ANALYSIS OF JAPANESE TOURIST DEMAND TO BALI USING CO-INTEGRATION TEST AND VECTOR ERROR CORRECTION MODEL

NLP Suciptawati [1], **M Sianipar** [2]
Department of Mathematics, Udayana University, Kampus Bukit Jimbaran, Badung
Email: suciptawati@unud.ac.id[1], merarysianipar@gmail.com[2]

ABSTRACT

This study was aimed to figure out of the long term and short term correlation between -tourism price and tourist income to the tourism demand of Japanese to Bali. Quarterly data from 2003-2016 were analyzed by co-integration test and Vector Error Correction Model (VECM). The result showed that there were both long term and short term balance among research variables. At long term, the tourist income has a positive influence on tourism demand and on the other hand the tourism price has a negative one. Meanwhile at the short term the tourist income has a negative influence on the tourism demand.

Keywords: co-integration test, VECM, tourism demand, tourism price, tourist income.

INTRODUCTION

Bali is one of tourism destination that always have many visitors, either domestic or foreigners. Bali is well-known as the island of God because of its religion and culture. The unique culture and beautiful natural view attract tourist to visit this island. The free visa for the tourist from some Asian countries has increase the foreign visitors come to Bali.

According to Bali Provincial Statistics Office, the number of foreign tourists visiting Bali in year 2016 reached 4.92 million visitors, 23.14 percent growth compared to previous year. Classify according nationality, Australian tourists position in the first place, Chinese tourist position in the second, and Korean visitors are in the third rank (BPS, 2016).

The empirical research related to foreign tourist coming to Bali has been done. The study from (Armoni, 2011) showed that the number of visitors from South Korea to Bali has affected by the annual income and the exchange rate of Won to IDR. In this study she used multiple regression analysis with ordinary least square (OLS) method.

(Suciptawati, et.all, 2017)uses a time varying parameter (TVP) model to modelling Korean tourist visits to Bali. This method does not require the stationary assumptions of research variables. Results obtained show the exchange rate of WON to IDR has positively affect the Korean arrivals to Bali

Often, the tourist arrival, tourism price, and exchange rate are non-stationary data time series. When the regression analysis is applied with OLS method on thus non-stationary data, the regression model $\mathrm{Y_t} = \beta_0 + \beta_1 \mathrm{X_t} + \mu_t$ will be resulted in spurious regression. In spurious regression, the high value ofR^2 will be obtained, eventhough there is no enough significant correlation between Y_t and X_t variables (Enders, 2004).

This research was aimed to analyze Japanese tourism demand to Bali and investigate long run equilibrium and short run equilibrium between tourism price and tourist income to the tourism demand of Japanese to Bali. The method used to study the *long run equilibrium* was co-integration, meanwhile the *short run equilibrium* was studied by *Vector Error Correction Model* (VECM). In this study to see the existence of co-integration we use Johansen Co-integration Test.

Co-integration techniques have been successfully applied to model tourist data of a number of countries (Katafo, R. and A. Gounder, 2004) apply co-integration method to model tourist arrivals in Fiji, their results are; in the long-run that income in their major trading partner countries are positively related to the demand for tourism while in the short-run, current income is positively related to tourism demand. (Asemota, O.J. and Bala, D.A., 2012) used co-integration and error correction model to modelling tourism demand in Japan, their results that there is a long-run relationship between tourists' arrival series and the causal variables. Both the short-run and long-run models indicate that GDP per capita in tourists' origin country is the most significant factor influencing the inflow of visitors into Japan. Refers to (Asemota, O.J. and Bala,D.A., 2012) several other studies that use co-integration model tourism demand includes; Lim and McAleer (2002) used co-integration method to model tourist arrivals from Malaysia to Australia, their results support a long-run equilibrium relationship among the international tourism demand, transportation costs and exchange rates. In addition Kulendran and Wilson (2000) also using co-integration to modeling business travel on Australia, Lim and McAleer (2001) also study the case of Australia, Daniel and Ramos (2002) apply co-

integration on Portugal, Kadir and Karim (2009) study in Malaysia. Algieri (2006) using Russia as a destination, Salman (2003) and Witt*et al.* (2003) focused on Sweden and Denmark as destination countries respectively, Dritsakis (2004) examined the case of Greece, Narayan (2004) examined the case of Fiji, Choyakh (2009) also apply focused on Tunisia.

RESEARCH METHOD

The data used in this study were secondary data. All of the data are in quartile form, For period2003-2016.The independent variable is Japanese tourism demand to Bali, and the predictor variables are tourist income and tourism price.

Refers to (Song, 2008), Japanese tourism demand to Bali (TD_t) proxied by Japanese arrival to Bali, Tourist income (TI_t) proxied by Japanese Bruto Domestic Product, and Tourism price proxied by consumer price index (CPI) relative, that is

$$TP_t = \frac{CPIa / ex}{CPIo}$$

Where

TP_t = Tourism price, CPIa= consumer price index of destination area

Ex= exchange rate, CPI_o= consumer price index of origin country

In general in this study we used the level of significance$\alpha = 10\%$.

Modelling steps are as follows:

Stationary data test

This test is needed since regression analysis on the non-stationary data will be resulted in spurious *regression.* This test was done by using unit root test. Technique unit root test is by forming regression between ΔY_t and Y_{t-1} . in this study the unit root test used is *Augmented Dickey-Fuller* (ADF) with $\alpha = 10\%$. ADF is unit root test to autoregressive processes of order greater than 1or $AR(p)$ model. In the unit root test of the ADF, residuals on the model assumed to be auto-correlated or have relationship. Regression model to be used is

$$\Delta TD_t = \rho_1 TD_{t-1} + \sum_{i=1}^{m} \phi_{1i}\, TD_{t-1} + v_{1t},$$

$$\Delta TI_t = \rho_2 TI_{t-1} + \sum_{i=1}^{m} \phi_{2i}\, TI_{t-1} + v_{2t},$$

$$\Delta TP_t = \rho_3 TP_{t-1} + \sum_{i=1}^{m} \phi_{3i}\, TP_{t-1} + v_{3t}$$

Where $\rho = \sum_{i=1}^{p} \varphi_i - 1, m = p - 1$, and $\phi_i = -\sum_{j=i+1}^{m} \varphi_j$, v_t is acomponent error,

The hypothesis, statistical test and rejected area of ADF test as follows:

Hypothesis:

$H_0: \rho = \sum_{i=1}^{p} \phi_i - 1 = 0$ or $H_0: \sum_{i=1}^{p} \phi_i = 1$

$H_1: \rho = \sum_{i=1}^{p} \phi_i - 1 < 0$ or $H_1: \sum_{i=1}^{p} \phi_i < 1$

Statistical test

$$\tau = \frac{\sum_{i=1}^{p} \phi_i - 1}{\text{std.error}(\sum_{i=1}^{p} \widehat{\phi}_i)} \quad (1)$$

H_0 is rejected when the statistical value τ test smaller than the critical value of DF or MacKinnon, or we can rejected $H_0$when the probability ADF < $\alpha = 10\%$.

When the data is non-stationary in the unit root test, differencing need to be done. The test is conducted started from the first differencing form until we obtained the stationary data. The number of lags in the ADF test is determined using the Akaike Information Criterion (AIC). AIC is used to investigate the significance of the model, with formula:

$$\ln(AIC) = \ln\left(\frac{\sum \hat{u}_i^2}{n}\right) + \frac{2k}{n} \quad (2)$$

$\sum u_i^2$is the amount of quadrate residue, k is dependent variable, and n is observation number.

Co-integration Test

Co-integration is the linier combination from nonstationary variables and co-integrated at the similar order (Johansen, 1988). Co-integration test is conducted to ascertain if there is any long-run relationship between two or more nonstationary time series. The existence of a long-run or equilibrium relationship among asset of non-stationary time series implies that their stochastic trends must be linked. In this study, co-integration test was performed by Johansen's co-integration method. Johansen's co-integration test is very sensitive to length of the lag used, so before performing Johansen's test, it needs to determine the optimum length of the lag. Determination of lag length is performed by choose the smallest AIC value. The length of the *lag* was obtained from the equation with the smallest AIC value. (Tsay, 2002).

In Johansen's test to measure the number of co-integration vectors based on the result of maximum eigen value test (Johansen & Juselius, 1990).

$\lambda_{\text{max}}(r, r+1) = -T \ln\left(1 - \hat{\lambda}_{r+1}\right)$(3)

Hypothesis tests:

$H_0: \lambda_t = 0,\ t = r+1, \ldots, n$ $r = 0$ (no co-integration)

$H_1: \lambda_1 = \lambda_2 = \cdots = \lambda_n = 0,$ $r = 1$ (1 co-integration vector)

$\lambda_2 = \lambda_3 = \cdots = \lambda_n = 0,$ $r = 2$ (2 co-integration vector)

$\lambda_3 = \lambda_4 = \cdots = \lambda_n = 0,$ $r = 3$ (3 co-integration vector)

etc.

H_0 is rejected or there is co-integration if the maximum eigenvalue> critical value at probability level α or probability value < $\alpha = 10\%$.

In addition the number of co-integration vectors can also be viewed based on trace statistic value.

Vector Error Correction Model Test

The VECM equation used in this research is formulated as follow:

$$\Delta TD_t = \alpha_{10} + \alpha_{11}\Delta TD_{t-i} + \alpha_{12}\Delta TI_{t-i} + \alpha_{13}\Delta TP_{t-i} + u_t \quad (4)$$

Equation model (4) is the valid model for describing the short term dynamiques from the error correction *term* significancy point of view. Where the probability value of the error correction term less than $\alpha = 10\%$ then equation (4) is the valid model to describe a short term dynamic.

Validating the Model

In the regression analysis which used of OLS must be meet some classical assumption such as: residual should be spread normally, the data should be homogen (no hetero scedasticity), and also no multi-colinearity.

RESULT AND DISCUSSION

The plot for Japanese tourism demand depicted in Figure 1.

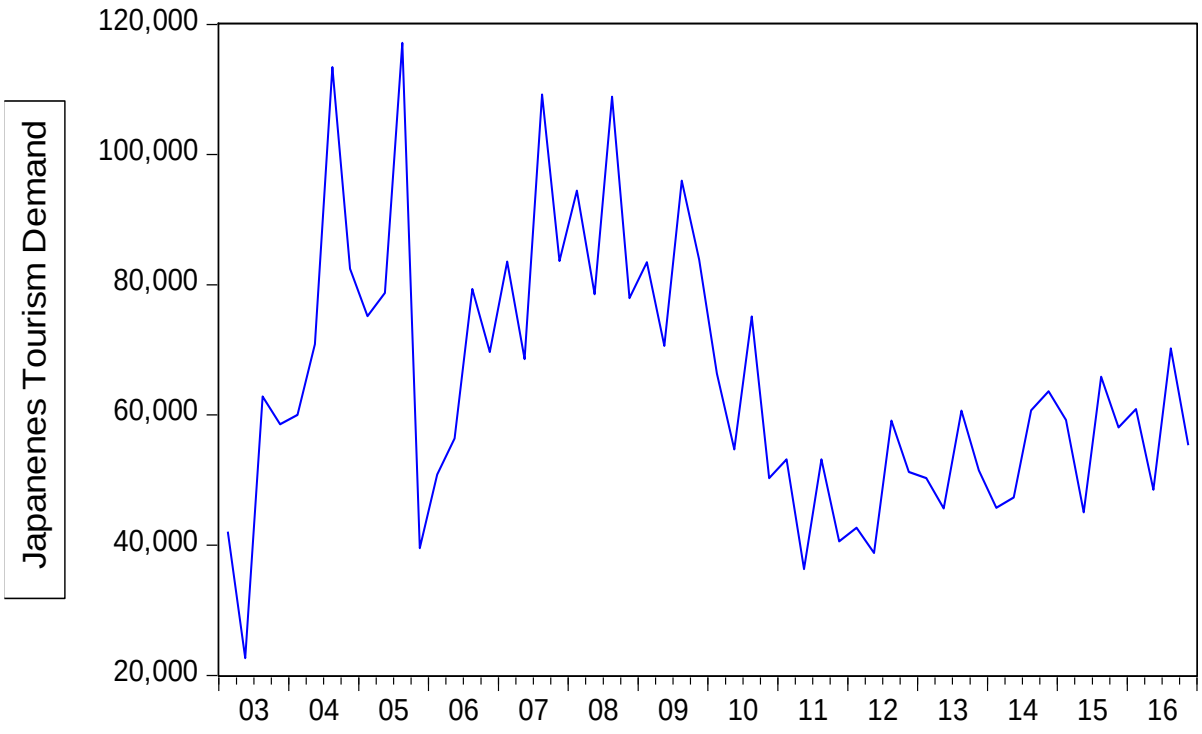

Figure 1. Japanese tourist visit to Bali in 2003-2016

The data showed that the number of Japanese tourism demand to Bali was fluctuated. The most visitation of the Japanese tourist was usually in the third quartile because on the August the Japanese people has enjoyed their long summer holiday. We can see after 2010 Japanese tourism demand to Bali has decreased compared to previous years, this can happen with the start of the development of other tourist destinations in some areas in Indonesia, that presents its natural tourism and cultural tourism.

The stationary data test

The data stationary test was performed by Augmented Dickey Fuller (ADF) test. The results of the Augmented Dickey Fuller (ADF) test are showed in Table 1.

Tabel 1 Augmented Dickey Fuller (ADF) test

No.	Variables	t-Statistic	Critical Value	Prob.	Stationary/ Non-stationary
1	Tourism demand	-2,224821	-2,925169	0,1401	Non-stationary
2	Tourist income	-1,232974	-2,919952	0,4182	Non-stationary
3	Tourism price	-1,712512	-2,921175	0,3414	Non-stationary

Table 1 showed that all the data are non-stationary means that there are co-integration among variables. Further, the integration degree test was performed to determine on which degree or differential order will the data become stationary by ADF test of I(1). If there still non-stationary data on I (1), the differentiation will be repeated until all of data become stationary. The results of integration test are showed in Table 2 below.

Table. 2 ADF TestI(1)

No.	Variables	t-Statistics	Critical Value	Prob.	Justification
1	D(tourism demand)	-3,578591	-2,925169	0,0057	Stationary
2	D(Tourist income)	-5,478636	-2,921175	0,0001	Stationary
3	D(Tourism price)	-5,151747	-2,922449	0,0000	Stationary

Based on table 2, it's indicated that on differentiation-1 the entire variable has been stationary, so that co-integration test can be continued.

Co-integration Test

In this study, co-integration test was performed by Johansen's co-integration method. Length lag calculations are presented in Table 3

Table 3. The Optimal Length of *Lag*

Lag	Log L	LR	FPE	AIC
0	-798.8215	NA	8.66e+10	33.42890
1	-711.6096	175.8807	2.50e+09	30.18849
2	-701.7440	14.16441	2.53e+09	30.19763
3	-699.1296	7.304401	3.20e+09	30.28140
4	-682.5500	24.17857*	2.39e+09*	30.06441*

It showed that the smallest value of AIC was on the length of lag 4, so the co-integration test use of that lag length.

Table 4. Johansen's Co-integration Test

	Eigenvalue	Statistical trace	Prob.	Max-Eigen Statistic	Prob
r = 0*	0.401700	33.40871	0.0174	24.14230	0.0180
r ≤ 1	0.135799	9.256443	0.3343	6.958367	0.4928
r ≤ 2	0.050771	2.288974	0.1301	2.300104	0.1300

Table 4 showed that trace statistic value and maximum eigen value at r = 0 have probability $<\alpha = 10\%$. Its mean that H_0 is rejected, it's indicated that it has co-integration amongs research variabels, namely one co-integration. That result showed that there are long run equilibrium between the tourism demand, tourist income and tourism price. The result of long-term coeffisien estimation amongs reserarch variables can be seen in equation (5)

$$\mathrm{TD}_t = 0.651522^{*}\mathrm{TI}_t - 2864248^{*}\mathrm{TP}_t \qquad (5)$$

Based on that model, it's obtained that tourist income has positive influence on tourism demand. It is indicated that, the increasing of tourist income will increase the number of Japanese tourist come to Bali. Meanwhile, the tourism price has negative influence. The increasing of tourism price resulted on the decrasing of Japanese tourist number come to Bali, they will looking for other similar tourism destination in other country which has lower price.

Vector Error Correction Model Test

Since the variables have long term correlation, then the estimation of short term correlation was performed using VECM test. In order to construct the VECM equation, variables are use in the model has to be *differencing*.

$$\Delta TD_t = -279.9951 + 0.06419^{*}\Delta TD_{t-1} + 0.03999^{*}\Delta TD_{t-2} - 0.073002^{*}\Delta TD_{t-3} + 0.410869^{*}\Delta TD_{t-4} - 0.670015^{*}\Delta TI_{t-1} - 0.130015^{*}\Delta TI_{t-2} - 0.534421^{*}\Delta TI_{t-3} - 0.394589^{*}\Delta TI_{t-4} + 1180031^{*}\Delta TP_{t-1} + 2131859^{*}\Delta TP_{t-2} - 4054330^{*}\Delta TP_{t-3} + 3675199^{*}\Delta TP_{t-4} - 0.73601^{*}\mathrm{ECT}_{t-1} \quad (6)$$

Based on VECM, it's obtained that R^2 =0.690060, indicated that on short term of Japanese tourism demand to Bali around 69% by tourist income and tourism price, while the rest are influenced by other variables which are not include in the model. We also obtained the probability of ECT = 0.0003 and the probability F = 0.00003 shows that equation (6) is a valid model for describing short-term dynamics. The coefficien value ECT -0.73061 indicated that unequilibrium of previous period has been corrected around 0.73%.

Tourism demand is influenced by its dynamic on previous four periods, with the highest Japanese tourism demand at previous four period and the smallest coeffisien Japanese tourism demand in the previous three periods. Generally, the Japanesse tourism demand give a positive influence on the dynamic of themselves.

The Japanese tourist income give negative influence on the short term on Japanese tourism demand. The effect given on the Japanese tourism demand is similar to the coeffisien on each period with the highest Japanese tourist income was obtained at the previous two period while the smallest was at the previous one periode. This is not inline with the influence of long-term period. The increase of Japanese tourist income has resulted in the decrease of Japanese tourism demand. On the other hand, the tourism price give a positive influence on Japanese tourism deman to Bali. It's also not inline with the influence give on the long term period.

Validating the Model

Validating test is required to get the BLUE (Best linier Unbiased Estimator) of OLS estimator. The residuals from measurement equation (6) are checked by using Jarque-Bera normality test. The test showed p-value for test statistic is 0.845459, slightly greater than type-I error $\alpha = 10\%$. We concluded, the residuals follow normal

distribution. To checked heteroskedasticity we used heteroscedasticity test white and we found p-value for test statistic is 0.68 so it can be concluded that there are no heteroskedasticity in the regression model. In addition, we also checked the correlation between the predictor variables. If the coeffisien of the correlation among predictor variables more than 0.8, showed that there are multicolinearity in the regression model (Gujarati,2004).The test showed correlation value among tourism price and tourist income -0.078234<0.8 it mean that there are not multi-colinearity in the regression model. Since all of the classic assumptions are fixed, the VECM model estimation is valid and reliable to use.

CONCLUSION

In the long term, the tourist income gives a positive influence on the tourism demand, while the tourism price has a negative influence on the tourism demand. In the long term, the increase of tourist income has contribution to the increase of Japanese tourism demand coming to Bali. The increase of tourism price will decrease the number of Japanese tourist come to Bali, and they will looking for the similar kind of tourism destination in the other places which has lower price. Meanwhile, in the short term, the tourist income gives a negative influence on tourism demand, it showed that on the short term if their income is increase, they plan to go to more secure, more comfort, and more interesting of the tourism destination. In the other hand, tourism price gives a positive influence to the tourism demand.

The long term equilibrium among research variables, and the negative influence of tourism price to the tourism demand, we hope that the government of Bali Province create the unique tourism package which can compete with similar kind of tourism destination on the other country, so the tourist will still eager to come to Bali. The increase of tourist come to Bali will have a significant benefit for the Balinese people, both of socially and economically.

REFERENCES

Armoni, N. L. E. 2011. "Pengaruh Pendapatan Per Kapita, Nilai Tukar, dan Keamanan Terhadap Jumlah Kunjungan Wisatawan Korea Selatan ke Bali", *Jurnal Perhotelan dan Pariwisata,* Volume 1 (1), pp. 1-15.

Asemota, O.J. and Bala, D.A. 2012. "Modeling tourism demand in Japan using co-integration and error correction model". *International Review of Business Research Papers.Vol. 8.No.2,* pp. 29 – 43.

Badan Pusat Statistik. 2016. *Statistik Wisatawan Mancanegara ke Bali,* Denpasar: BPS Provinsi Bali.

Enders, W. 2004. *Applied Econometric Time Series..* New York: John Wiley & Sons, Inc..

Engle, R. F. and Granger, C. W. J. 1987. "Co-Integration and Error Correction: Representation, Estimation, and Testing". *Econometrica,* Volume 55, pp. 251-276.

Gujarati, D. N. 2004. *Basic Econometrics.* 4 ed. New York: The McGraw−Hill.

Johansen, S. 1988. "Statistical Analysis of Co-integration Vector". *Journal of Economic Dynamics and Control,* Volume 12, pp. 231-254.

Johansen, S. and Juselius, K. 1990. "Maximum Likelihood Estimator and Inference on Co-integration with Applications to the Demand for Money". *Oxford Bulletin Of Economics,* Volume 67, pp. 482-489.

Katafo, R. and A. Gounder. 2004. *Modelling Tourism Demand in Fiji,* Suva Fiji: Economics Department Reserve Bank of Fiji.

Song, H. 2008. *Advanced Econometrics of Tourism Demand,* S.l.: Routledge.

Suciptawati, P., Sukarsa, KG., Kencana, EN. 2017. "Modelling Tourists Arrival Using Time Varying Parameter". *IOP Conf. Series: Journal of Physics: Conference Series,* Volume 855.

Tsay, R. 2002. *Analysis of Financial Time Series.* United States of America: John Wiley & Sons Inc.