413	3133	3075	3232	4850	4377	262	318	295
Jun-07	2162	2981	3088	3358	4572	4509	282	327	341
Jul-07	2175	2840	2712	4362	4376	4500	443	336	456
Aug-07	2374	2737	2812	4288	4251	4430	379	341	346
Sep-07	3173	2704	4055	2949	4181	4154	238	344	378
Oct-07	2082	2775	2523	3348	4165	3872	268	347	328
Nov-07	2700	2940	2818	4515	4201	4026	341	353	320

Table B continues………

Dec-07	3877	3162	3040	5252	4277	4325	418	363	350
Jan-08	5149	3382	3588	6589	4369	4708	505	375	391
Feb-08	5325	3540	3908	5904	4447	4752	526	385	455
Mar-08	4570	3603	3577	4785	4487	4441	454	395	398
Apr-08	3415	3561	3412	3770	4476	3904	323	403	352
May-08	2748	3454	3536	3225	4432	4332	375	408	421
Jun-08	2337	3346	3324	3841	4390	5186	332	412	401
Jul-08	2559	3281	3225	4187	4363	4456	519	415	534
Aug-08	2642	3277	3213	4096	4340	4225	508	417	465
Sep-08	2427	3317	3223	3009	4316	4198	240	419	381
Oct-08	2753	3379	3505	3819	4292	4460	308	417	378
Nov-08	3185	3442	3416	4871	4274	4412	466	415	439
Dec-08	4533	3482	3540	4982	4271	4054	507	416	425
Jan-09	6739	3479	4537	5969	4294	4207	604	418	459
Feb-09	4751	3441	3408	5523	4330	4450	396	421	346
Mar-09	4355	3383	3371	4632	4355	4326	448	424	392
Apr-09	3379	3317	3317	4272	4366	4343	431	427	461
May-09	2476	3248	3214	3409	4351	4541	409	432	461
Jun-09	2231	3185	3192	3172	4302	4312	323	438	394
Jul-09	2534	3129	3203	3695	4240	4042	457	441	469
Aug-09	2409	3073	2995	3993	4190	4120	367	439	341
Sep-09	2189	3013	2997	3205	4149	4435	276	435	440
Oct-09	2268	2950	2987	3377	4106	3964	373	433	454
Nov-09	2772	2893	3022	4492	4067	4110	442	434	417
Dec-09	3590	2862	2763	5125	4035	4127	476	439	407
Jan-10	4292	2877	2821	5668	4021	3963	625	445	465

Table B continues………

Feb-10	4072	2943	2887	4783	4030	3861	506	452	443
Mar-10	3903	3052	3002	4322	4059	4061	530	450	464
Apr-10	3308	3183	3227	4227	4090	4246	447	438	474
May-10	2583	3302	3430	3163	4116	4171	363	419	408
Jun-10	2326	3377	3367	3037	4136	4155	323	400	396
Jul-10	2734	3409	3452	3478	4137	3884	53	389	54
Aug-10	2683	3426	3369	4111	4129	4244	367	390	342
Sep-10	2495	3447	3438	3038	4125	4171	276	398	442
Oct-10	2543	3478	3367	3569	4123	4212	373	410	454
Nov-10	3135	3514	3434	4244	4107	3911	442	417	419
Dec-10	4936	3523	3749	5151	4066	4087	476	417	411

APPENDIX B

Table C: Result from TRAMO/SEAT Model for AranyaPhradej, Klongyai and Pong Numron

	AranyaPhrades			Klongyai			Pong Numron		
	Actual	Forecast		Actual	Forecast		Actual	Forecast	
		Trendand cycle	Seasonal adjustment		Trendand cycle	Seasonal adjustment		Trendand cycle	Seasonal adjustment
Jan-04	21500	17509.7	17677.6	3259	1529.89	1613.216	203	143.888	
Feb-04	19834	17078.1	17627.4	3146	1700.453	1722.27	208	156.075	
Mar-04	18416	17035	16303.2	2994	1962.739	2176.169	205	154.136	
Apr-04	16620	17914.9	18824.7	2056	2123.589	2208.473	205	151.617	
May-04	16833	18621.4	18635	1655	2187.597	2333.366	196	144.659	
Jun-04	17191	18757.2	19322.3	1241	2247.313	2307.303	199	158.984	
Jul-04	19240	18982	18674.4	1842	2302.19	2473.399	298	272.178	
Aug-04	21757	19678.1	20178.5	2035	2254.743	2386.784	500	384.453	
Sep-04	17213	20595.9	20604.4	1192	2166.231	2204.129	385	373.319	
Oct-04	18613	21569.8	21920.9	1448	2125.959	2301.997	495	492.443	
Nov-04	22875	22551.3	22757.5	2250	2083.377	2127.832	867	742.836	
Dec-04	26063	22334.2	23704.3	2945	2011.046	2207.97	746	586.093	
Jan-05	23971	21267.2	20102.8	74	1686.048	-1571.865	48	140.433	
Feb-05	24307	21408.4	22072.1	0	1173.83	-1349.838	44	-69.633	
Mar-05	24510	22266.4	22304.1	89	906.533	-728.795	5	146.873	
Apr-05	21089	23129.5	23309	1446	2744.611	1598.511	862	607.477	
May-05	22707	24443.6	24515.2	1479	2790.117	2157.452	780	812.175	
Jun-05	24194	25814.3	26357.2	1139	2734.524	2205.359	1018	985.911	
Jul-05	27533	25962.2	26961.3	3806	4728.106	4437.51	1334	1158.865	
Aug-05	26068	24954.5	24502.1	4143	4703.696	4494.86	1005	1028.695	
Sep-05	21360	24457.1	24770.5	3616	4726.791	4628.151	0	953.604	
Oct-05	21345	24269.5	24705.2	3900	4732.958	4754.062	0	876.181	
Nov-05	23885	23676.1	23823.9	4766	4587.33	4643.847	610	625.409	
Dec-05	25577	24221.9	23264	5068	4374.984	4331.001	5321	5404.8	
Jan-06	31422	26360	27444	4028	2321.293	2382.087	6044	5770.825	
Feb-06	30508	27185.5	28222.4	3804	2366.256	2379.887	5885	6144.776	

Table C continues………

Mar-06	28155	26173.3	25792.4	3433	2470.882	2615.101	7020	6615.252
Apr-06	23578	25314.2	25806.9	2455	2506.265	2607.44	3409	6309.232
May-06	22943	24383.9	24773.7	1880	2478.954	2558.518	5353	5281.839
Jun-06	20841	23756.1	23101.4	1509	2411.605	2575.383	4446	4601.893
Jul-06	25458	24293.4	24960.3	1704	2202.989	2335.612	4785	4755.271
Aug-06	26633	24612.7	25076.6	1622	2053.256	1973.91	5435	5356.042
Sep-06	20861	24031.9	24268.5	1333	2121.738	2345.21	5806	5616.183
Oct-06	20056	23574.3	23436.2	1389	2187.619	2243.202	2675	5247.351
Nov-06	24142	23259.5	24078.5	2465	2178.889	2342.909	4720	4780.907
Dec-06	24710	22284.3	22374.6	2950	2121.441	2213.006	4514	4182.862
Jan-07	25287	20474.6	21241.6	3791	2151.06	2145.002	3145	3494.213
Feb-07	20225	19344.6	17959.1	3955	2359.498	2530.569	3636	3319.577
Mar-07	23622	19585.8	21131.1	3480	2437.07	2662.044	3097	3202.97
Apr-07	16812	18919.6	19055.8	2172	2276.579	2324.404	3207	3123.194
May-07	15547	17504.2	17368.1	1548	2179.419	2226.633	3271	3208.759
Jun-07	14844	16588.2	17146.5	1305	2175.394	2371.459	3287	3282.73
Jul-07	16025	15705.3	15618.2	1532	2155.973	2163.684	3513	3397.465
Aug-07	16886	15396	15360.2	2005	2148.189	2356.861	3387	3318.535
Sep-07	12734	15884.5	16165.3	1135	2068.179	2147.25	3171	3193.724
Oct-07	13347	16517.9	16773.1	1199	2016.215	2053.318	3398	3360.313
Nov-07	17292	16829.7	17290.3	2365	2111.55	2242.978	3892	3949.902
Dec-07	19240	16799	16895.4	3076	2207.43	2338.972	4930	4751.281
Jan-08	21133	17397.5	17036.3	3987	2333.49	2340.867	5214	5059.762
Feb-08	21825	18297.5	19546.4	4170	2424.883	2745.341	4748	4687.054
Mar-08	20574	18511.6	17994.2	3118	2323.454	2300.092	4033	3889.426
Apr-08	17156	19025.3	19435.8	2228	2253.379	2380.395	3055	3301.39
May-08	18378	19879	20159.3	1706	2264.328	2384.738	3568	3312.147
Jun-08	18394	20120.3	20694	1273	2247.116	2339.558	3217	3228.01
Jul-08	20255	20012.1	19863.9	1725	2242.921	2356.726	3094	3098.192
Aug-08	22116	20409	20549.1	1999	2300.611	2350.788	3267	3113.685
Sep-08	18175	21013	21599.2	1564	2354.133	2576.264	2989	3039.996
Oct-08	17779	21448.1	21233.3	1491	2282.713	2345.346	3238	3199.393
Nov-08	22567	21799.6	22654.2	2418	2291.552	2296.013	3691	3662.867
Dec-08	23962	21543.6	21589.5	3398	2526.883	2660.944	4418	4486.757

Table C continues………

Jan-09	25433	21459.3	21267.1	4568	2654.388	2921.761	5603	5262.986
Feb-09	24895	22639.1	22629.4	3970	2519.562	2545.226	5267	5302.105
Mar-09	27592	24238.1	24953.9	3316	2449.703	2498.154	4951	4685.352
Apr-09	22998	25806.7	25342.5	2537	2520.162	2689.392	3717	3943.998
May-09	26711	27355.3	28514.8	1957	2622.648	2635.829	3694	3395.62
Jun-09	25636	27543.1	27987.7	1895	2662.188	2961.669	2768	3015.185
Jul-09	27013	27383.5	26611.8	1890	2605.673	2521.714	3234	3028.706
Aug-09	30846	27965.1	29242.5	2498	2594.074	2849.713	3062	2994.978
Sep-09	24276	27507.5	27699.9	1575	2592.117	2587.277	2714	2731.394
Oct-09	22867	25530.8	26329	1922	2570.693	2776.323	2821	2826.008
Nov-09	22548	23812.6	22691.1	2697	2549.525	2574.972	3309	3229.793
Dec-09	26926	24357.1	24447	3441	2569.375	2703.952	3891	4042.703
Jan-10	31098	25473.4	26767	4373	2678.114	2726.739	5276	4834.447
Feb-10	27167	25362.1	24853.1	4412	2746.519	2987.151	4681	4783.141
Mar-10	28602	24981.1	25907.1	3535	2673.689	2717.166	4664	4657.041
Apr-10	21764	24260	24190	2553	2551.189	2705.399	5095	5070.389
May-10	21743	23864.3	23680.1	1830	2378.483	2508.917	5599	5412.967
Jun-10	22325	25256.5	24821.2	1156	2345.53	2222.812	5509	5642.052
Jul-10	28975	27383.9	28627.2	2228	2571.429	2859.685	6322	6200.002
Aug-10	29910	28696.5	28397.5	2424	2669.539	2775.663	6768	6586.04
Sep-10	26776	30314	30290.8	1687	2606.099	2699.275	6414	6412.955
Oct-10	29708	33088.3	33195.6	1828	2626.661	2682.297	6414	6543.452
Nov-10	11880	36367.4	11993.5	2997	2644.478	2874.896	7675	7749.368
Dec-10	42630	39156	40016	3315	2535.776	2577.952	9589	9253.55

Table D. Result from TRAMO/SEAT Model for PiboonMungsaharn, Nongkhai and Mukdahan

	PiboonMungsaharn			Nongkhai			Mukdahan		
	Actual	Forecast		Actual	Forecast		Actual	Forecast	
		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment
Jan-04	1667	1304.844	1208.1	13147	12018.2	12355.2	515	1470.7	
Feb-04	1753	1321.7	1312.9	11756	11950.2	13774.8	788	1654.8	
Mar-04	1341	1339.671	1206.7	11242	11538.2	9951.8	1160	1805.5	
Apr-04	1253	1361.696	1379.2	10796	11441.9	12161.4	855	1891	
May-04	971	1336.411	1339.6	10644	11631.5	11292.6	1318	1948.3	
Jun-04	848	1226.73	1227	9893	12037.5	11832	786	2005.1	
Jul-04	708	1128.47	848.7	14951	12575.6	13548.8	1663	2103.7	
Aug-04	1306	1155.59	1080.6	15696	12939.3	12832.1	1025	2173.6	
Sep-04	969	1221.443	1291.8	12421	13162.5	13881.5	922	2444.1	
Oct-04	812	1197.866	1178.3	12873	13154.3	13722.4	3129	2817.7	
Nov-04	802	1166.915	922.7	12585	12940	12872.1	1605	2839.4	
Dec-04	1937	1217.744	1231.5	14010	13104.6	11772.9	1968	2702	
Jan-05	0	1280.897	1223.4	15560	13771.7	15037.4	0	2536	
Feb-05	1624	1294.123	1318	11867	14368.6	14337.6	1315	2308.2	
Mar-05	0	1255.977	1193.9	17186	14748.1	15390.4	0	2117.8	
Apr-05	0	1195.965	1133.7	13222	15202.3	14449.5	0	1946.1	
May-05	442	1239.897	868.2	16029	15924.3	16401	230	2040.6	
Jun-05	981	1504.263	1381.9	15828	16543.9	17657.4	1379	2790.4	
Jul-05	2150	1801.542	2078.6	17281	16968.7	16004.3	3583	3936.7	
Aug-05	2115	1925.801	1800.9	21036	17620.4	18233.7	4855	4693.7	
Sep-05	4128	1999.229	4602.8	16293	18521.1	17954.3	3873	4809.7	
Oct-05	5362	2124.106	5775.7	18878	19658.3	19927.4	3460	4746.7	
Nov-05	3690	2219.894	3630.8	22065	20583.8	22417.5	3573	4960.6	
Dec-05	3748	2221.598	3104.5	24258	20595.1	21694.7	5962	5064.6	
Jan-06	3179	2208.118	2678.4	18302	20456.8	17945.6	3223	4516.9	
Feb-06	2776	2266.633	2663.2	19102	21128.5	22161.7	2690	3827.7	
Mar-06	2921	2324.483	2705.4	26278	21542.2	24014.1	1902	3614	

Table D continues………

Apr-06	2133	2384.103	2298.1	19052	21135.3	19776.8	3139	3944.1
May-06	2680	2554.706	2676.6	21239	20887	21253.9	3865	4478.6
Jun-06	2597	2721.672	2979.1	19318	20931.5	21068.9	4079	4867.3
Jul-06	2710	2776.707	2702.7	22763	20922.5	21393.9	4176	5146.5
Aug-06	3084	2810.882	2840.4	23219	21009	20363.3	5070	5261.5
Sep-06	2002	2869.288	2787	21345	20954.9	23301.8	3817	5191.7
Oct-06	2251	2949.979	2928.8	17701	20552.3	18996.4	4208	5292.3
Nov-06	3004	3045.109	2992.5	18669	20801.1	19466	4794	5595.2
Dec-06	3508	3179.415	3017.6	24051	22414.1	21263.5	5075	5871.3
Jan-07	3986	3369.617	3380.7	26380	24720.2	26059.6	6316	5746.4
Feb-07	3441	3553.795	3506.1	22953	26850.9	27007.6	2918	5254.6
Mar-07	3965	3725.253	3629.6	30685	28838.9	28706.1	4056	5228.3
Apr-07	4215	3857.669	3990.3	31850	30749.7	32063.2	5141	5666.4
May-07	4402	3870.364	3844.4	32419	32323	32219.2	5393	6017.2
Jun-07	3149	3853.936	3628.6	32496	33699	34330.3	4996	6306.7
Jul-07	3695	3957.504	3817.5	36526	35014.1	34958	6058	6678.9
Aug-07	4314	4146.435	4143.6	39650	36361	36511.7	6171	7041.2
Sep-07	3293	4315.154	4284.2	35577	37830.1	37832.7	6460	7367.2
Oct-07	3492	4462.969	4350.6	38804	39415.2	39528.8	6910	7683.3
Nov-07	4609	4608.834	4625.6	40720	41108.8	41174	7115	7925
Dec-07	5197	4671.537	4768.1	47473	42644.7	43911.7	7406	8048.3
Jan-08	5249	4629.892	4506.7	44277	43794.9	43748.6	7170	8095.9
Feb-08	4116	4662.524	4337	39789	44834.2	44943.7	6918	8279.4
Mar-08	5197	4826.227	4947.7	46835	46165.4	45418.7	7375	8894.7
Apr-08	5247	5012.333	4786.1	49081	47596.5	49285.2	10222	9615.3
May-08	6237	5220.04	5242.8	48663	48654.7	48498.9	8619	9890
Jun-08	4895	5437.992	5343.8	46934	49711.6	49094.5	8725	10099.5
Jul-08	5505	5645.761	5598.4	53700	50979.9	52147.4	9986	10505.9
Aug-08	5856	5831.468	5842.7	56104	51847	52722	10713	10605.2
Sep-08	4605	5987.15	5858	48883	52455.4	51472.3	8778	10323.4
Oct-08	4940	6184.635	6048.7	54975	53018.5	55064	9005	10229.9
Nov-08	6160	6419.276	6449.9	53074	53101	52952.7	9578	10547.7
Dec-08	6761	6609.439	6569.7	57024	53052.3	52661.2	10288	11102.9
Jan-09	7690	6753.293	6691.6	54425	53287.1	53674.1	10415	11933.9

Table D continues………

Feb-09	6863	6863.629	6875.2	47419	53635.9	53495	12096	13187.7
Mar-09	7065	6964.921	6774.9	55393	54088.1	54277	14081	14568.1
Apr-09	7910	7142.013	7013.2	53520	54842.1	53988.7	15658	15449.3
May-09	8912	7290.739	7570.1	57533	55703.2	57499.9	15726	15265.5
Jun-09	6928	7218.122	7232.1	53383	56231.4	55794.2	11956	14411.6
Jul-09	6917	7010.688	6879.2	58071	56694.5	56842.2	13538	13800.7
Aug-09	6505	6920.148	6556.8	59974	57576.8	56561.5	12598	13244.9
Sep-09	5569	7043.122	6989.4	57259	58688.3	60286.8	10970	12726.4
Oct-09	5918	7245.149	7231.3	59403	59543.6	59306	11953	12619.7
Nov-09	10972	7417.807	11740.1	61986	60027	61379.3	16089	17074
Dec-09	7165	7626.331	7411.4	76881	59998.1	71632.5	16114	17251.9
Jan-10	9007	7888.05	7970.3	68893	59422.1	67735.2	17483	17348.1
Feb-10	8125	8096.301	8072.4	56281	58938.7	62765.7	15641	17120.8
Mar-10	8340	8258.34	8124.2	18686	13170.7	17498.8	64883	65469
Apr-10	9632	8389.438	8532.9	16201	13403.6	16682.1	64564	65184.5
May-10	9370	8491.581	8184.3	14627	13549.7	14752.7	63014	65019.9
Jun-10	8239	8713.718	8558.6	13481	13842.6	15911.1	65061	65210.7
Jul-10	9450	9040.632	9077.6	15719	14188	14752.3	72595	65312
Aug-10	9811	9268.027	9411.4	76244	70643.6	72805.2	16118	11016.2
Sep-10	8094	9332.188	9270.2	65833	70774.6	69500	13711	10708.1
Oct-10	8043	9324.268	9279.7	13609	71456.5	13775.3	72685	10383.1
Nov-10	8157	9344.712	9156.8	73138	72670.8	72587.4	11041	10189.9
Dec-10	409	9442.232	861.1	80963	73879.3	75282.3	16087	10171.5

Table E. Result from TRAMO/SEAT Model for Nakhonpanom, Chiang Khong and Chiang San

	NakhornPanom			**Chiang Khong**			**Chiang San**		
	Actual	**Forecast**		**Actual**	**Forecast**		**Actual**	**Forecast**	
		Trend and cycle	**Seasonal adjustment**		**Trend and cycle**	**Seasonal adjustment**		**Trend and cycle**	**Seasonal adjustment**
Jan-04	324	318.241		1673	1033.265	1094.397	104	156.927	78.375
Feb-04	441	354.152		1554	1053.858	1021.473	207	161.997	215.805
Mar-04	341	369.456		1547	1080.067	1090.937	92	166.49	138.906
Apr-04	310	382.677		1071	1112.942	1105.775	115	170.213	181.299
May-04	334	413.994		861	1148.86	1219.8	168	173.832	159.876
Jun-04	248	483.947		664	1182.29	1245.503	117	177.86	152.868
Jul-04	759	583.74		1012	1213.188	1214.273	197	182.275	205.292
Aug-04	706	662.223		1282	1242.532	1352.106	210	185.888	175.707
Sep-04	649	715.795		725	1265.442	1335.527	102	189.756	151.717
Oct-04	664	783.179		778	1281.684	1327.824	178	195.933	157.259
Nov-04	661	896.043		1896	1290.684	1438.226	306	203.022	254.165
Dec-04	909	1074.943		1666	1291.025	1294.002	260	208.61	185.83
Jan-05	1449	1286.325		1787	1294.61	1204.603	243	213.582	210.154
Feb-05	1765	1445.774		1912	1309.465	1360.885	187	219.05	202.18
Mar-05	1449	1530.223		1878	1325.997	1415.32	225	223.711	271.112
Apr-05	1450	1608.684		1311	1339.134	1331.851	166	225.805	234.796
May-05	1673	1723.957		947	1357.14	1310.084	270	224.972	262.13
Jun-05	2230	1818.646		942	1378.713	1539.117	181	221.811	215.088
Jul-05	1689	1848.642		1291	1390.457	1493.355	193	217.854	204.156
Aug-05	1527	1899.256		1281	1393.857	1369.913	176	215.857	139.898
Sep-05	1615	2074.038		777	1401.221	1398.226	193	216.573	239.532
Oct-05	2852	2314.643		939	1412.48	1497.126	288	216.316	264.474
Nov-05	2894	2447.524		1801	1425.575	1363.713	165	215.01	117.292
Dec-05	3004	2377.59		1896	1443.624	1514.152	230	218.02	152.965
Jan-06	1448	2212.068		2037	1466.522	1422.008	252	226.052	210.814
Feb-06	1596	2182.684		2177	1491.672	1606.832	231	235.301	253.412
Mar-06	2747	2288.538		1954	1516.595	1486.619	209	243.129	259.629
Apr-06	2584	2332.612		1586	1543.976	1581.519	170	249.348	243.657

Table E continues………

May-06	2130	2294.322	1350	1569.911	1710.434	204	256.174	199.795
Jun-06	2146	2269.01	970	1587.993	1607.306	256	264.586	288.848
Jul-06	2597	2242.907	1418	1603.757	1632.373	241	273.019	254.742
Aug-06	2044	2166.386	1520	1622.914	1619.99	412	279.079	369.484
Sep-06	1888	2092.827	1138	1642.292	1769.264	205	281.559	249.661
Oct-06	2082	2062.06	1147	1654.798	1722.498	286	283.306	263.18
Nov-06	2138	2030.628	1935	1670.344	1493.405	86	120.99	33.507
Dec-06	1450	2025.625	2210	1699.39	1824.504	282	128.111	197.467
Jan-07	2261	2098.745	2336	1735.227	1660.593	208	132.891	158.102
Feb-07	1487	2263.994	2327	1780.139	1749.275	33	135.992	63.706
Mar-07	3147	2493.674	2412	1833.164	1937.462	46	142.114	104.003
Apr-07	2553	2678.546	1868	1887.585	1836.694	86	150.701	165.835
May-07	2987	2801.008	1528	1950.68	1902.438	177	158.517	173.956
Jun-07	2794	2904.281	2304	2025.334	2992.984	99	165.404	133.631
Jul-07	3186	2985.523	1734	2112.327	1960.897	158	172.757	174.206
Aug-07	3201	3015.021	2123	2216.708	2231.609	269	179.018	228.965
Sep-07	2959	2986.221	1964	2319.096	2642.27	139	182.387	180.541
Oct-07	2928	2939.804	1463	2415.475	2048.779	230	183.523	207.98
Nov-07	2922	2888.913	3413	2517.3	2948.939	259	182.735	193.025
Dec-07	2613	2849.241	2735	2615.653	2349.695	204	181.816	115.987
Jan-08	2717	2858.987	3879	2706.014	3142.135	253	182.759	196.666
Feb-08	2654	2939.609	3448	2773.315	2858.295	187	183.111	220.628
Mar-08	3264	3063.037	3259	2822.918	2780.833	347	180.488	409.515
Apr-08	3259	3159.677	3032	2875.104	2958.451	184	177.034	270.327
May-08	3440	3187.831	2474	2931.966	2842.405	323	174.266	322.422
Jun-08	2847	3184.353	2145	3004.675	2871.159	186	170.792	220.007
Jul-08	3475	3187.629	3055	3091.178	3266.647	190	167.085	208.876
Aug-08	3291	3148.403	3048	3175.27	3159.499	192	164.733	160.289
Sep-08	2736	3081.278	2509	3257.775	3295.041	164	163.572	202.632
Oct-08	3196	3046.034	3123	3329.243	3674.714	166	162.919	146.496
Nov-08	2663	3045.532	3751	3378.173	3326.311	311	161.613	232.258
Dec-08	3012	3106.727	3702	3429.716	3269.403	228	158.676	131.592
Jan-09	2849	3255.285	4254	3501.892	3529.769	248	154.878	187.505
Feb-09	3690	3462.689	4068	3589.542	3471.424	80	150.983	118.188

Table E continues………

Mar-09	3863	3637.766		4340	3684.72	3857.687	82	147.655	149.775
Apr-09	3926	3722.404		3915	3775.236	3799.487	89	143.952	177.778
May-09	3693	3745.417		3634	3857.711	3967.392	89	139.352	94.145
Jun-09	3509	3778.593		3254	3933.802	3981.452	92	135.972	122.583
Jul-09	4078	3839.346		3758	4009.197	3960.505	108	133.941	128.738
Aug-09	3882	3873.231		4033	4090.601	4137.573	93	133.557	66.115
Sep-09	3403	3926.505		3165	4180.661	4069.485	78	136.413	115.107
Oct-09	4422	4035.967		3800	4280.747	4356.858	185	140.719	166.835
Nov-09	4040	4123.476		4712	4387.363	4328.544	254	143.235	169.24
Dec-09	4258	4176.031		5365	4486.046	4850.749	246	143.595	138.098
Jan-10	4350	4200.422		5177	4565.862	4476.205	190	143.456	128.767
Feb-10	4038	4197.449		5415	4636.903	4793.029	74	144.302	114.815
Mar-10	5932	4206.057		3772	4707.533	3300.452	16	147.683	89.343
Apr-10	4247	4224.735		4144	4777.715	3994.633	11	155.091	104.27
May-10	4105	4248.243		3972	4840.72	4280.034	133	166.245	141.216
Jun-10	4156	4305.1		3755	4894.075	4475.037	183	178.487	210.124
Jul-10	4525	4384.568		4555	4941.268	4740.787	144	189.876	166.674
Aug-10	4657	4422.884		4759	4978.578	4852.893	236	200.91	208.807
Sep-10	4080	4430.33		3666	5017.66	4644.415	186	211.358	221.695
Oct-10	4716	4450.863		4363	5078.002	4941.584	184	221.819	169.907
Nov-10	4133	4481.326		5440	5155.872	5075.937	313	234.049	227.394
Dec-10	4643	4536.714		5815	5237.333	5273.013	442	245.422	324.781

Table F. Result from TRAMO/SEAT Model for Ranong, Maesai and Tak

	Ranong			Maesai			Tak		
	Actual	Forecast		Actual	Forecast		Actual	Forecast	
		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment		Trend and cycle	Seasonal adjustment
Jan-04	4738	3471.806	3292.019	7433	5354.847	5357.566	601	479.698	501.941
Feb-04	4909	3542.041	3559.674	6783	5464.991	5419.297	580	480.996	496.939
Mar-04	4803	3621.499	3650.737	6281	5661.384	5653.073	503	482.178	457.038
Apr-04	3871	3625.353	3586.389	5498	5856.021	5919.455	349	483.58	445.388
May-04	3022	3554.812	3639.495	4296	5933.92	5944.862	401	485.294	478.344
Jun-04	2251	3484.727	3242.852	4275	5959.118	5931.406	397	487.091	488.652
Jul-04	2844	3478.486	3622.259	6142	6011.082	6024.244	464	488.927	498.352
Aug-04	2747	3515.61	3296.821	5834	6140.662	6053.766	613	490.614	549.67
Sep-04	2648	3589.937	3692.972	4502	6288.092	6427.189	296	491.853	482.813
Oct-04	2802	3669.036	3558.24	5425	6342.991	6253.614	282	493.333	416.514
Nov-04	3448	3674.155	3796.452	7474	6342.966	6442.404	727	495.343	572.297
Dec-04	4464	3508.971	3609.153	7765	6294.508	6237.882	693	496.82	531.313
Jan-05	0	3271.308	3017.609	8399	6354.097	6245.787	508	497.923	412.543
Feb-05	0	3245.471	3114.749	8080	6566.168	6667.442	535	499.67	457.335
Mar-05	0	3514.503	3311.745	7299	6721.921	6689.23	560	501.836	499.066
Apr-05	0	3826.394	4179.509	6297	6856.635	6842.157	420	503.955	491.867
May-05	53	867.417	670.596	5301	7010.653	7048.011	430	506.032	502.453
Jun-05	0	871.31	1044.841	5426	7135.485	7104.836	382	508.015	475.336
Jul-05	6938	8284.725	7716.346	7377	7287.485	7277.362	368	510.23	404.617
Aug-05	8564	8552.304	9113.884	7265	7420.639	7488.551	487	513.223	456.032
Sep-05	7253	8720.868	8298.153	5386	7586.922	7419.418	350	516.629	539.102
Oct-05	8424	8747.648	9180.31	7148	7878.445	7999.655	425	519.777	527.695
Nov-05	7933	8721.818	8281.798	9100	8298.504	8072.57	613	522.799	506.002
Dec-05	9790	8749.25	8934.726	10640	8721.018	9039.979	661	526.083	530.546
Jan-06	7096	5683.767	5649.026	11120	8856.786	8755.455	719	529.433	602.611
Feb-06	6860	5710.675	5510.679	10350	8894.134	8876.428	692	532.405	606.718
Mar-06	7166	5708.601	6013.676	9660	9001.17	9047.629	696	534.972	624.815
Apr-06	5704	5514.826	5419.712	8378	8907.76	9044.825	604	536.966	659.576

Table F continues………

May-06	4579	5209.658	5196.629	6722	8652.535	8501.293	503	538.348	571.01
Jun-06	3822	4971.801	4813.834	6943	8682.399	8516.838	522	539.59	602.461
Jul-06	4101	4787.737	4879.29	9290	8869.239	9164.033	616	540.619	606.026
Aug-06	4016	4522.239	4566.12	8562	8574.558	8678.287	593	541.178	569.928
Sep-06	3016	4191.034	4061.256	5898	8058.234	7793.376	149	370.898	335.65
Oct-06	3080	3942.846	3836.539	7127	7953.794	7908.625	420	371.755	491.046
Nov-06	3530	3759.164	3879.093	9185	7853.21	8195.377	457	372.036	387.101
Dec-06	4192	3606.917	3336.377	8603	7437.405	7143.433	487	371.993	384.761
Jan-07	5111	3511.534	3663.464	9691	6982.065	7265.431	482	372.015	357.679
Feb-07	4688	3369.685	3338.606	7706	6396.951	6265.083	399	372.112	328.249
Mar-07	4259	3173.779	3106.746	6281	5664.534	5808.202	365	372.431	317.033
Apr-07	3219	3060.929	2934.985	3953	5072.095	4761.028	206	373.168	279.397
May-07	2413	3065.535	3030.705	3232	4841.208	4918.146	262	374.497	330.614
Jun-07	2162	3078.605	3153.817	3358	4724.506	4758.56	282	376.17	361.768
Jul-07	2175	3027.346	2953.218	4362	4546.849	4475.364	443	377.772	396.573
Aug-07	2374	2970.36	2924.4	4288	4499.062	4467.843	379	379.301	352.628
Sep-07	3173	2944.362	4218.281	2949	4439.821	4592.019	238	380.848	409.598
Oct-07	2082	2957.736	2838.712	3348	4175.114	4137.85	268	382.23	345.443
Nov-07	2700	3044.587	3049.336	4515	3981.811	3830.356	341	383.783	309.371
Dec-07	3877	3264.582	3020.924	5252	4096.603	4098.02	418	385.9	342.338
Jan-08	5149	3581.07	3700.965	6589	4323.904	4352.278	505	388.463	364.79
Feb-08	5325	3705.875	3975.557	5904	4420.918	4513.4	526	391.04	456.509
Mar-08	4570	3525.163	3417.822	4785	4368.311	4326.46	454	393.168	401.767
Apr-08	3415	3341.468	3131.184	3770	4371.65	4303.627	323	395.21	377.899
May-08	2748	3327.101	3365.756	3225	4569.429	4532.339	375	397.463	426.786
Jun-08	2337	3351.548	3328.808	3841	4690.513	4920.673	332	399.685	416.2
Jul-08	2559	3335.144	3337.134	4187	4513.535	4425.793	519	401.835	459.64
Aug-08	2642	3349.314	3192.641	4096	4351.867	4281.698	508	403.585	489.936
Sep-08	2427	3436.169	3472.259	3009	4399.653	4395.007	240	404.78	405.261
Oct-08	2753	3527.166	3509.811	3819	4447.921	4528.711	308	406.056	390.029
Nov-08	3185	3584.502	3534.58	4871	4312.093	4363.172	466	407.599	439.938
Dec-08	4533	3590.007	3676.448	4982	4108.117	4003.602	507	409.019	437.193
Jan-09	6739	3513.821	5290.617	5969	4106.698	4040.193	604	410.071	445.183
Feb-09	4751	3390.138	3401.694	5523	4235.039	4329.637	396	411.007	347.267

Table F continues………

Mar-09	4355	3260.56	3202.924	4632	4332.661	4246.269	448	412.432	394.124
Apr-09	3379	3171.51	3095.314	4272	4435.638	4508.92	431	414.132	455.089
May-09	2476	3170.785	3093.786	3409	4419.426	4493.399	409	415.483	451.899
Jun-09	2231	3221.441	3222.783	3172	4247.869	4201.303	323	416.545	416.574
Jul-09	2534	3214.961	3312.031	3695	4133.334	4089.608	457	417.592	413.836
Aug-09	2409	3160.87	2959.797	3993	4189.675	4133.519	367	418.818	383.63
Sep-09	2189	3139.629	3234.245	3205	4241.215	4403.804	276	420.29	437.331
Oct-09	2268	3111.743	3024.916	3377	4147.633	4042.234	373	421.689	444.373
Nov-09	2772	3020.182	3121.857	4492	4095.174	4098.358	442	422.884	421.82
Dec-09	3590	2899.893	2733.008	5125	4060.924	4140.821	476	424.154	418.096
Jan-10	4292	2822.968	2843.318	5668	3916.84	3878.527	625	425.526	451.213
Feb-10	4072	2803.604	2722.891	4783	3854.635	3761.55	506	426.797	449.946
Mar-10	3903	2867.38	2750.982	4322	4013.119	3992.237	530	427.909	458.247
Apr-10	3308	3027.785	3024.379	4227	4186.227	4306.014	447	428.815	452.96
May-10	2583	3207.081	3200.797	3163	4174.445	4163.567	363	429.608	411.583
Jun-10	2326	3346.336	3317.779	3037	4069.982	4076.256	323	430.526	422.39
Jul-10	2734	3407.871	3511.992	3478	4049.266	3954.385	53	431.546	18.67
Aug-10	2683	3415.551	3233.904	4111	4127.907	4200.706	367	432.699	402.973
Sep-10	2495	3427.526	3540.302	3038	4176.678	4159.802	276	434.055	434.547
Oct-10	2543	3469.927	3300.005	3569	4123.627	4198.835	373	435.413	439.188
Nov-10	3135	3641.657	3485.161	4244	4057.339	3938.859	442	436.706	426.661
Dec-10	4936	3889.786	4078.549	5151	4086.756	4141.595	476	438.081	425.457