

TOURISM DEMAND FOR BALI-THE HEGY APPROACH FOR SEASONAL UNIT ROOT TEST

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Abstract

Tourism plays an important economic role for a destination. This study aims to investigate the behavior of seasonal direct tourist arrivals to Bali. To achieve the aforementioned objective archival data of direct tourist arrivals to Bali from 2001 to 2010 were used. Error Correction Model (ECM) and HEGY approach were applied to analyze the behavior of seasonal tourist arrivals. Wald test was applied in joint test for quarterly parameter. Cusum test were applied to examine the parameter stability for the periods mentioned above. USA, UK, and Japan tourist arrivals were the dependent variables while exchange rates and inflation rates for those mentioned countries were independent variables of the model. The findings of the study are as follows. The ECM results for Japan revealed that in the short run and the long run as well the exchange and inflation rates were negatively related to arrivals. For UK, in the short run exchange rates negatively related to arrivals while inflation rates exhibited positive relation to arrivals. For the US, all exchange rate and inflation rates were positively related to arrivals. Cusum test revealed the following. Japan arrivals exhibited relatively stable parameter for the periods of 2001-2010. UK arrivals showed parameter instability; while US arrivals experienced relatively stable parameter for the periods mentioned earlier. Wald test results showed that all arrivals, USA, UK, and Japan contained a unit root for their quarterly data.

Keywords: Error Correction Model (ECM), HEGY approach, Cusum test, Wald test, and quarterly data.

Abstrak

Pariwisata memainkan peran ekonomi yang penting bagi tujuan. Penelitian ini bertujuan untuk menyelidiki perilaku musiman kedatangan wisatawan langsung ke Bali. Untuk mencapai tujuan tersebut digunakan arsip data kedatangan wisatawan langsung ke Bali 2001-2010. *Error Correction Model* (ECM) dan pendekatan HEGY diterapkan untuk menganalisis perilaku kedatangan wisatawan musiman. Wald test digunakan dalam uji bersama untuk parameter triwulanan. Cusum tes diaplikasikan untuk menguji stabilitas parameter untuk periode yang disebutkan di atas. Variabel dependen adalah kedatangan turis Amerika Serikat, Inggris, dan Jepang, sedangkan nilai tukar dan tingkat inflasi untuk negara-negara yang disebutkan adalah variabel bebas dari model. Temuan Hasil ECM untuk Jepang mengungkapkan bahwa dalam jangka pendek dan jangka panjang serta nilai tukar dan tingkat inflasi memiliki hubungan negatif terkait dengan kunjungan. Untuk Inggris, dalam tingkat pertukaran jangka pendek berhubungan negatif dengan kunjungan sementara tingkat inflasi menunjukkan hubungan positif dengan tingkat kunjungan. Bagi AS, semua nilai tukar dan tingkat inflasi adalah positif berhubungan dengan pendatang. Tes Cusum mengungkapkan sebagai berikut. Kedatangan Jepang menunjukkan parameter yang relatif stabil untuk periode 2001-2010. Kedatangan Inggris menunjukkan ketidakstabilan parameter, sedangkan AS kedatangan mengalami parameter yang relatif untuk periode yang disebutkan sebelumnya. Hasil uji Wald menunjukkan bahwa semua kedatangan, Amerika Serikat, Inggris, dan Jepang mengandung unit root untuk data kuartalan mereka.

Kata kunci: Error Correction Model (ECM), HEGY approach, Cusum test, Wald test, and data kuartalan.

JEL Classification: C22, L83

1. Introduction

Tourism nowadays plays an important role in a country's economy growth. This is due the long and complex blend of tourism as an industry. It embraces traveling, transportation industry, hotel, restaurants, entertainments to mention a few industry that constitute to tourism. People visit a country with several reasons: visiting friend and relatives, pleasure, businesses, health, pilgrimage, and other reasons. The destination country thus becomes a demand for tourist for several reasons mentioned above. Demand for a destination is subject to some variables. Haiyan Song *et al.*, (2009) mentioned that population, income, price, taste, marketing, and expectations and habit persistence were amongst variables that influence the choice of a destination. While Dritsakis (2004) mentioned that real income per capita, tourism prices, transportation costs, and exchange rates were factors influenced the demand for Greece.

The demand for a tourist destination fluctuates amongst months within a year. These fluctuations were due to business cycles, holidays, and other factors which drive seasonality of tourist arrivals. Due to this condition some scholars were interested in doing the forecast of tourist demand for a destination. Forecasting is one of important tools to anticipate the resource allocations to fulfill tourist demands. Several methods were applied in forecasting tourist demand or arrivals. Since tourist arrivals were in time series modes then the forecasting approaches using time series methods as well. The most common methods were ARIMA (Auto Regressive Integrated Moving Average) and ECM (Error Correction Model) (Gang Li *et al.*, 2006).

The ARIMA method was applied among others by Wong *et al.*, (2002) (in Haiyan Song *et al.*, (2009)), Rahman *et al.*, (2004), Louvieris (2002). The ECM in the last two decades also gained its popularity in application for tourism forecasting by Dritsakis (2004), Gang Li *et al.*, (2006), Wong *et al.*, (2002) (in Haiyan Song *et al.*, (2009)) to mention a few.

In applying the ECM for forecasting tourism demand one may apply tourist arrivals as dependent variable and exchange rate, consumer price index, travel cost to a destination, etcetera as explanatory variables. Due to seasonality pattern of tourist arrivals to a destination Hyllerberg, *et al.*, (1990) (HEGY) tested the existence of unit root in quarterly data of tourist arrivals. They then conducted test if the seasonal parameter $\pi_1=\pi_2=\pi_3=\pi_4=0$. This implies that if they can not reject this hypothesis the quarterly or seasonal data has no unit root i.e. that the data are stationary. Stationary data are valid for the use of time series forecasting.

Tourism in the last decade has played important role in economic development in Indonesia. Foreign tourist arrivals in Indonesia achieved an average growth from 2002 to 2009 by 3.8 % (www.bps.go.id. accessed in March 30 2011). It was evident that tourism industry was influenced by unpredictable events like severe terrorist attacks, SARS, Avian flu, Swine flu and global financial crisis that broke-out in August 2007.

Bali is one of The Republic of Indonesia province with its regional product largely depend on tourism. In 2009 for example direct foreign tourist arrivals in Bali was 2.229.945, while in 2010 there was 2.493.058 arrivals. There was an 11.80 % increase of direct foreign arrivals within that year. A more detail of direct foreign tourist arrivals is presented in table 1 underneath.

**Table 1. Direct Foreign Arrivals in Bali
Periods of 2001-2010**

MoYr	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	108897	87027	60836	104062	101931	79721	109875	140275	164962	168923
Feb	99040	96267	67469	84374	100639	73430	118483	153757	139282	187781
Mar	114997	113553	72263	99826	117148	84064	119458	153534	159315	194482
Apr	117040	104960	53726	111022	116272	103886	125393	147836	179889	179697
May	111115	119284	47858	117191	116615	101776	129039	160223	182337	198004

Table 1., Continued...

Jun	128792	130563	81256	131707	136369	109651	145500	171301	189734	219574
Jul	138150	147033	111829	148117	158453	121988	164972	183325	224955	247778
Aug	145290	169420	115546	155628	157229	118104	167031	187879	222760	236080
Sep	133667	150747	106763	141952	162102	118329	152804	181314	208220	229573
Oct	96537	81100	97435	128399	81108	112629	146385	181084	211132	223643
Nov	72806	31497	83853	110506	62705	113844	142124	164920	175489	194152
Des	89443	63393	94196	125522	75877	122848	147467	166851	211142	215804
Total	1355774	1294844	993030	1458306	1386448	1260270	1668531	1992299	2269217	2495491

Source: www. baliprovttourism. go.id (2011)

The amounts of direct foreign tourist arrivals as mentioned in the literature were influenced by several variables like the exchange rates, gross domestic product, gross national product, marketing expenses, inflation rates, and political stability among others (Haiyan Song *et al.*, (2009). This study applies exchange rates and inflation rates as explanatory variables in forecasting tourist arrivals in Bali. Due to limited data availability especially for monthly data, only exchange rates and inflation rates of tourist generating countries are used as explanatory variables in forecasting tourist arrivals in Bali. The ECM is used to model tourist arrivals forecasting to Bali as final tourist destination, since using this model we could analyze the impacts of short term and long term impacts among variables in the model. Long term equilibrium among variables in the model become the focal point due to the needs of long term resource allocation. The arrivals of tourist to a destination follow continues series and in seasonal pattern. From table 1 above one could infer that tourist arrivals in Bali were on quarterly basis. Hyllerberg *et al.*, (1990) investigated the seasonal pattern of time series data to check if a unit roots exist in seasonal data. They also investigated the integration and co integration of seasonal data.

Using the ECM and the HEGY approach, this following research questions are posed.

1. How is the long-term equilibrium amongst explanatory variables?
2. How big will be the speed of adjustment should there any deviation from equilibrium among the variables in the ECM?
3. Are there any seasonal unit roots in direct foreign tourist arrivals in Bali using the HEGY approach?

The objectives of this study are as the following:

1. Investigate the long-term equilibrium amongst explanatory variables applying ECM methods;
2. Measuring the magnitude of adjustment of the explanatory variables in the ECM;
3. Estimating the unit roots in seasonal tourist arrivals and its integration.

It is expected that this study will contribute the following:

1. Providing empirical evidence on the long-term equilibrium amongst explanatory variables in the ECM model and its speeds of adjustment;
2. Providing empirical evidence on the integration and co integration among seasonal data by applying unit root tests;

The rest of this paper will be organized as follows. Next section will deal with related literatures, hypotheses development, research method, empirical results and discussions, conclusions, and limitations.

2. Literature Review

Modeling tourism demand is one of very interesting yet challenging tasks to do by researchers. Time series modeling gained popularity for tourism demand in the last two decades. Two classes of time series modeling gained their popularity are auto regressive integrated moving average (ARIMA) and error correction model (ECM).

Rahman *et al.*, (1996) conducted tourism demand model for Japanese arrivals for Singapore. They used real income, consumer price index, exchange rates as explanatory variables. Long term and short term dynamics model were also conducted as demand model in their study. They also inserted dummy variables in their ECM to capture the seasonality effects of Japanese arrivals for Singapore. Since tourist arrivals to Singapore follow seasonal patterns, the seasonal unit roots were also tested applying the HEGY approach. Their ECM found that in the short-term only consumer price index positively related to tourist arrivals though statistically insignificant. In the long run the speed of adjustments of the explained variable was at the rate of 33.34 percent to return to equilibrium should there any deviation in the explanatory variables. Their HEGY tests found that all variables exhibited stationary seasonal patterns.

Kulendran and Shan (2002) did a forecasting work for China's monthly inbound travel demand. They applied the ARIMA model to forecast the monthly tourist inbound to China. In their work they used two types of ARIMA, i.e. ARIMA (0,1,0) (0,1,2)¹² and ARIMA (1,1,0) (0,1,2)¹² for total visits and foreign visits respectively. An alternative approach in seasonal ARIMA was to do the first differences and used eleven seasonal dummy variables to model the seasonality of inbound tourist for China. Their research found that the conventional seasonal ARIMA model with non-seasonal and seasonal differences outperformed the alternative approach mentioned earlier.

Louvieris (2002) applying a contingency approach to forecast Greece's international tourism demand in the medium/long-term to the year 2005 that takes into account the impact of the 2004 Olympic games. He used a multiplicative seasonal autoregressive integrated moving average (SARIMA) (2,1,2) (0,1,1)¹² as a contingency approach. He used mean absolute percentage error (MAPE) and root mean square percentage error to assess the ex-post forecasting accuracy of the model. The finding of his research was that

SARIMA (2,1,2) (0,1,1)¹² model resulted in an acceptable MAPE (17%) for the medium/long-term forecast of international tourism demand for Greece. Dritsakis (2004) applied ECM to investigate the behavior of German and Great Britain tourist arrivals for Greece. In his study, he used income per capita, tourism prices, transportation cost, and exchange rates as explanatory variables. All figures of explanatory variables were transformed to natural logarithm. He also conducted unit root tests for error terms of the model using Augmented Dickey Fuller (ADF) method. His study found that except for tourism price, all variables for German were integrated with order one I(1). His ECM study revealed the following. For German and Great Britain arrivals there was a long-term equilibrium in the explanatory variables with reverse direction with tourist arrivals. These findings were logical that if Greece to increase the number of tourist from German and Great Britain, the prices of the explanatory variables should be adjusted downward.

Hyllerberg *et al.*, (1990) in their seminal paper suggested that time series data contained unit root which lead to spurious regression. To cope with this situation they then partitioned time series data to quarterly one. To investigate if each quarterly data behave uniformly they proposed null hypothesis that $\pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$ against $\pi_1 = \pi_2 = \pi_3 = \pi_4 \neq 0$. Da Silva and Montanes (2004) derived HEGY's procedures by examining if $\pi_1 = 0$ the data contains the (nonseasonal or zero frequency) root 1. When $\pi_2 = 0$ the semiannual root -1 is present, the presence of annual root $\pm i$ ($i = \sqrt{-1}$) implying $\pi_3 = \pi_4 = 0$. This study aims at investigating if quarterly data of tourist arrivals

in Bali contains a unit root. Based on the arguments mentioned above the following null hypothesis will be tested.

$$H_0: \pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$$

3. Research Method

This section will deal with theories of unit root, co integration, and ECM. To obtain the answers for the posed questions above archival data are used in this paper. The monthly direct foreign tourist arrivals from 2001 to 2010 were downloaded from Bali Tourism Provincial Office (www.baliprovttourism.go.id). Monthly exchange rates for USD, British pound sterling, and Japanese Yen were downloaded from Bank of Indonesia's website (www.bi.go.id accessed in April 2, 2011). Monthly inflation rates for UK, Japan, and USA were downloaded from www.rateinflation.com (accessed in April 2, 2011).

Rahman *et al.*, (1996) and Dritsakis (2004) to mention a few scholars who applied the ECM to model tourism demand. The following explanatory variables were used in ECM model: real income per capita, tourism prices, travel cost, consumer price indexes, and exchange rates. This study used tourist arrivals as dependent variable. Inflation rates and exchange rates of tourist generating countries i.e. UK, Japan, and USA used as explanatory variables. It is not uncommon that time series data contains a unit root. When a time series data contains a unit root, it may not be used in a regression model. A spurious regression will be the result when the time series contain a unit root. To cope with this problem, one could solve it by check the time series data using the following (Thomas, 1997).

$$x_t = \alpha + \varphi x_{t-1} + \mu_t \dots\dots\dots(1)$$

Model (1) above should be differenced to achieve a stationary series, thus:

$$\Delta x = \alpha + \varphi^* x_{t-1} + \mu_t \dots\dots\dots(2)$$

Where:

$$\Delta x = (x_t - x_{t-1}) \dots\dots\dots(3)$$

$$\varphi^* = \varphi - 1 \dots\dots\dots(4)$$

OLS could be used to derive the value of φ^* . When it exceeds the critical value, the null hypothesis of non stationary will be rejected. Co integration among time series data is very common. Its existence suggests that there is a stable long run or equilibrium linear relationship among them. If for example tourist arrivals for a certain destination and exchange rates are not co integrated, then the tourist arrivals would drift away above or below exchange rates in the long run (Dritsakis, 2004). It is suggested in the literature to test the co integration of time series data to avoid spurious regression (Gujarati, 1995). The co integration work as follows. Suppose:

$$Y_t = a + b x_t + \varepsilon_t \dots\dots\dots(5)$$

$$\varepsilon_t = y_t - a - b x_t \dots\dots\dots(6)$$

If ε_t in the above is linear combination of $Y_t = a + bx_t + \varepsilon_t$ at order $I(0)$, then both variables x and y are co integrated.

The ECM is commonly used for time series data to correct the disequilibrium of the previous period in the current one. The estimation model for long term equilibrium of tourist arrivals for Bali is underneath:

$$TA_{ij} = a + b_1 ER_{ij} + b_2 IR_{ij} + \varepsilon_t \dots\dots\dots(7)$$

Where:

- TA = tourist arrivals
- ER = exchange rate of IDR to tourist generating country currency at year end
- IR = annual inflation rate of tourist generating country
- a = intercept
- i,j = the ith period of variables and j tourist generating countries respectively.
- ε = error term

The ECM approach for tourist arrivals to capture short run dynamics is as follows:

$$\Delta TA_{ij} = a + b_1 \Delta ER_{ij} + b_2 \Delta IR_{ij} + b_3 \varepsilon_{t-1} + b_4 (TA_{ij-1} + b_1 ER_{ij-1} + b_2 IR_{ij-1}) + v \dots\dots\dots(8)$$

From (8) one could infer that b_1 , b_2 , and b_3 , are short-term shock to tourist arrivals, where b_4 is long term equilibrium relationship among variables in the model. The ε_{t-1} is residual lag 1 derived from (7) included to investigate the speed of adjustments of the explained variable should the explanatory variables deviate from long term equilibrium.

Since direct foreign tourist arrivals follow seasonal pattern, dummy variables are included (Rahman *et al.*,1996)) to capture the seasonal effects. The ECM to capture the seasonal effects is underneath.

$$\Delta TA_{ij} = a + b_1 \Delta ER_{ij} + b_2 \Delta IR_{ij} + b_3 \varepsilon_{t-1} + b_4 (TA_{ij-1} + b_1 ER_{ij-1} + b_2 IR_{ij-1}) + b_5 D1 + b_6 D2 + b_7 D3 + v \dots\dots\dots(9)$$

Where:

- Δ = stands for first difference ($\Delta y_t = y_t - y_{t-1}$)
- v = error term of the model which has the usual usual property of i.i.d ($0, \sigma^2$)
- b_1, b_2 , = parameters of short-term dynamics
- b_3 = the speed of adjustment of explained variables should explanatory variables deviate from equilibrium.
- B_4 = parameter of long-term equilibrium of the explanatory variables
- $D1, D2, D3$ = dummy variable for quarter1,2, and 3.

HEGY (1990) investigating the behavior of seasonal time series data. They derived the model as follows:

$$\phi^*(B)y_{4t} = \pi_1 y_{1t-1} + \pi_2 y_{2t-1} + \pi_3 y_{3t-2} + \pi_4 y_{3t-1} + \varepsilon_t \dots\dots\dots(10)$$

The model of (10) above as stated by HEGY assumed to be generated by a general auto regression such that:

$\varphi(B)x_t = \varepsilon_t \dots\dots\dots(11)$

The property of (11) follows the usual i.i.d.(0,σ²)

One could infer that from (10) HEGY investigated the seasonal unit root that consisted of quarterly data. Hence:

$y_{1t} = (1 + B + B^2 + B^3) x_t = S(B) x_t;$
 $y_{2t} = -(1 - B + B^2 - B^3) x_t;$
 $y_{3t} = -(1 - B^2)x_t;$
 $y_{4t} = -(1 - B^4)x_t = \Delta_4 y_t = y_t - y_{t-4} \dots\dots\dots(12)$

The null hypothesis stating that quarterly time series data of tourist arrivals to Bali contain a unit root will be tested using the following Wald χ^2 test.

Since this study takes HEGY’s assumptions as in (11) then one has an exact, finite sample F statistic:

$$F = \frac{\frac{S1}{k}}{\frac{S2}{(n1 + n2 - 2k)}} \dots\dots\dots(13)$$

Where S₁ and S₂ are sum of squares residuals of regression 1 and 2, and n₁, n₂, are number of observations of regression 1 and 2 and; while k is the parameter estimated in the model. Stated differently F test compares the residual sum of squares computed with and without the restriction imposed (EViews 4 User’s Guide (2000:353)).

The Wald χ^2 test is merely the above F test divided by restricted parameters in (10) (Boswijk, 1993). Such that:

$\frac{W}{q} = F \dots\dots\dots(14)$

Where W is the Wald test which is asymptotically distributed as χ^2 with q number of restrictions under the null hypothesis H₀.

Wald χ^2 test would be conducted in joint test for $\pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$.

If Wald χ^2 test observed value exceeds the critical Wald χ^2 test value at the chosen level of α, reject the null hypotheses that time series data of tourist arrivals using quarterly data to Bali contains a unit root.

Global financial crisis which broke-out in August 2007 become common knowledge to almost everybody in the world. This situation was triggered by the defaults of sub-prime mortgage in USA. As of that date, almost all countries in the world experienced this phenomenon. Tourism is one among other industries received the impact of global financial crisis. The impacts caused by these situations were that potential tourists would reconsider their traveling expenses which eventually influenced the demand for a certain destination. This study will investigate the impact of global financial crisis to tourist arrivals from UK, Japan, and US. The structural stability or parameter stability of tourist arrivals for the aforementioned countries

will be investigated using cumulative sum (cusum) method. The formula of cusum is underneath (Alippi and Roveri, 2008).

$$R(t) = \sum_i^T \ln \frac{p1(x(t))}{p0(x(t))} \dots\dots\dots(15)$$

- Where:
- R(t) = Cumulative sum at time t
- Ln = natural logarithm.
- PΘ(x) = probability distribution function parameterized in Θ
- Θ = parameter vectors (θ₁, θ_n)
- T = sensitivity test.

3.1. Empirical Results, Discussions and Conclusions

This section deals with descriptive statistics, auto correlation graph, unit root test results, co integration results, ECM results, the behavior of seasonal time series data using the HEGY approach, structural stability results, and hypothesis test results.

Table 2. Descriptive statistics of the variables in the models

	JAPAN	U K	US
Direct Arrivals			
Mean	24567	6732	4791
Median	23821	6382	4670
Mode	20947	7201	3950
Minimum	5898	1230	1547
Maximum	44521	13324	7831
Std. Deviation	8001	2436	1458
t-statistics	33.64	30.27	35.98
Skewness	0.1278	0.4311	0.1211
Exchange Rate (Rp)			
Mean	86.48	15917.81	9379.81
Median	82.96	16088.63	9140.15
Mode	-	-	-
Minimum	69.20	12793.20	8187.95
Maximum	127.73	19112.64	11793.35
Std. Deviation	13.22	1709.80	751.77
t-statistics	71.57	101.98	136.68
Skewness	1.13	-0.07	1.38
Inflation Rate (%)			
Mean	-0.0025	0.0017	0.0020
Median	-0.0020	0.0016	0.0021
Mode	0.0000	0.0011	0.0023
Minimum	-0.0253	0.0005	-0.0017
Maximum	0.0230	0.0044	0.0047
Std. Deviation	0.0085	0.0008	0.0012
t-statistics	-3.22	25.00	18.25
Skewness	0.3093	0.9458	-0.6906

3.2. Regression results

Using (7) above the regression results for Japan, UK, and US are as follows:

Table 3. Regression results

Variables	Japan		U K		US	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	19645.385	4.066*	12823.066	6.330*	-69.259	-0.040
Exchange	61.628	1.109	-0.431	-3.235*	0.543	3.089*
Inflation	163193.24	1.889***	444378.262	1.49318	-115715.37	-1.051

Note: *: significance at 1 %. **: significance at 5 %. ***: significance at 10 %.

In their level as table 3 reveals that for Japan inflation significantly positively related to arrivals. This finding at glance seems weird and against the common theory that states that inflation rate is in reverse to arrivals. During the periods of January 2001 to December 2010 Japan experienced 73 months (61%) negative inflations or deflations. The same condition applies for UK. These findings explain inflation rate positively and significantly related to Japan arrivals. Only US inflation is inline with the theory that inflation rate negatively related to arrivals. The graphs for exchange rates and inflation movements are presented in the appendix for Japan, UK, and US.

3.3. Autocorrelation of residuals

Residuals of arrivals for Japan, UK, and US were derived from model (7). From table 4 underneath one could conclude that for Japan no spill over of arrivals from one period to another consecutive one after lag 2 periods. Whereas for UK and US no spill over for the arrivals after lag 3. Stated differently that the residual of arrivals for Japan still spill over to the next periods until lag 2, whereas for UK and US after lag 3.

Table 4. Autocorrelation of residuals

Lag	Japan arrivals		UK arrivals		US Arrivals	
	Correl.	t-stat	Correl.	t-stat	Correl.	t-stat
1	0.73	8.04	0.74	8.05	0.62	679
2	0.33	2.50	0.57	4.35	0.49	4.02
3	0.04	0.30	0.46	3.03	0.42	3.10
4	-0.07	-0.48	0.28	1.70	0.24	1.66

Notes: Correl.: correlation. t-stat: t-statistic.

3.4. Unit Root test results

Unit root test applying the Augmented Dickey Fuller test show the following results

Table 5. Unit Root Test, ADF Test Statistic

Variables	Japan		U K		US	
	Level	Difference 1	Level	Difference 1	Level	Difference 1
Arrivals	-0.249**	0.381*	-0.241**	-0.058	-0.228***	-0.233
Exchange	-0.036	0.293*	-0.031	0.057	-0.136**	0.299*
Inflation	-0.104**	0.235**	-0.065	0.201**	-0.114	0.571*

Note: *: significance at 1 %. **: significance at 5 %. ***: significance at 10 %.

Please note that exchange rate for UK (United Kingdom) is stationary after difference 2 with t-statistic of -1.940 (p-value 0.10)

3.5. Co integration test results

In testing the co integration amongst the variables the Johansen procedures were applied. The results for Japan, UK, and US as shown by table 6 underneath.

Table 6. Co Integration Results, Johansen procedures

Japan				
No. of C.E	Log likelihood	Eigen Value.	5 % critical v.	1 % critical v.
r=1	13.487	0.091	15.41	20.04
r=2	2.469	0.021	3.76	6.65
U.K				
r=1	5.538	0.033	15.41	20.04
r=2	1.519	0.013	3.76	6.65
US				
r=1	21.211	0.115	15.41	20.04
r=2	7.128	0.060	3.76	6.65

Note: CE: Cointegrating Equation. V:value

Results of co integration lead us to conclude that arrivals, exchange rates, and inflation rates for Japan, UK, and US are co integrated simultaneously. They co integrated in level and in difference.

3.6. ECM results

Results of ECM are derived from (8) to capture the short dynamics of the model and from (9) to capture the seasonal effects.

▪ The short run dynamics results are underneath

• Japan

$$\Delta TA = -130319 - 56.49 \Delta ER - 44247 \Delta IR - 7.08 \epsilon_{-1} + 6.56 TA_{-1} - 388.09 ER_{-1} - 1073055 IR_{-1} + v$$

$$\begin{matrix} (558983) & (179648) & (141244) & (28.438) & (28.447) & (1752.08) & (4645816) \\ [-0.233] & [-0.314] & [-0.313] & [-0.249] & [0.231] & [-0.221] & [-0.231] \end{matrix}$$

• UK

$$\Delta TA = -3028700 - 0.014 \Delta ER + 586623 \Delta IR - 236.56 \epsilon_{-1} + 236.12 TA_{-1} + 101.91 ER_{-1} - 1.05E+08 IR_{-1} + v$$

$$\begin{matrix} (1626207) & (0.4185) & (614921) & (126.812) & (126.814) & (54.716) & (5.6E+07) \\ [-1.862] & [-0.034] & [0.953] & [-1.865] & [1.862] & [1.863] & [-1.859] \end{matrix}$$

• US

$$\Delta TA = -2153.47 + 0.272 \Delta ER + 6679.30 \Delta IR + 8.852 \epsilon_{-1} - 9.301 TA_{-1} + 5.207 ER_{-1} - 1076763 IR_{-1} + v$$

$$\begin{matrix} (2409.22) & (0.320) & (262891) & (30.684) & (30.675) & (16.639) & (3553055) \\ [-0.894] & [0.853] & [0.025] & [0.288] & [-0.303] & [0.313] & [-0.303] \end{matrix}$$

• The seasonal effects results are as follow.

• Japan

$$\Delta TA = -223511 - 97.322 \Delta ER - 70968 \Delta IR - 11.908 \epsilon_{-1} + 11.386 TA_{-1} - 701.979 ER_{-1} - 1865423 IR_{-1}$$

$$\begin{matrix} (562979) & (179.132) & (142313) & (28.638) & (28.647) & (176399) & (4676500) \\ [-0.397] & [-0.543] & [-0.499] & [-0.416] & [0.397] & [-0.398] & [-0.399] \end{matrix}$$

$$-0.383D1+0.093D2+0.190D3 + v$$

(0.220)	(0.311)	(0.214)
[-1.740]	[0.299]	[0.888]

• UK

$$\Delta TA = -3063393 + 0.376\Delta ER + 1032877\Delta IR - 239.102\varepsilon_{-1} + 238.674TA_{-1} + 103.112ER_{-1} - 1.06E+08IR_{-1}$$

(1604768)	(0.419)	(646197)	(125.141)	(125.143)	(53.995)	(5.6E+07)
[-1.909]	[0.897]	[1.598]	[-1.911]	[1.907]	[1.910]	[-1.902]

$$+0.471D1-0.325 D2 +0.055D3 + v$$

(0.365)	(0.416)	(0.267)
[1.290]	[-0.783]	[0.205]

• US

$$\Delta TA = -1005.207 + 0.496\Delta ER + 175427.30\Delta IR - 2.317\varepsilon_{-1} + 1.584TA_{-1} - 0.880ER_{-1} + 229439IR_{-1}$$

(2405.56)	(0.322)	(268972)	(30.823)	(30.816)	(16.713)	(3569194)
[-0.418]	[1.540]	[0.652]	[-0.075]	[0.060]	[-0.053]	[0.064]

$$+ 0.258 D1 - 0.560D2 + 0.033D3 + v$$

(0.302)	(0.367)	(0.236)
[1.749]	[-1.523]	[0.141]

The ECM results for Japan reveal the following. In the short run and in the long run as well the exchange and inflation rates were negatively related to arrivals though statistically insignificant. All variables in the models in the long run were negatively related with the speed of adjustments of 7 times of their residuals or their deviation from equilibrium. The seasonal effect for the first quarter data was negatively related to arrivals whereas on the other hand the second and third quarter were positively related to arrivals, yet statistically insignificant.

For UK, in the short run exchange rates were negatively related to arrivals, whereas inflation rates were positively related to arrivals though both statistically insignificant. This was due to the inflation rates in UK in the short run getting smaller as compared to the previous months. In the long run all variables in the model were negatively related with the magnitude of 236.56 times its residual with $p = 0.10$. The seasonal effects showed the following results. The first and third quarter were positively related to arrivals from previous periods whereas the second one negatively related to previous arrivals period.

For the US, all exchange rates and inflation rates were positively related to arrivals in the short run. All variables in the model positively related to arrivals with the magnitude of 8.85 times its deviation to equilibrium. When seasonal dummies were inserted in the model the results are as follows. The first and third quarter positively related to previous arrivals whereas the second quarter negatively related to arrivals of the previous period.

Japan, UK, and the US are amongst the major tourist generating countries for Bali. Tourism plays a very important role for Bali since it contributes almost up to 70 % of Bali government revenues. The findings on seasonal effects for Japan arrivals imply that Bali government should keep on trying to minimize the negative effects of the first quarter of the year. Government actions to stimulate the number of Japan could be done by facilitating incentives for them for the first quarter of the year. For UK and the US, the negative seasonal effects were on the second quarter of the year. As mentioned above, the Bali government should in all cases do their best efforts for UK and the US especially for the second quarter of the year.

3.7. Parameter Stability Test Results

Cusum test was applied to examine the parameter stability of Japan, UK, and US arrivals from 2001 to 2010 due to economic situation using (15) above with 5 % significance test.

Test results are presented in figure 1, 2, and 3 for Japan, UK, and US respectively. Japan arrivals experienced relatively stable parameters for the time period mentioned above. The volatility of Japan arrivals happened relatively small since it still in the range of 5% significance during the periods of 2003 to 2004. This condition may be due to the Bali bombing chapter 1 in October 2002. The global financial crisis which was triggered by the defaults of capital market in the US did not contribute significant impact in parameter stability of Japan arrivals.

UK on the other hand, had higher volatility during periods of 2003 to 2008. This finding signifies that there was parameter instability for UK arrivals during 2001 to 2010.

US like Japan had relatively stable parameter for their arrivals during 2001 to 2010. This finding confirms that though there were extra ordinary happenings like Bali bombing in 2002 and 2005 and global financial crisis broke out in August 2007, the number of US arrivals did not change significantly.

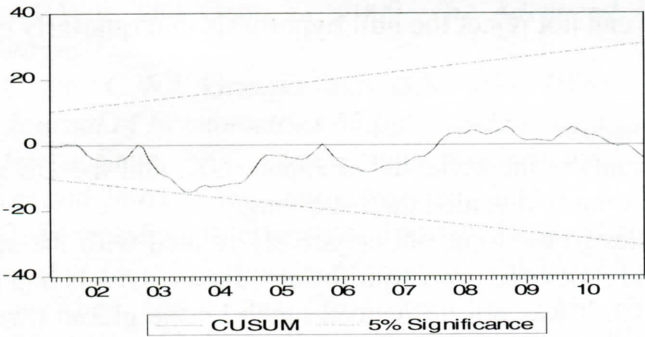


Figure1. Parameter stability of Japan Arrivals

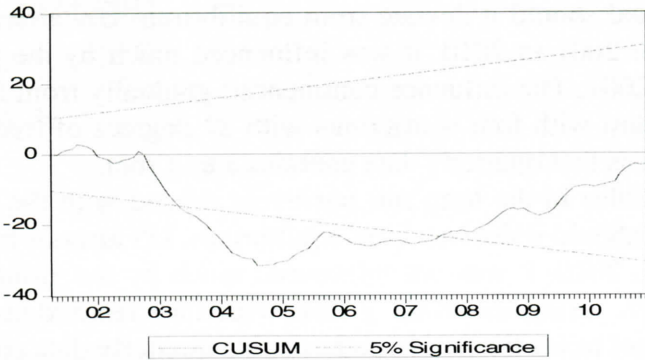


Figure2. Parameter stability of UK Arrivals

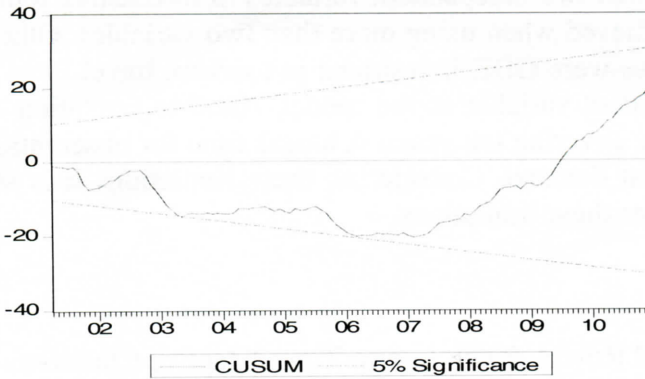


Figure3. Parameter stability of US Arrivals

The hypotheses were tested using the Wald χ^2 test for all arrivals in the study. The Wald χ^2 test results are as follows.

For Japan with four restrictions with 22 degrees of freedom resulting the following:

$\chi^2_{0.05,22} = 21.202$ versus the critical value of 33.924. Since the observed values did not exceed the critical one we can not reject the null hypothesis that quarterly data contain a unit root for Japan arrivals.

For UK with four restrictions with 22 degrees of freedom resulting the following:

$\chi^2_{0.05,22} = 5.343$ versus the critical value of 33.924. Since the observed values did not exceed the critical one we can not reject the null hypothesis that quarterly data contain a unit root for UK arrivals.

For the US with four restrictions with 22 degrees of freedom resulting the following:

$\chi^2_{0.05,22} = 18.637$ versus the critical value of 33.924. Since the observed values did not exceed the critical one we can not reject the null hypothesis that quarterly data contain a unit root for US arrivals.

4. Conclusions and Discussions

This study tried to analyze the behavior of Japan, UK, and the US arrivals to Bali. Using the ECM the finding of this study revealed the following.

For Japan all variables in the long run negatively related with the speed of adjustments 7 times of the residual should it deviate from equilibrium. Japan arrivals had parameter stability for the periods of 2001 to 2010. It was not influenced much by the global financial crisis that broke out in August 2007. Using the Wald χ^2 test with four restrictions with 22 degrees of freedom this study could not reject the null hypothesis that quarterly data contains a unit root.

For UK all variables in the long run negatively related with the speed of adjustments 236.56 times of the residual should it deviate from equilibrium. UK arrivals had not parameter stability for the periods of 2001 to 2010. It was influenced much by the global financial crisis that broke out in August 2007. The influence commenced gradually from the periods of 2007 to 2008. Using the Wald χ^2 test with four restrictions with 22 degrees of freedom this study could not reject the null hypothesis that quarterly data contains a unit root.

For the US all variables in the long run positively related with the speed of adjustments 8.85 times of the residual should it deviate from equilibrium. US arrivals had parameter stability for the periods of 2001 to 2010. It was not influenced much by the global financial crisis that broke out in August 2007. Using the Wald χ^2 test with four restrictions with 22 degrees of freedom this study could not reject the null hypothesis that quarterly data contains a unit root.

4.1. Limitations

This study only applied two independent variables in forecasting tourism demand for Bali. A better result may be achieved when using more than two variables. Other variables applied as mentioned in the literatures were GDP, investment in tourism, travel fares from origin countries could be used as independent variable in the model. Another limitation of this study was the length of observation only covering ten years. A longer time for observation might give a better result in forecasting tourist demand. Considering these limitations it is strongly suggested for future research to overcome these limitations.

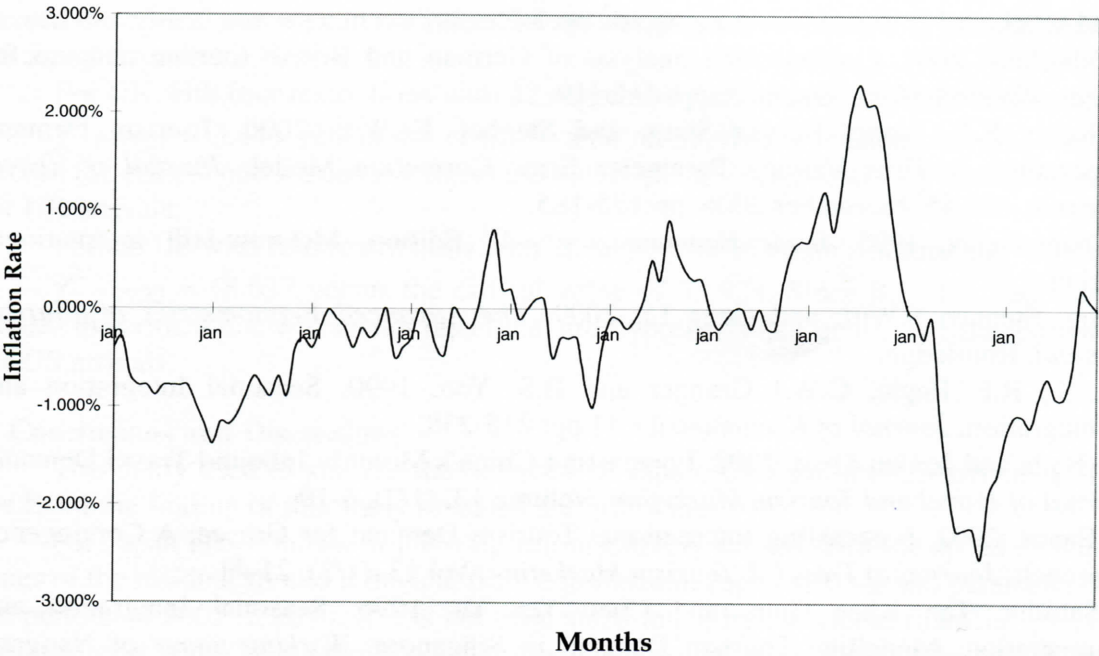
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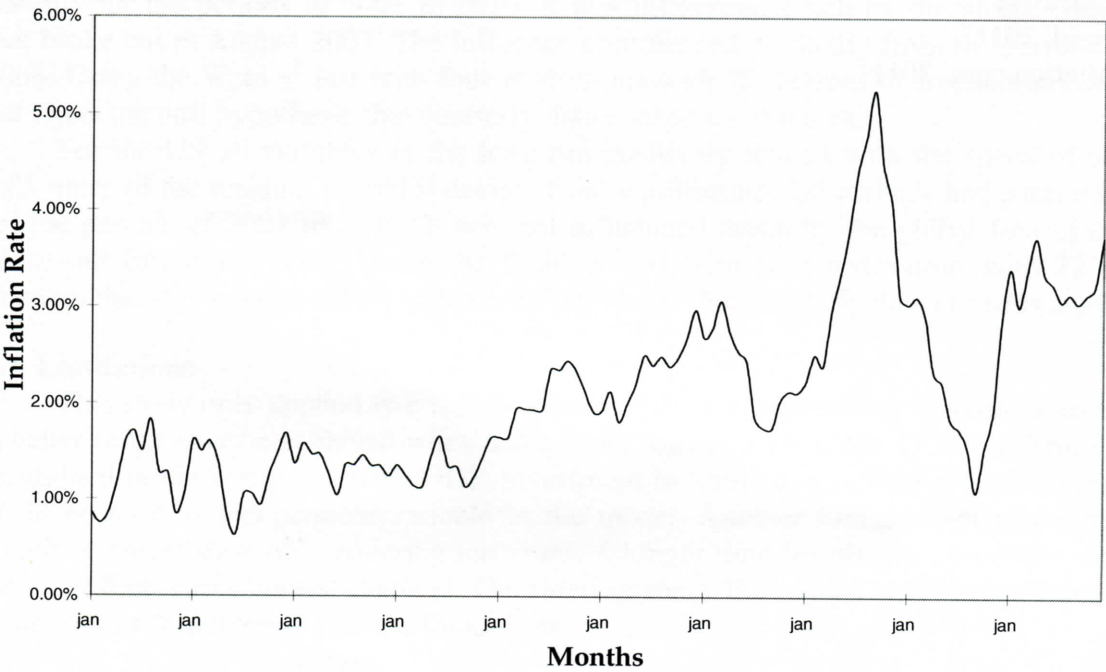
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Appendix

Japan Inflation Rate movements



UK Inflation Rate movements



US Inflation Rate movements

