

Time Series Models for Forecasting International Visitor Arrivals to Thailand

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Abstract

Forecasting is an essential analytical tool in tourism policy and planning. This paper focuses on forecasting methods based on two concept to forecast international tourism arrivals to Thailand during 2006-2010. First concept is forecasting methods establishes a single variable and second concept is forecasting methods establishes more variables. These forecasting methods were employed in this paper namely SARIMA, ARIMA, Holt-Winter-Additive, Holt-Winter-Multiplicative, Holt-Winter-No seasonal, Neural network, VAR, GMM estimation for time series analysis, ARCH-GARCH-M, ARCH-GARCH, TARCH, PARCH and EGARCH. The secondary data were used to produce forecasts international tourists arrivals to Thailand for 2006-2010 based on the period 1997-2005. The results confirm that the best forecasting method based on first concept is SARIMA(0,1,1)(0,1,4) and the best forecasting method based on second concept is VAR model. Furthermore both SARIMA model and VAR model predict that international tourism arrivals to Thailand during 2006-2010 are positive growth rate. If this results can be generalized for future year, then it augurs that both the Thailand government sector and private tourism industry sector should prepare supply of tourism enough for much more the number of international tourism arrival to Thailand in this period.

Key Words: International tourism of Thailand, Best forecasting methods, A single variable, More variable.

1. Introduction

International tourist arrivals and international tourist receipts have traditionally been used as benchmark aggregate series to assess the overall importance of tourism worldwide and in specific countries. A high international tourist arrivals level may be used in advertising campaigns and also in political discussions to legitimize and emphasize the success of a country in the international community. Similarly, sizeable international tourist receipts can be a good indicator of the role of tourism in an economy in term of both Gross Domestic Product and foreign exchange generation. Policy makers may subsequently be convinced to assist tourism development and further increase profitability from tourism activities. It is not surprising, therefore, that the majority of World Tourism Organization(WTO) statistics focus on these two time series reported as levels, annual changes and market shares(Papatheodorou and Song 2005). Furthermore The United Nations Conference on Trade and Development singled out tourism as the only sector in international trade in services for which developing countries had experienced positive surpluses in their trade account(UNCTAD,1998). Tourism receipts in developing countries, valued at US\$ 6 billion in 1980, reached an unprecedented US\$ 62.2 billion in 1996. The prognosis is that this surge will continue, a manifestation of growing importance of tourism(Narayan,2005). From above some information emphasize that international tourism industry can make money give to economy of developing country especially Thailand. In 2003 Thailand received the number of international tourists were 10,082,109 million and in the same year Thailand received income from them equal to 309,269 million baht. Once again in 2004 Thailand received the number of international tourists were 11,737,413 million and in the same year Thailand also received income from them equal to 384,359 million baht. From data of international tourists of Thailand during 2003-2004 presented when increasing the number of international tourists in Thailand then also increasing income from international tourists of Thailand. Therefore if econometrics approach able to use forecast the number of international tourists arrivals to Thailand then it also able to forecast income from international tourists of Thailand. As well as it is an essential analytical tool in tourism policy and planning. This paper focus on econometrics approach to forecast the number of international tourists arrival to Thailand during 2006-2010 based on period 1997-2005. The various forecasting models developed in reference to tourism can be broadly classified into four categories(Kamra,2006): (a) Structural Models; (b) Trend Extrapolation Models; (c) Simulation Model; and Qualitative Modes. Structural Models are based on establishing the relationship between some measure of tourism demand and a series of causal variables, such as price, income, motivation, image, competition, or distance. Trend Extrapolation Models is also known as Time-Series models, by their very name, depend on the extrapolation of a historical series of data into the future. The two variables are some measure of tourism demand/market activity and time. Simulation Models, a complex set of equations, are a distinctive combination of both Structural Models and Trend Extrapolation Models resulting in a more comprehensive systems simulation. And the last one is Qualitative Models are primarily non-mathematical models. The most widely acknowledged and most commonly used qualitative forecasting model is the Delphi Model. One again this paper will forecast international tourists arrival to Thailand during 2006-2010 based on two categories: (a) Structural Models and in this paper it has been called that the methods of forecasting from more variables, (b) Trend Extrapolation Models and also in this paper it has been called that the methods of forecasting from a single variable.

2. Research Aim and Objective

This research has the aim and objective of seeking to know the best forecasting methods to forecasts international tourist arrivals to Thailand during 2006-2010 and to know how many number international tourists arrivals to Thailand in this period.

3. Scope of this Research

The scope of this research is the period 1997-2010 and mostly the data was secondary data. The countries used for forecasts international tourists arrivals to Thailand were the every countries for the international tourism industry of Thailand (source: Thailand's tourism organization).

The variables used in this research were the number of international tourist arrivals to Thailand based on during 1997-2005 produce to forecast 2006-2010 and the income growth rate of country's industry based on during 1997-2005 produce to forecast 2006-2010.

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4. The research framework of tourism forecasting and forecasting methodology

Tourism forecasting methods can be divided into qualitative and quantitative methods and causal quantitative techniques. Regardless of the type of forecasting method used, the usefulness of any tourism demand forecasting model is really determined by the accuracy of the tourism forecasts that it can generate, as measured by comparison with actual tourism flows (Mahmoud,1984). Frechtling(1996,2001) highlighted five patterns in a tourism time series: (a) seasonality, (b) stationarity, (c) linear trend, (d) non-linear trend and (e) stepped series. The time series non-causal approach or forecasting a single variable approach is limited by the lack of explanatory variables and it also was best used for short-term to medium-term forecasting. As well as this approach is assumed that the factors related to seasonality, trend and cycle are slow to change and can be extrapolated in the short term (Kon and Turner, (2005) . In this paper was used two concept of time series forecasting methods such as the methods of forecasting from a single variable and the method of forecasting from more variables (Hall, Lilien, Sueyoshi, Engle, Johnston and Ellsworth(2005)). In first concept based on the methods of forecasting from a single variable such as Holt-winter method, ARIMA method, SARIMA method and Neural Net work method. In second concept based on the methods of forecasting from more variables such as VAR model, GMM method, ARCH-GARCH method, ARCH-GARCH-M method, TARCH method, EGARCH method and PARCH method.

4.1. The Method of Forecasting from a Single Variable

4.1.1. Holt-winter

1. Holt-Winter-No seasonal (Two parameter)
2. Holt-Winter-Multiplicative (Three parameter)

4.1.2. ARIMA Modelling

4.1.3. Neural Network Method

4.2. The method of forecasting from more variables

4.2.1. VAR Model

4.2.2. GMM method for time series analysis

4.2.3. ARCH-GARCH Model

4.2.4. ARCH-M Model and GARCH-M Model

4.2.5. TARCH Model

4.2.6. EGARCH Model

4.2.7. PARCH Model

5. The results of the research

The forecasting methods were employed in this paper to forecast international tourists arrival to Thailand during 2006-2010 based on two concept. First concept is most forecasting methods establishes a single variable(the number of international tourists arrivals to Thailand). These forecasting methods, namely SARIMA, ARIMA, Holt-Winter-Additive, Holt-Winter-Multiplicative, Holt-Winter-No seasonal and Neural network. Second concept is forecasting methods establishes more variable(the number of international tourists arrivals to Thailand and growth rate of country's industry income). These forecasting methods, namely VAR model, GMM estimation for time series analysis, ARCH-GARCH-M model, ARCH-GARCH model, TARCH model, PARCH model and EGARCH model.

5.1. Forecasting accuracy is based on Mean Absolutes Percent Error (MAPE) of each method (the method of forecasting from a single variable)

Table 1 shows the forecasting performance accuracy comparisons of the six method to forecast international tourists arrival to Thailand during 2006-2010. Most method is based on the method of forecasting from a single variable.

Table 1: An accuracy comparison in sample for different forecasting model is based on the method of forecasting from a single variable

Number	Method of forecasting	MAPE(%)
1	SARIMA(0,1,1)(0,1,4)	16.73
2	ARIMA(2,1,3)	22.23
3	Holt-Winter-Additive (Three parameter)	22.59
4	Holt-Winter-Multiplicative (Three parameter)	24.30
5	Holt-Winter-No seasonal (Two parameter)	31.31
6	Neural network	32.18

Form: computed

Form table 1, the best method to forecast international tourists arrival to Thailand during this period is SARIMA(0,1,1)(0,1,4). Because the MAPE(%) of this method is very low than other method such as ARIMA(2,1,3), Holt-Winter-Additive(three parameter), Holt-Winter-Multiplicative(three parameter), Holt-Winter-No seasonal(two parameter) and Neural network.

5.2. Forecasting accuracy is based on Mean Absolutes Percent Error (MAPE) of each method (more variable)

Table 2 shows the empirical findings of the seven method to forecast international tourists arrival to Thailand during 2006-2010. Most method is based on the method of forecasting from more variable.

Table 2: An accuracy comparison in sample for different forecasting model is based on the method of forecasting from more variable

Number	Method of forecasting	MAPE(%)
1	VAR model	27.26
2	GMM estimation for time series analysis	27.79
3	ARCH-GARCH-M model	28.71
4	ARCH-GARCH model	29.08
5	TARCH model	30.33
6	PARCH model	34.96
7	EGARCH model	39.05

Form: computed

Form table 2, the best method to forecast international tourists arrival to Thailand during this period is VAR model. Because the MAPE(%) of this method is very low than other method such as GMM estimation for time series analysis, ARCH-GARCH-M model, ARCH-GARCH model, TARCH model, PARCH model and EGARCH model.

5.3. The empirical results of forecasting international tourism demand arrivals to Thailand during 2006-2010

The table 3 presents the results of forecasting by SARIMA(0,1,1)(0,1,4) model during 2006-2010. Mostly both first quaternary growth rate and second quaternary growth rate in international tourist arrivals to Thailand are negative growth. And mostly both third quaternary growth rate and fourth quaternary growth rate in international tourist arrivals to Thailand are positive growth. Furthermore average per year growth rate is positive growth as well as average per year growth rate equally between 1.40% and 1.50 % during this period.

Table 3 : Forecasts of quaternary percentage change in international tourist arrivals to Thailand is based on SARIMA(0,1,1)(0,1,4) model during period 2006-2010.

Year	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	Average per Year
2006	-6.82	-3.86	10.88	5.69	1.47
2007	-2.03	-0.13	4.11	3.74	1.42
2008	-4.43	-1.92	7.39	4.77	1.45
2009	-3.35	-1.07	5.91	4.36	1.46
2010	-3.94	-1.50	6.75	4.64	1.50

From: computed

The table 4 presents the results of forecasting by VAR model during 2006-2010. Mostly second quaternary growth rate(except both first quaternary growth rate in 2006 and second quaternary growth rate in 2007 are negative growth), third quaternary growth rate and fourth quaternary growth rate in international tourist arrivals to Thailand are positive growth.

Table 4 : Forecasts of quaternary growth rate percentage change in international tourist arrivals to Thailand is based on VAR model during period 2006 - 2010.

Year	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	Average per Year
2006	1.07	-1.53	5.29	5.04	2.47
2007	-2.17	-0.39	4.59	5.36	1.85
2008	-2.74	0.98	3.76	5.69	1.92
2009	-3.38	2.62	2.76	6.10	2.02
2010	-4.14	4.58	1.62	6.55	2.15

From: computed

And mostly first quaternary growth rate in international tourist arrivals to Thailand are negative growth (except first quaternary is negative growth). Furthermore average per year growth rate is positive growth as well as average per year growth rate equally between 1.90% and 2.50 % during this period. The best method of forecasting international tourist arrivals to Thailand based on both SARIMA(0,1,1)(0,1,4) and VAR model indicated that positive growth rate (average per year) during 2006-2010. Mover over in quaternary three and quaternary four based on two method of forecasting also indicated that international tourism arrivals to Thailand has positive growth rate (average per year) during this period.

6. The conclusions of research and policy recommendations

This paper provides forecasting analysis of international tourists arrival to Thailand during 2006-2010 based on two categories: (a) Structural Models and in this paper it has been called that the methods of forecasting from more variables, (b) Trend Extrapolation Models and also in this paper it has been called that the methods of forecasting from a single variable. The Structural Models or the methods of forecasting from more variables was used to forecasts the number of international tourist arrival to Thailand during 2006-2010. Such as VAR model, GMM method, ARCH-GARCH method, ARCH-GARCH-M method, TARCH method, EGARCH method and PARCH method. The Trend Extrapolation Models or the methods of forecasting from a single variable was used to forecasts the number of international tourist arrival to Thailand in this period. Such as Holt-winter method, ARIMA method, SARIMA method and Neural Net work method.

The best method of forecasting from Structural Models is SARIMA(0,1,1)(0,1,4) method because the MAPE value of this method is very low than other methods (see table1). And the best method of forecasting from Trend Extrapolation Models is VAR method because also the MAPE value of this methods is very low than other methods (see table 2). The MAPE value was used looking for the best forecasting methods of international tourists arrival to destination countries in the world (Law and Au,1999), (Papatheodorou and Song,2005), (Kon and Turner, 2005). And SARIMA (0,1,1)(0,1,4) method predicts that in 2010 the number of international tourists arrival to Thailand is 15,700,656.00 million (see both appendix A and table 5). Also VAR method predicts that in 2010 the number of international tourists arrival to Thailand is 15,985,416.00 million (see both appendix A and table 6). Therefore the conclusions results of this research show that five year forward during 2006-2010 the number of international tourist arrival to Thailand has continue

increasing. This result was similar with the results of previous empirical studies of forecasting in international tourist receipts of both World and Asia (Papatheodorou and Song, 2005). Because the results of previous empirical studies of this research show that international tourist of both world and Asia have positive growth rate during 2006-2010.

If this results can be generalized for future year, then it augurs that both the Thailand government sector and private tourism industry sector should prepare every thing enough for much more the number of international tourism arrival to Thailand during 2006-2010. Such as the number of hotel, the number transportation, new tourism place, more unit of tourism polices, much more problem environment impact on tourism place, airport unit, arrange budget for develop to tourism place in Thailand and human training in tourism industry.

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Appendix A

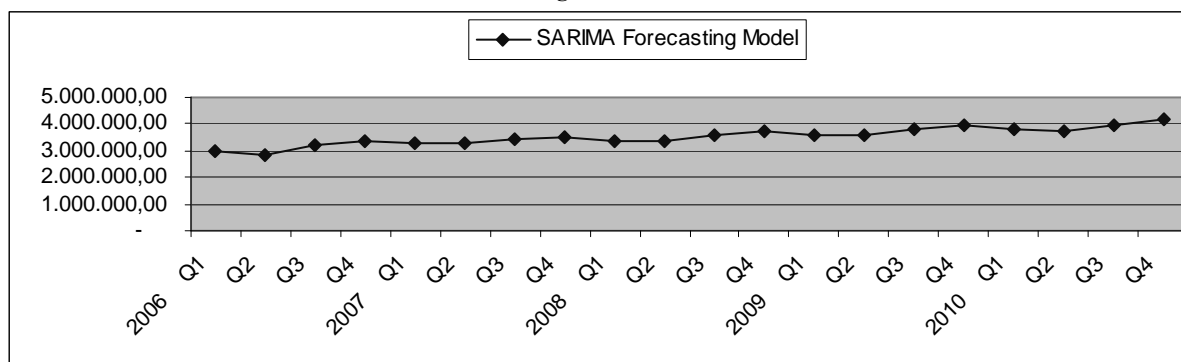
Extension experimental results of forecasting international tourists arrivals to Thailand during 2006-2010 based on both SARIMA method and VAR method.

Table 5: Forecast the number of international tourists arrivals to Thailand during 2006(Q1)-2010(Q4) based on SARIMA Forecasting Model.

Year / Quaternary	SARIMA forecasting method (Million)
2006 Q1	2,977,142.10
Q2	2,862,141.00
Q3	3,173,676.00
Q4	3,354,156.00
Total	12,367,115.10
2007 Q1	3,285,954.00
Q2	3,281,727.00
Q3	3,416,709.00
Q4	3,544,509.00
Total	13,528,899.00
2008 Q1	3,387,561.00
Q2	3,322,602.00
Q3	3,568,173.00
Q4	3,738,279.00
Total	14,016,615.00
2009 Q1	3,613,206.00
Q2	3,574,569.00
Q3	3,785,883.00
Q4	3,950,979.00
Total	14,924,637.00
2010 Q1	3,795,390.00
Q2	3,738,390.00
Q3	3,990,771.00
Q4	4,176,105.00
Total	15,700,656.00

From: computed

Figure 1: Graphical presentation of forecasting international tourists arrivals to Thailand during 2006-2010 based on SARIMA Forecasting Model



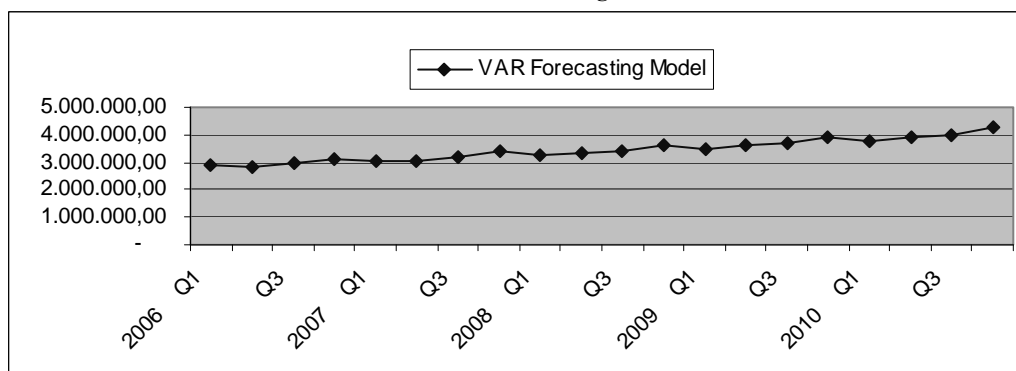
From: computed

Table 6: Forecast the number of international tourists arrivals to Thailand during 2006(Q1)- 2010(Q4) based on VAR Forecasting Model.

Year / Quaternary	VAR Forecasting Model (Million)
2006 Q1	2,887,912.30
Q2	2,843,776.20
Q3	2,994,270.00
Q4	3,145,155.70
Total	11,871,114.20
2007 Q1	3,076,805.30
Q2	3,064,769.20
Q3	3,205,338.00
Q4	3,376,997.00
Total	12,723,909.50
2008 Q1	3,284,452.10
Q2	3,316,614.90
Q3	3,441,269.00
Q4	3,637,182.00
Total	13,679,518.00
2009 Q1	3,514,418.00
Q2	3,606,444.00
Q3	3,706,075.00
Q4	3,932,221.00
Total	14,759,158.00
2010 Q1	3,769,423.00
Q2	3,941,909.00
Q3	4,005,906.00
Q4	4,268,178.00
Total	15,985,416.00

From: computed

Figure 2: Graphical presentation of forecasting international tourists arrivals to Thailand during 2006-2010 based on VAR Forecasting Model.



From: computed