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Application of Co-integration and Causality Analysis for Expenditure of International Tourists' Arrival in Nepal

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Abstract This study examines long run and short run causality of average expenditure of tourists by analyzing their length of stay and number of international visitors' arrivals in Nepal by using co-integrating and causality analysis. The study has used annual tourism data of Nepal from the period of 1991 to 2014 provided by Ministry of Tourism and Civil Aviation. The co-integration analysis indicates that there is long run relationship among average expenditure per visitor, their length of stay and number of international tourist arrivals in Nepal. The result of vector error correction model indicates that coefficient of tourists' expenditure elasticity with respect to average length of stay is more elastic as compared to coefficient of tourists' expenditure elasticity with respect to number of international tourists' arrival in Nepal. The results of Granger causality analysis, on the other hand, have depicted that there exists bidirectional causal relationship between expenditure per visitor and their average length of stay and unidirectional causality exists from average length of stay to number of international tourist.

Keywords: *co-integration, dickey fuller test, granger causality, length of stay*

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1. Introduction

"Tourism activity is temporary movement of people to destinations outside their normal places of work and residence, the activities undertaken during their stay in those destinations, and the facilities created to cater to their needs [1]". Tourism plays an important role especially for small countries with diversified geographical location and favorable weather conditions. "Tourism, both international and domestic, brings about an intermingling of people from diverse social and cultural backgrounds, and also a considerable spatial redistribution of spending power, which has significant impact on the economy of the destination area [2]".

Nepal is a homeland of several caste/ethnic groups of people. The culture, festivals, food habit, clothing and languages of people differ from place to place i.e. social activities and cultural practices of the residents of the mountain differ from those of the terai and hill.

Nepal is incredibly rich in arts and architects. Its fine art, magnificent wood and stone carvings and pagoda type of architects are famous in the world. Nepal's flora and fauna are truly amazing in terms of their variety and rarity, and picturesque views of the Himalayas including the highest peak of the world, Mount Everest. In addition to this, country is peopled by a reliably friendly population who are generally happy to share their inherent hospitality as well as their customs and traditions with visitors. It is also a holy- land of Hindus and Buddhists where they have lived together in perfect harmony for the centuries. So, Nepal is one of the highly potential lands for the ultimate destination of tourism of different kinds.

With possession of such numerous attractions, the potentiality of tourism is very high in Nepal. It has many places that can be developed as perfect tourist destinations. If we effectively develop more tourist destinations, it is certain to help in lengthening the stay of the tourist as well as increase the expenditure per visitor which plays positive impact to the foreign exchange earnings and provide greater job opportunities for local people.

There are various empirical studies analyzing the tourism contribution to the national income of country by using co-integration and causality analysis. Some of significant works on tourism contribution are Balguer and Cantavilla [3] for Spain, Dritsakis [4] for Greece, Gunduz and Hatemi-J [5] for turkey; Louca [6] for Cyprus, Noriko and Mototsugu [7] for Japan, and Gani [8] for South Pacific islands, Oh [9] study contribution of tourism development to economic growth for Korea, Kim et al. [10] study tourism expansion and economic development for Taiwan. Proenca and Soukiazis [11] for Portuguese regions, Shan and Wilson [12] study the causality between tourism and Trade for china. Birda, Carrera and Risso [13] study the tourism's impact on economic growth of Mexico. Georgantopoulos [14] analyzes tourism expansion and economic development of India. Tang and Tan [15] assess the role of tourism in Malaysia's economic growth.

The several studies point out that tourism is the one of the sources of foreign exchange earnings. It provides a significant contribution to national income and generating employment opportunities for local people in the different sectors by making low investment as compared to other sectors. The purpose of this paper is to analyze long run and short run causality of average expenditure of tourist (in USD) by analyzing their length of stay and number of international tourists' arrival by using co-integration and causality analysis.

2. Materials and Methods

This study employs annual data during the period of 1991 to 2014 obtained from Tourism Statistics published by Ministry of Tourism and Civil Aviation (MOTCA) [16]. All data sets are transferred into logarithmic returns in order to achieve the long run relationship and to make statistical test procedure valid. On the empirical framework of the study, in order to examine the relationship between average tourists' expenditure (EXPV), their average length of stay (AVLS) and international tourist arrival (TOUR) in Nepal, the following model is specified.

$$U = (\text{EXPV, AVLS, TOUR}) \quad (1)$$

Where EXPV is dependent variable and AVLS and TOUR are explanatory variables. All the statistical analysis has been performed by using STATA 9.0, College Station, Texas, USA.

In order to avoid spurious regression estimation results of the model, firstly stationary property of EXPV, AVLS and TOUR has been examined. The unit root test is performed by using Augmented Dickey-Fuller test [17]. The Test inspects the null hypothesis of unit root (non stationary) process against the alternative hypothesis of no unit root (stationary) in the series [18].

$$\Delta Yt = \delta_0 + \delta_{1t} + \delta_{2t} Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-1} + \varepsilon_t \quad (2)$$

Where Δ is the difference operator, the ADF regression tests for the existence of unit root of Y_t namely in the logarithm of all model variable at time t, variable ΔY_{t-1} expresses the first difference with p lags and final ε_t is the variable that adjust the errors of autocorrelation. The coefficients δ_o, δ_1, δ_2 and α_i are being estimated.

Most of the time series multivariate data are very sensitive to lag length of order. So this study has been used Akaike Information Criteria (AIC) or Schwartz Bayesian Information Criteria (SBIC) for selecting lags order to determine the optimal specification of equations [19]. The appropriate order of the model is determined by computing co-integrating equation over a selected grid of values of the number of lags p and finding that value of p at which the AIC or SBIC attain the minimum. AIC and SBIC has been computed using equation (3) and (4).

$$\text{AIC} = \text{T ln (sum of square of residuals)} + 2\text{n} \quad (3)$$

$$\text{SBIC} = \text{T ln (sum of square of residuals)} + \text{n lnT} \quad (4)$$

Where n is number of parameters estimated and T is number of usable variables**.**

Johansen Co-integration test [20] has been used to determine the number of co-integrating vectors among the variables (EXPV, AVLS & TOUR) and then the Johansen VECM framework can be expressed as:

$$\Delta Yt = V + \alpha\beta' Y_{t-1} + \sum_{i=1}^{p-1} \phi_1 \Delta Y_{t-1} + \delta_i + \varepsilon_t \quad (5)$$

Where δ is the kx1 vector of parameter that implies the quadratic time trend. Similarly, β is coefficient of co-integrating equation and α is the adjustment coefficient. V is a kx1 vector of parameters. Johansen‘s approach derives two likelihood estimators for determining the number of co-integration vectors: a trace test and a maximum Eigen value test.

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The Maximum Eigen value statistic tests the null hypothesis of r co-integrating relations against the alternative of r+1 co-integrating relations for r=0,1,2………n-1. It is computed as

$$R\max\left(\frac{\text{r}}{\text{n}}+1\right) = -T * \ln(1-\lambda) \quad (6)$$

Where **λ** is the maximum Eigen value and T is the sample size.

Trace statistics investigates the null hypothesis of r co-integrating relations against the alternative of n co-integrating relations, where n is the number of variables in the system for r=0,1,2……..n-1 . It is computed through the use of the following formula:

$$\text{R}trace\left(\frac{\text{r}}{\text{n}}\right) = -T * \sum_{i=r+1}^{n} \ln(1-\lambda i) \quad (7)$$

In this test, the null hypothesis of r co-integrating vectors is tested against the alternative hypothesis of r+1 co-integrating vectors (For detail, please see, Johansen, 1988).

Vector Error Correction Model (VECM) has been used to test the long run relationship between target variables and explanatory variables. For this purpose, consider a Vector Autoregressive (VAR) with lag order p which is expressed as

$$\begin{aligned} Yt = V + A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} \\ + \ldots\ldots\ldots\ldots\ldots.. + A_p Y_{t-p} + \varepsilon_t \end{aligned} \quad (8)$$

Where Yt is a Kx1 vector of variable, V is a kx1 vector of parameters, A_I, A_2, A_3,…………..A_p are k x k matrices of parameters, and ε_t is a kx1 vector of disturbances having mean 0 and sum of covariance matrix is identically and independently distributed (i.i.d.) normal over a time.

Any Vector Autoregressive Model can be rewritten as Vector Error Correction by using some algebra, which gives both long and short run causality information. The short run causality is determined with Wald test on the coefficient of EXPV, AVLS and TOUR and long run determined by the sign of the value of coefficient of error correction term (ECT) [21].

$$\Delta Yt = V + \Pi Y_{t-1} + \sum_{i=1}^{P-1} \phi_i \Delta Y_{t-i} + \varepsilon_t \quad (9)$$

Where $\Pi = \sum_{j=1}^{P} A_j - I_k$ and $\phi i = -\sum_{j=i+1}^{P} A_j$.

Where Yt is a Kx1 vector of variable, V is a kx1 vector of parameters, A_I, A_2, A_3 ,…………..A_p are k x k matrices of parameters, and ε_t is a kx1 vector of disturbances having mean 0 and sum of covariance matrix is identically and independently distributed (i.i.d.) normal over a time.

If co-integration has been detected between the series, there exists a long term equilibrium relationship between them, and VECM is applied in order to evaluate the short run properties of the co-integrated series. In case of no co-integration, VECM is no longer required and directly proceeds to Granger causality test to establish causal links between variables [22].

Granger Causality [23] has been used to test the bidirectional and unidirectional causality between bivariate variables. A general specification of the Granger causality test in bivariate (X, Y) with autoregressive lag length p (or k) can be modeled as:

$$Xt = \lambda_{1t} + \sum_{i=1}^{p} a_{1i} x_{t-i} + \sum_{j=1}^{p} b_{1j} y_{t-j} + \mu_{1t} \quad (10)$$

$$Yt = \lambda_{2t} + \sum_{i=1}^{k} a_{2i} x_{t-i} + \sum_{j=1}^{k} b_{2j} y_{t-j} + \mu_{2t} \quad (11)$$

In this model, t denotes time periods, μ is a white noise error and **λ** is constant parameters.

The null hypothesis and alternative hypothesis for the existence of Granger causality in variables X_t and Y_t expressed as:

H_0 : X_t does not Granger cause of Y_t against H_1: X_t Granger causes of Y_t.

H_0: Y_t does not Granger cause of X_t against H_1: Y_t Granger causes of X_t.

Lagrange-Multiplier (L-M) test [24] has been used to test for autocorrelation as well as test for stability of the model. The formula for L-M test statistic of lag p is:

$$LM = (T - d - 0.5)\ln\left[\frac{\left|\sum c\right|}{\left|\sum s\right|}\right] \quad (12)$$

Where T is the number of observations and d is the number of coefficients estimated in augmented VAR; $\sum_c$ is the maximum likelihood estimate of variance-covariance matrix (∑) of the disturbances; $\sum_s$ is the maximum likelihood estimate of ∑ from augmented vector autoregressive.

Finally, Jarque-Bera (J-B) test has been applied for normality of disturbances distribution [25]. It is based on the fact that skewness and kurtosis of normal distribution equal to zero.

$$JB = \frac{n-k}{6}\left[(skew)^2 + \frac{(Kurt-3)^2}{4}\right] \quad (13)$$

Where n is number of observations and k is number of regressors.

3. Results and Discussions

The first step in co-integration analysis is to test the unit roots in each variable. For this purpose, Augmented Dickey Fuller test is applied on EXPV, TOUR and AVLS.

Table 1. Results of Augmented Dickey Fuller Test

Before first differenced (at level)				After first differenced		
Variable	Test statistics	5% critical value	p- value	Test statistics	5% critical value	p- value
EXPV	-1.883	-3.00	0.2879	-4.503	-3.000	0.0002
TOUR	-0.693	-3.00	0.8486	-3.876	-3.000	0.0022
AVLS	-4.394	-3.00	0.0003	-6.746	-3.000	0.0000

Table 1 reports the results of the ADF test which shows that the variables EXPV and TOUR are not stationary but AVLS is stationary at level (before first difference). After the first difference all variables are stationary i.e. do not have unit root. It can reject the null hypothesis of non-stationary after the first difference at 5% level of significant. This implies that all the variables in the series are integrated of order one, i.e. I(1).

For getting optimal lag length for co-integrating analysis, two criteria: Akaike Information Criteria (AIC) and Schwarz Bayesian Information Criteria (SBIC) have been adopted.

Table 2 shows that SBIC suggested a lag length of 1 as optimal, while AIC indicated 4 as optimal lag length. But in this study of series (EXPV, TOUR, and AVLS) for co-integration analysis 4 lag lengths has been adopted because 1 lag length could not be found the co-integrating vector under both trace and maximum Eigen value statistics. While at lag length 4 could be found one co-integrating vector under both trace statistics and max statistics. The co-integration relationship among EXPV, TOUR and AVLS has been investigated using the Johansen technique.

Table 2. Results of Lag order selection Criteria

Lag	df	p-value	AIC	SBIC
0	.	.	-1.2904	-1.1409
1	9	0.000	-3.0467	-2.4493*
2	9	0.025	-3.0957	-2.0503
3	9	0.113	-2.9089	-1.4154
4	9	0.000	-3.6623*	-1.7206

*indicates lag order selected by the criteria.

Table 3. Results of Johansen test of co-integration

Null Hypothesis	Eigen value	Trace statistic criteria		Max statistic criteria	
		λtrace	5% critical value	λmax.	5% critical value
H0:r=0	.	43.419	29.68	32.428	20.97
H0:r⩽1	0.802	10.992*	15.41	6.769	14.07
H0:r⩽2	0.287	4.222	3.76	4.222	3.76

*indicates co-integration vector.

Table 3 reports the results of co-integration test based on Johansen's Maximum likelihood method. Both trace statistic (**λ**trace) and maximum Eigen value statistics (**λ**max) indicate that there is at least one co-integrating vector among EXPV, TOUR and AVLS. It can reject the null hypothesis of no co-integrating vector against under both test statistics at 5 % level of significant. It also can not reject the null hypothesis of at most one co-integration vector against the alternative hypothesis of two co-integrating vectors for both trace and max Eigen value test statistics. Consequently, it can conclude that there is one co-integrating relationship among EXPV, TOUR and AVLS. This implies that the EXPV, TOUR and AVLS establish a long run relationship.

Table 4. Results of Co-integration Equation

Variable	Coeff. of Beta	S.E.	Z	p- value	95% C.I.
*ln*_EXPV	1				
*ln*_TOUR	-2.209	0.192	-11.5	0.000	(-2.586 -1.833)
*ln*_ AVLS	6.406	0.663	9.60	0.000	(5.106 7.706)
CONS.	7.000				

The long run relationship between expenditure per visitor, number of international tourist and average length of stay for one co-integrating vector for Nepal in the period of 1991-2014 are displayed below (Standard errors are displayed in parenthesis)

$$ln-\text{EXPV}$$
$$=-2.209\ (ln-\text{TOUR})+6.406(ln-\text{AVLS})+7.000$$
$$(0.192)\qquad\qquad (0.663)$$

The co-integration equation has been transferred to logarithmic returns for getting the meaning of the coefficients. If all variables are logarithmic, it can be easy to interpret the coefficients in terms of elasticity. So it can be said that increasing EXPV by 100% produces an increment of almost 640.6% of AVLS. Similarly increasing EXPV by 100% produces an impact of almost 220.9% of TOUR. Thus coefficient of EXPV elasticity with respect to AVLS is more elastic as compared to coefficient of EXPV elasticity with respect to TOUR.

Table 5. Result of Coefficient of Error Correction Terms (ECT)

Variable	Coef. of ECt_1	S.E	Z	p- value	95% C.I.
*Δ_ln*_EXPV	-0.099	0.330	-0.30	0.765	(-0.752 0.553)
*Δ_ln*_TOUR	0.258	0.292	0.89	0.375	(-0.313 0.829)
*Δ_ln*_AVLS	-0.427	0.123	-3.47	0.001	(-0.669 -0.186)

The coefficient of error correction term of EXPV variable has the speed of convergence towards equilibrium of 9.96 percent. In the short run, it is adjusted by 9.96 percent of past years deviation from equilibrium. As large absolute value of the coefficient on the ECT shows equilibrium agents remove a large percentage of disequilibrium in each period i.e. the speed of adjustment is very rapid. While low absolute values are indicating of slow speed of adjustment towards equilibrium. It means that speed of adjustment of EXPV towards equilibrium is slow. The coefficient of error correction term of EXPV has negative sign but it is statistically insignificant at 5% level. It implies that the system convergence towards equilibrium path but unstable due to the any disturbance in the system. Similarly, the coefficient of error correction term of TOUR carries positive sign but it is insignificant at 5% level. It depicts that the system divergence from equilibrium path but unstable in case of any disturbance in the system. The coefficient of error correction term of AVLS is negative and statistically significant at 5% level. It implies that the system convergence towards the equilibrium path and stable due to any disturbance in the system.

Table 6. Granger Causality Test

Null Hypothesis	Chi square	df	p -value
EXPV does not Granger cause TOUR.	0.463	4	0.977
EXPV does not Granger cause AVLS.	18.308	4	0.001
TOUR does not Granger cause EXPV.	4.825	4	0.306
TOUR does not Granger cause AVLS.	7.892	4	0.096
AVLS does not Granger cause EXPV.	39.856	4	0.000
AVLS does not Granger cause TOUR.	124.65	4	0.000

Table 6 reports the results of bidirectional and unidirectional causality among the variable EXPV, TOUR and AVLS. It shows that EXPV Granger causes AVLS and AVLS also Granger causes EXPV. So bidirectional Granger causality exists between EXPV and AVLS. Similarly, AVLS Granger causes TOUR but TOUR does not Granger cause AVLS. So, unidirectional Granger causality exists from AVLS to TOUR. EXPV does not Granger cause TOUR and TOUR also does not Granger cause EXPV. No direction Granger causality between EXPV and TOUR i.e. they are statistically independent.

The stability of the VEC model has been assessed through the L-M test for autocorrelation, and the results are presented in Table 7.

Table 7. Results of L- M Test of Autocorrelation

Lag	Chi square	df	p- value	Decision
1	7.231	9	0.613	Not significant
2	9.878	9	0.360	Not significant
3	11.847	9	0.220	Not significant
4	6.152	9	0.725	Not significant

The null hypothesis of no residual autocorrelation at lag order 1 through 4 cannot be rejected as justified by L-M test implying that there is no evidence to contradict the validity of the model. Further, the test of normality of disturbances distribution in the series of the variables has also been evaluated by Jarque-Bera test (Table 8). The J-B test clearly indicates that the disturbances are distributed normally.

Table 8. Results of Jarque –Bera Test for Normality Distributed Disturbances

Variable	Chi square	df	p- value	Decision
ln_EXPV	0.802	2	0.669	Not significant
ln_TOUR	0.355	2	0.837	Not significant
ln_AVLS	1.418	2	0.492	Not significant
ALL	2.575	6	0.860	Not significant

4. Conclusion

The results of Johansen test of co-integration indicates that there is one co-integrated vector that implies there exists long run relationship among the variables EXPV,TOUR and AVLS under 4 lag of length. The long run relationship based on vector error correction model has indicated that coefficient of visitors' expenditure elasticity with respect to average length of stay is more elastic as compared to coefficient of visitors' expenditure elasticity with respect to number of international tourist arrival in Nepal. The results of Granger causality analysis have depicted that there exists bidirectional causal relationship between expenditure per visitor and their average length of stay and unidirectional causality exists from average length of stay to number of international tourists' arrival. It clarifies that the average length of stay of tourist increases expenditure visitor and vice versa. The large number of international tourist plays the positive role to increase their length of stay. The findings suggest that the expenditure per visitor of Nepal positively relates to their length of stay in terms of short run and long run causality. Hence, policy makers should pay critical and sustained attention towards promoting cultural and natural resources, improving the infrastructure of tourism industry and employing the tourism marketing skills. So, it is necessary to develop the appropriate necessary environment to extend the length of stay of tourists' arrival in Nepal for increasing their average expenditure.

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