Tourist Arrivals from Korea, US, Japan and China to the Philippines: Two-year Ahead Monthly Forecast Scenarios

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Abstract: Accurate prediction of the number of international tourists that will visit the country in the future from its major country sources is an absolute requisite for effective tourism planning. For a well-endowed country as the Philippines, which has all the potentials to become a force to reckon with in international tourism, particularly in the Southeast Asian region, effective planning is sorely needed. The government on its part is not remiss in formulating tourism plans and strategies over the years, yet the country has been lagging in this area over lesser endowed neighbors in the region – one of the world's fastest growing tourism destinations. The Philippine international tourism market is currently dominated by four countries – Korea (South Korea), United States, Japan and China. Collectively these countries capture more than 60% of the Philippine international tourism market, with Korea occupying the top with market share of more than 25%, followed by the U.S., Japan and China, in that order. Developing reliable short to medium-term arrival scenarios for these countries may prove to be enormously beneficial to a wide-range of local tourism and hospitality businesses in crafting their operational, tactical and strategic business plans. This study attempts to develop and operationalize empirical forecasting models for the monthly number of tourists coming from these countries. The models, developed through a framework that considers possible influential events plus an ARIMA background noise are used to formulate two-years-ahead arrival scenarios. The models passed all conventional econometric model selection criteria and turned-in outstanding in-sample and out-of-sample forecasting performances.

Key Words: Tourism Demand Forecasting; Transfer Function; ARIMA Model Based Noise Modeling; Ex-Ante Forecasting

1. INTRODUCTION

The Philippine international tourism market is currently dominated by four countries – Korea (South Korea), United States, Japan and China. Collectively these countries capture more than 60% of the Philippine international tourism market, with Korea occupying the top with a market share of more than 25%, followed by the U.S., Japan and China, in that order, with U.S. the sole long-haul market. The three East Asian giants which comprise the "plus 3" in the expanded ASEAN+3 grouping is the traditional "bread and butter" short-haul markets for the Philippines inward tourism. Developing reliable short to medium-term arrival scenarios for these four countries would prove to be enormously beneficial to a wide-range of local tourism and hospitality businesses in crafting their operational, tactical and strategic business plans.

This study is an attempt to develop and operationalize empirical time series forecasting models for the monthly number of tourists coming from the Philippines' top four international tourism markets. The central goal is to formulate two-years-ahead monthly arrival scenarios. Employing a framework that considers possible influential events that may impact on the level and direction of arrival time series, together with a dependable procedure of modeling background noise, the study aims to establish for each of these source countries "a-theoretic" (or non-structural) forecasting models that are robust enough to pass all conventional econometric model selection criteria. Contrary to structural forecasting models which are basically founded on sound economic principles (e.g. consumer demand theory), a-theoretic models are mainly anchored on the examination of the trajectory of historical time series as they are impacted by influential events (e.g., **travel advisories, terrorist attacks, airline route opening, political conflicts**, **policy changes**, etc.), natural tendencies (e.g. **seasonality**, Higham & Hinch 2002, Koenig & Bischoff 2003) and the **business cycle**.

Most of the tourism demand forecasting models presented in the literature are classified as structural or theoretic (see e.g. the review articles: Lim 1997, Song & Witt 2000, and Li, et. al 2005). Unlike non-structural models however, these models are subject to the so-called "Lucas Critique" (Lucas 1976) or a form of Meese-Roggoff Paradox (Meese & Rogoff 1983), that despite their sophistication produce less accurate forecasts than their a-theoretic counterparts. Furthermore, when used in forecasting, structural models (particularly the static ones) will require policy values or forecasts of explanatory variables, which at times can only be extrapolated with substantial error (Song & Turner 2006). Their comparative advantage though lies in estimating parameters useful in policy formulation, counterfactual simulations and stylized facts analysis (e.g. elasticities, multipliers, marginal propensities, etc.). The literature also points out that econometric regression models are almost always out-performed by time-series models (e.g., Witt & Witt 1995).

This study will provide additional evidence on the practicability and efficacy of using non-structural univariate time series models in establishing accurate forecasts of demand of a highly volatile industry which is extremely susceptible not only on traditional economic determinants, but also on influential events and emerging developments on various fronts.

2. METHODOLOGY

2.1 The ARIMA Noise Transfer Function Modeling

The non-structural modeling approach adopted in the study is the so-called ARIMA Model-Based (AMB) Methodology. Under the AMB approach, each of the monthly visitor arrival series, one for each country will be depicted as being generated by a stochastic process driven by different deterministic factors and a non-stationary stochastic noise element which can be modeled as a Box-Jenkins Seasonal ARIMA process. These exogenous factors are classified into two categories, namely: (1) **Calendar Effects (CE)** – caused by the distribution of weekdays of every month, as well as the **Easter Effects (EE)** which are captured by the movable date of Easter in every year; (2) **Outliers** – Dummy variables representing the date of occurrences of influential events which are further classified into **Additive Outliers (AO)** – events that cause one time spikes in the series; **Transitory Changers (TC)** – events that create fleeting changes; and **Level Shifters (LS)** – shocks that have permanent effects.

Symbolically, if $\mathbf{y}$ represents the monthly vector of the number of tourists arriving to the Philippines from the four top source countries, $\mathbf{c}$ the calendar effect vector, $\mathbf{e}$ the vector of Easter dummy variables, $\mathbf{a}$, $\mathbf{t}$ and $\mathbf{l}$ representing the AO, TC and LS outlier vectors respectively, the model can be specified as:

$$y_t = \gamma' c_t + \varepsilon' e_t + \alpha' a_t + \tau' t_t + \lambda' l_t + \zeta_t \quad (1)$$

The vectors $\gamma, \varepsilon, \alpha, \tau$ and λ contain the coefficients for the vectors $\mathbf{c}$, $\mathbf{e}$, $\mathbf{a}$ $\mathbf{t}$ and $\mathbf{l}$ respectively. The stochastic vector ζ contains the noise elements for the regression models for the four tourist sending countries, each is assumed to follow $ARIMA(\mathrm{p,d,q})(\mathrm{P,D,Q})_{12}$ process. The Modified

Box-Jenkins procedure is employed in modeling the noise element. Monthly Visitor Arrivals data from the four countries for the period January 2000 to December 2017 is used in the study. Forecast scenarios are established for January 2018 to December 2019. The econometric software **Eviews 9.5 and TSW+ Ver. 941** are used in the study.

2.2 The Modified Box-Jenkins Procedure

The ARIMA Model Based Methodology (AMB) is implemented by procedure which is basically a modification of the classical Box-Jenkins procedure (Box and Jenkins 1970), originally envisioned to develop non-structural univariate models with optimal forecasting properties. Also introduced in this seminal publication was a seasonal ARIMA model called the "Airline Model" which has become the benchmark Box-Jenkins model. This model is the ARIMA(0,1,1)(0,1,1) which underlie many real-world monthly processes. In the AMB approach, the background noise ζ is modeled as a seasonal ARIMA process, while the deterministic portion in (1) is modeled as a Transfer Function of calendar effects and different kinds of outliers which represent the influential events that impact both the magnitude and direction of the Visitor Arrival series.

Estimation of model (1) is undertaken by **Kalman Filter** if log transformed, or by **Exact Maximum Likelihood** if modeled in level. The iterative component of the modified Box-Jenkins procedure lies in the diagnostics stage where the assumed model is tested for adequacy using a number of criteria. Aside from testing the statistical adequacy of the parameters, the following testing procedures are implemented in the diagnostics stage to handle the goodness-of-fit assessment of the alternative models for each series:

- **Ljung-Box (LB)** test for residual autocorrelation
- **Jarque-Bera (JB)** test for normality of residuals
- **SK t-test** for residual skewness
- **Kur t-test** for residual kurtosis
- **Box Pierce (QS)** test of residual seasonality
- **McLeod and Li (Q2)** test of residual linearity
- **Runs** t-test for residuals randomness
- **Correlogram Analysis** – for alternative models' selection

The Airline model is used as the initial model considered in the iterative procedure.

3. RESULTS AND DISCUSSION

3.1 The Estimated Transfer Function Models and their Diagnostics

The Modified Box-Jenkins procedure resulted in successfully fitting optimal Transfer Function models with ARIMA(p,d,q)(P,D,Q) noise are presented in Table 1. Summary of the models' diagnostics is shown in Table 2. From both tables, it can be gleaned that the models passed all model selection criteria with estimated parameters deemed highly significant statistically.

USA and Japan are modeled in levels, while the rest are log transformed. The Airline Model is the optimal noise model for Japan and USA, while Korea has ARIMA(3,1,0)(0,1,1) and China has ARIMA(2,1,0) (1,0,1). Japan turned in significant trading day effects, while USA exhibits Easter effects. China has the most outliers with six; Korea has 4 while Japan and USA are the most robust with 3. Table 3 presents the influential observations (by outlier categories) and the months these outliers were detected. The varying signs and highly significant t values for the outliers in all countries suggest that detected influential events can either increase or decrease tourism numbers from these four countries to the extent of their coefficients. In-sample and out-of-sample performance of all models proved to be highly satisfactory.

3.1 The 24-Month-ahead Arrival Scenarios from the Top Four International Tourism Markets of the Philippines

The main objective of the study is to establish 24-month ahead forecasts of the number of international tourists that will visit the Philippines from the top four country sources – USA, Japan, Korea and China. The most likely, worst case and best case forecast scenarios are generated by the fitted models for the period January 2018 to December 2019, and are presented in Table 4.

Table 1. Fitted Transfer Function with ARIMA Noise Models for the Four Countries

Country/ Market Share	Level/ Log	Mean	SARIMA Noise Models						SE(res)	BIC	#OUT	TD	EE
			p	d	q	P	D	Q					
USA	1	0	0	1	1	0	1	1	2630.89	15.8772	3	0	1
JAPAN	1	0	0	1	1	0	1	1	2132.52	15.4572	3	1	0
KOREA	0	0	3	1	0	0	1	1	0.0867	-4.7205	4	0	0
CHINA	0	0	2	1	0	1	0	1	0.1941	-3.0767	6	0	0
Top4_Share	0	0	0	1	1	0	1	1	0.0283	-7.0435	2	0	0

Table 2. Model Diagnostic Results

Country/ Market Share	Mean Test	Q Test	N-test	SK(t)	KUR(t)	Q2	RUNS	Mean Stability		Variance Stability		LEV/LOG	Out of Sample F	Model Fit
								Full period	Last 10y	Full period	Last 10y			
USA	0.66	33.47	3.61	1.56	1.09	42.72	-1.28	-0.01	0.02	1.37	1.55	0.95	2.45	Good
JAPAN	0.88	14.55	0.634	0.774	0.188	17.29	0.142	1.22	-0.64	1.35	0.98	0.89	1.38	Good
KOREA	-0.51	28.27	3.79	-1.12	1.59	13.91	0.569	1.22	-0.11	1.03	0.77	1.31	1.70	Good
CHINA	1.19	19.06	3.14	1.56	0.843	21.87	0.277	0.32	0.53	1.21	1.09	4.64	0.80	Good

Table 3. Detected Outliers per Country, By Categories, Dates and t values

USA	**AO01** (122003, 3.85)	**TC01** (032003, -5.87)	**TC02** (052003, -4.27)			
JAPAN	**TC01** (102001, -5.80)	**TC02** (042003, -5.41)	**TC03** (012017, 3.92)			
KOREA	**AO0 1**(042002, 5.12)	**TC01** (042003, -7.10)	**TC02** (092009, -6.11)	**TC03** (072003, 3.86)		
CHINA	**AO01** (052003, -6.66)	**AO02** (012009, 5.24)	**AO03** (122010, 4.48)	**AO04** (012012, 3.99)	**LS01** (022005, 4.89)	**LS02** (092010, -3.81)

Legend: AO (Additive Outlier) TC (Transitory Changer) LS (Level Shifter)

Table 4. The 24-month Ahead Tourist Arrival Forecasts from the Top Four Markets of The Philippines (January 2018 to December 2019)

DATE	USA			JAPAN			KOREA			CHINA		
	Most Likely	Worst Case	Best Case	Most Likely	Worst Case	Best Case	Most Likely	Worst Case	Best Case	Most Likely	Worst Case	Best Case
2018-Jan	101,682	97,473	105,891	47,322	43,361	51,283	169,687	146,795	192,579	110,340	85,754	134,926
2018-Feb	83,871	79,355	88,386	52,666	48,809	56,522	162,638	137,145	188,131	143,613	106,827	180,399
2018-Mar	85,233	80,397	90,069	57,842	53,958	61,727	128,352	105,688	151,016	113,301	80,890	145,712
2018-Apr	87,727	82,622	92,831	45,311	41,338	49,285	119,148	97,546	140,750	114,610	78,690	150,530
2018-May	86,393	81,065	91,721	45,351	41,267	49,434	122,750	98,557	146,943	109,082	72,110	146,054
2018-Jun	88,100	82,528	93,673	40,168	35,965	44,370	127,372	100,798	153,946	107,930	68,773	147,087
2018-Jul	88,917	83,110	94,724	49,538	45,204	53,871	157,873	122,549	193,197	159,464	98,002	220,926
2018-Aug	65,382	59,350	71,414	65,975	61,520	70,430	167,393	128,421	206,365	149,517	88,660	210,374
2018-Sep	61,058	54,809	67,307	48,548	43,966	53,130	129,227	97,717	160,737	126,257	72,248	180,266
2018-Oct	72,701	66,242	79,160	42,495	37,783	47,206	137,776	102,921	172,631	120,772	66,697	174,847
2018-Nov	78,349	71,687	85,012	47,072	42,252	51,893	140,770	103,655	177,885	114,067	60,791	167,343
2018-Dec	102,731	95,872	109,590	50,325	45,389	55,262	166,885	121,382	212,388	110,715	56,931	164,499
2019-Jan	106,057	97,542	114,572	49,782	43,528	56,036	189,160	132,984	245,336	157,378	74,052	240,704
2019-Feb	88,245	79,232	97,259	55,155	48,838	61,472	173,450	119,287	227,613	204,834	90,352	319,316
2019-Mar	86,735	77,248	96,221	59,923	53,451	66,395	139,739	93,936	185,542	161,600	66,666	256,534
2019-Apr	94,975	85,038	104,911	48,265	41,596	54,935	129,407	85,597	173,217	163,467	62,902	264,032
2019-May	90,768	80,401	101,134	47,885	41,030	54,741	135,137	87,500	182,774	155,583	55,629	255,537
2019-Jun	92,475	81,695	103,255	42,281	35,220	49,341	138,478	87,949	189,007	153,940	50,977	256,903
2019-Jul	93,292	82,114	104,470	52,514	45,239	59,789	172,301	107,138	237,464	227,443	69,435	385,451
2019-Aug	69,757	58,195	81,319	68,096	60,640	75,553	181,883	111,031	252,735	213,254	59,688	366,820
2019-Sep	65,433	53,499	77,367	51,530	43,877	59,183	141,214	84,533	197,895	180,079	45,895	314,263
2019-Oct	77,076	64,781	89,371	45,049	37,195	52,904	150,104	88,197	212,011	172,257	39,663	304,851
2019-Nov	82,724	70,079	95,369	49,199	41,166	57,232	153,661	88,538	218,784	162,692	33,510	291,874
2019-Dec	107,106	94,120	120,092	53,311	45,091	61,531	181,741	102,771	260,711	157,911	28,737	287,085

4. SUMMARY AND CONCLUSION

The Philippines has been lagging behind most of its ASEAN neighbors in terms of international tourist arrivals. Despite its being traditionally considered as a tropical paradise and with massive promotional support from both the government and the private sector, the country is only able to attract 5.361 million international tourists in 2015, as compared to 29.881 million of Thailand, 25.721 million of Malaysia, 12.052 million of Singapore, 10.408 million of Indonesia, and 7.944 million of Vietnam (UNWTO Tourism Highlights 2016 Edition). These figures indicate that the

Philippines is only the 6th destination of choice among international tourists in the ASEAN region. Even the lowly Cambodia, with 4.775 million arrivals in 2015 is slowly catching up on us. The Philippines has excellent tourism products as compared to most of these ASEAN countries, with aggressive promotional thrusts from the private and the public sectors, quality infrastructures, not to mention the world-renowned hospitality of the people, But what ails the country to be at this modest state? One may cite a variety of reasons ranging from peace and order, corruption, political uncertainty, bureaucratic red tape, etc. This author suspects one culprit - mediocre planning based on not so reliable demand forecasting systems or models used by both government and private planning entities. Under the backdrop of the ASEAN economic integration, with all preparations already in place, countries in the region are in a planning frenzy employing a variety of expert systems and planning models, most of which are structural in nature, in prognosticating future scenarios, (Song & Li 2008, and Li, et. al 2005). This study empirically demonstrates the practicability of an alternative methodological paradigm, anchored on the non-structural framework that may produce more accurate and reliable demand forecasts for the top country sources which account for more than 60 percent of country's inward tourism market.

The excellent forecast simulation performance and diagnostics of the models accentuate their viability for use in tourism management and planning. However, their true worth in accurately anticipating both the future magnitudes and directions of the arrival series for such a long-term horizon of two years (24 months) still remain to be seen and examined until actual arrivals for this time period are finally recorded and published.

6. REFERENCES

Box, G.E.P., & Jenkins, G. (1970). *Time series analysis, forecasting and control*. San Francisco: Holden Day

Egan, D., & Nield, K. (2003). The economic impact of tourism – A critical review. *Journal of Hospitality and Tourism Management, 10*(2), 170-177

Higham, J., & Hinch, T.D. (2002). Tourism, sports and seasons: the challenges and potential of overcoming seasonality in the sports and tourism sectors. *Tourism Management, 23*(2), 175-185.

Koenig, N., & Bischoff, E. (2003). Seasonality of tourism in Wales: A comparative analysis. *Tourism Economics, 9*(3), 229-254.

Li, G., Song, H., & Witt, S.F. (2005). Recent developments in econometric modeling and forecasting. *Journal of Travel Research, 44*(1), 82-99.

Lim, C. (1997). Review of international tourism demand models. *Annals of Tourism Research, 24*(4), 835-849.

Lucas, R. (1976). Econometric policy evaluation: A critique. In K. Brunner (Ed.), *The Phillips Curve and Labor Markets*, Carnegie-Rochester Conference Series on Public Policy, (1), 19-46

Meese, R., and K. Rogoff. "Empirical Exchange Rate Models of the Seventies." *Journal of International Economics*, 1983, 14 pp. 3-24.

Song, H., & Li, H. (2008). Tourism demand modeling and forecasting – A review of recent research. *Tourism Management, 29*(2), 203-220.

Song, H. and S.F. Witt (2000), *Tourism Demand Modelling and Forecasting: Modern Econometric Approaches*, Oxford: Pergamon.

UNWTO Tourism Highlights 2016 Edition. World Tourism Organization (www.unwto.org)