CAUSALITY ANALYSIS AMONG TOURIST ARRIVAL, ECONOMIC DEVELOPMENT AND CO_2 EMISSION: THE CASE OF MALAYSIA

by

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ABSTRACT

This current study attempts to examine the causal relationship between tourist sector, gross domestic product and carbon dioxide emission. Annual time series data were utilized from the period of 1980 to 2010. The test was carried out using Unit Root tests, Johansen-Juselius Cointegration test and Vector Error Correction Model (VECM) to assess the relationship between the respective variables. All the variables are found to be co-integrated thus indicating the existence of long-run relationship. In addition, uni-directional relationship is found from gross domestic product and carbon dioxide emission in the short-run. The results suggest that policy makers should specify certain policy targeting on the adaptation of tourism development while preserving the environment.

KEYWORDS
Real GDP Per Capita, CO_2 Emission, Tourist Arrival, Vector Error Correction Model

INTRODUCTION

Malaysia is one of the fastest developing nations in South East Asia. As Malaysia concentrates on being a service-based economy, the heart of its economy initially originates from the manufacturing based industry prior to the nation's independence. After the economy underwent several transitions during the process of its development, tourism sector emerges as one of the lucrative industry attracting not only foreign direct investments but the growth of goods and services industries comprising of transportation, accommodations, food and beverage and encouraging the development of cottage industry. Tourism sector accounted for 14.8 per cent total contribution in gross domestic product (GDP) in 2011 while securing a 12.9 per cent (1.56 million jobs) out of total employment in Malaysia. (World Travel and Tourism Council, 2012) Table 1 shows the number of tourist arrival in Malaysia based on the top 10 ranking. It is found that Singapore has the highest number of tourist visiting Malaysia followed by Indonesia and Thailand. Interestingly, these countries are neighbouring countries which has the geographical proximity advantage to Malaysia resulting in lower transportation costs in comparison with other countries. This is supported by Ahmad Kosnan and Ismail (2012) whereby they explain that the factors attracting tourists to Malaysia are the role of exchange rate or depreciation, low cost of living, and sharing common border and language.

TABLE 1
TOURIST ARRIVALS IN MALAYSIA, 2010

Rank	Country	Number of Visitors (in millions)	Growth since 2009 (in percentage, %)
1	Singapore	13.04	2.4
2	Indonesia	2.51	7.04
3	Thailand	1.46	0.6
4	China	1.13	10.8
5	Brunei	1.24	5.9
6	India	0.69	17.1
7	Australia	0.58	8.9
8	Phillipines	0.49	8.8
9	United Kingdom	0.43	-1.2
10	Japan	0.42	5.1

Source: Ministry of Tourism, Malaysia (2012).

A vast number of literatures pointed out on the contribution of tourism sector to economic growth (Khalifah & Tahir, 1997; and Opperman, 1992). Others tend to discover the demand factors for tourism sector (Mohd Hanafiah & Mohd Harun, 2010) Nonetheless there are insufficient works on the impacts of tourism on the environment, and vice versa. Despite tremendous economic gain, uncontrolled tourism activities would results in severe environmental degradation activities. Davies and Cahill (2000) mentioned that there are three categories for the environmental impact of tourism including: (i) direct impacts, including impacts from the travel to a destination, the tourist activities in and of themselves at that destination, such as hiking or boating, and from the creation, operation and maintenance of facilities that cater to the tourist; (ii) “upstream” impacts, resulting from service providers’ ability to influence suppliers; and “downstream” impacts, where service providers can influence the behaviour or consumption patterns of custom.

According to Organization for Economic Co-operation and Development (2011), the relevant key impacts for tourism sector includes a rising frequency of weather extremes, flooding, droughts and water shortages; increasing temperatures, declining water quality and coastal erosion lessening the tourism attractiveness. This has drawn the attention on the importance of tourism sectors in affecting the environmental conditions. Nonetheless, limited number of studies on the relationship between tourism sector and environmental degradation has been made specifically in Asia. Thus, this study focuses on the causal relationship between CO_2, RGDP and number of tourist arrivals. The rest of this paper is organized as follows: the next section reviews previous literatures; the third section describes the data and methodology; the fourth section presents the empirical results for this research and finally the fifth section presents the conclusion.

LITERATURE REVIEW

Jatuporn and Chien (2011) analyzed the causal relationship between tourism development and CO_2 (carbon dioxide) emissions in Thailand over the period of January 1986 to May 2010 by using a multivariate vector autoregressive (VAR) model and generalized variance decomposition (VDC). They found that tourism development increases the consumption of energy and CO_2 emissions through transportation and economic activities. The results also showed that transport sector has a strong relative shock on CO_2 emissions through the time prediction.

Nademi and Najibi (2011) estimated and evaluated the relationship between CO_2 emission and international tourism in selected developed countries including Austria, Belgium, Canada, Chile, Denmark, France, Ireland, Japan, South Korea, Sweden and the United States. Using panel data analysis for the period between 2000-2007, the study found that the impact of CO_2 emission towards international tourism in a few Developed Countries are significantly negative suggesting that policymaking is crucial in order to reduce the pollution level. Zaman, Khan and Ahmad (2011) explored the relationship between indicators of tourism development and Carbon emission in Pakistan over a period of 1991-2010 by employing co-integration and Granger Causality test. The results indicated a bi-directional relationship between tourism indicator and Carbon emission.

DATA AND METHODOLOGY

Data Description

The data that will be used are annual time series data of the carbon dioxide emission (CO_2), real gross domestic product per capita (RGDP) and number of international tourist arrival from 1980 to 2010. The RGDP and CO_2 data are acquired from World Development Indicator, World Bank. The number of international tourist arrival is obtained from Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) and Ministry of Tourism, Malaysia. The RGDP data is in constant 2000 US dollar while the CO_2 data is in kilotonnes. All the data are transformed into natural logarithm.

METHODOLOGY

Augmented Dickey Fuller Unit Root Test

The ADF test is described by Said and Dickey (1984) as the basic autoregeressive unit root test to accommodate general autoregressive moving average (ARMA) (p, q) models with unknown orders. The ADF test tests the null hypothesis that a time series y_t is I (1) against the alternative that is I (0) with the assumption that the data dynamics have an ARMA structure. Equation (1) is the test regression estimation of the ADF test in which D_t is a vector of deterministic terms (constant and trend etc). The p lagged difference terms, Δy_{t-j} are used to approximate the ARMA structure of the errors and the value for p for serially uncorrelated error ε_t.

$$y_t = \beta' D_t + \phi y_{t-1} + \sum_{j=1}^{p} \psi_j \Delta y_{t-j} + \varepsilon_t \quad (1)$$

Phillips-Perron Unit Root Test

The difference between ADF and PP tests depend on how serial correlation and heteroscedasticity in the errors are dealt. Specifically, the PP test neglects any serial correlation in the test regression whereby the ADF tests apply a parametric autoregression to approximate the test regression's estimation of the ARMA structure of the errors. The PP test regression is presented as follows:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + u_t \quad (2)$$

Cointegration test

In order to identify the cointegration relationship of all the variables included in the system, Johansen and Juselius (1990) procedure is utilized. The importance of cointegration test is to seek the existence of spuriousness in the regression. If, the variables are found to be cointegrated, hence, there exists a linear, stable and long-run relationship among the variables. This implies that the variables tend to move in steady path in the long run. The Johansen and Juselius test is based on the two test statistics which are the trace statistics and maximum eigenvalue test statistics. The trace test examine the whether the smallest k - r_0 eigenvalues are significantly different from zero. Furthermore, the H_0: r $\leq r_0$ versus the more restrictive alternative H_1: r = r_0+1 can be tested using maximum eigenvalue test. The trace statistics test is as follow:

$$\lambda_{trace}(r_0) = -T \sum_{j=r_0+1}^{k} \log(1 - \hat{\lambda}_j) \quad (3)$$

The maximum eigenvalue test is based on the estimated $(r_0+1)^{th}$ largest eignevalue. Maximum Eigenvalue test is as follow:

$$\lambda_{\max(r_0)} = -T \log 1 - \hat{\lambda}_{r_0+1} \quad (4)$$

Vector Error Correction Model

Vector Error Correction Model (VECM) is a restrictive Vector Autoregressive (VAR) model that restricts the endogenous variables' behaviour in the long run in order to converge to the long run equilibrium relationship and permits the long run dynamics. In the case of at least one cointegrating vector to be found exist among the variables, therefore a corresponding error-correction representation that connote that changes of the dependant variable can be formulates as function of disequilibrium in the relationship of the cointegration and fluctuations in other explanatory variables. The regression equation form for VECM can be expressed as below:

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i}$$

$$\Delta X_t = \alpha_2 + p_2 e_{i-1} + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i} \quad (5)$$

RESULTS AND DISCUSSION

Unit Root and Cointegration test

The ADF and PP test is conducted to test on individual stochastic trend. It is imperative that the series are integrated at the same order prior to the analysis of cointegration. The ADF and PP tests at level and difference are presented at table 2. The results indicate that non stationarity of the null hypothesis at level for the series failed to be rejected. Conversely, stationarity is detected at first difference. This shows that the variables are all integrated at I (1).

TABLE 2
AUGMENTED DICKEY-FULLER AND PHILLIPS-PERRON UNIT ROOT TEST RESULTS FOR SERIES

	Augmented Dickey-Fuller		Phillips-Perron	
Variables	Level	First Difference	Level	First Difference
CO_2	-1.6445	-6.0655*	-1.7070	-6.0580*
RGDP	-1.5343	-4.3942*	-1.7417	-4.4043*
TOUR	-2.8551	-5.3467*	-2.7038	-10.3707*

*Notes: Significance at the 5% level.

TABLE 3
JOHANSEN-JUSELIUS MULTIVARIATE COINTEGRATION TEST RESULTS

H_0:	H_1:	Trace Statistic	Critical Value	Max-Eigen Statistic	Critical Value
r=0	r=1	34.33*	29.80	29.61*	21.13
r≤1	r=2	4.72	15.49	4.59	14.26
r≤2	r=3	0.13	3.84	0.13	3.84

Notes: (*) denotes rejection of the hypothesis at the 5%. The letter "r" represents the number of co-integrating equations. The critical values are based on MacKinnon (1996).

Johansen-Juselius Multivariate Cointegration test is carried out to discover the existence of long run equilibrium relationship among the variables. The results of Johansen-Juselius maximum likelihood (ML) can be seen in Table 3. According to the results, both Trace statistic and Max-Eigen statistic show the existence of cointegration between the variables. This implies that common trend is to be found in the model.

Vector Error Correction Model Estimates

TABLE 4
NORMALIZED EQUATION TEST RESULTS

LnTOUR	LnRGDP	$LnCO_2$
1.0000	9.7457	-5.4540
	(8.0441)	(-6.3281)

Notes: (*) denotes rejection of the hypothesis at the 5%. Numbers in brackets are t-statistics.

The normalized cointegration equation is depicted in Table 4 which shows that all the variables are significant whereby RGDP has a positive effect on TOUR while CO has a negative effect on TOUR. The RGDP coefficient indicates that in Malaysia, a one per cent increment in RGDP (while others held constant) contributes to 9.75 per cent increase in TOUR. For CO coefficient, it is indicated that a one per cent increase in CO leads to a 5.45 per cent decline in TOUR.

TABLE 5
VECTOR ERROR-CORRECTION MODEL (VECM)

Dependent variable	ΔTOUR	ΔRGDP	ΔCO_2	Coefficient of ECT (*T*-ratio)
ΔTOUR	-	0.3871	0.9513	-0.2580*(-2.3138)
ΔRGDP	0.2331	-	0.2514	0.0761 (3.2565)
ΔCO_2	0.0611	0.0455*	-	0.0425 (0.7227)

Note: The above values are the values of F. Numbers in squared brackets are p-values. In the table, * shows that coefficients are significant at 5% level.

The specification of VECM only applies to cointegrated series in identifying the short-run and long-run relationship of the variables. The results can be seen in Table 5. In the long-run, it is found that cointegrating vector of TOUR equation of VECM is significant with speed adjustment of 25.80 per cent. This implies that RGDP and CO_2 granger cause TOUR in the long-run and it takes approximately 4 years to reach long run equilibrium as a result of any disequilibrium in the system. It is noted that causal relationships exist only from RGDP to CO_2 in the short-run.

CONCLUSION

The analysis utilized three annual time series variable for the period 1980-2010 in order to assess the causal relationship between number of international tourist arrival, RGDP and CO_2. Using VECM, it is evident that long-run relationship exists among the variables. Furthermore, short-run causality exists from RGDP to CO_2 in the short-run. The results suggest policy makers should specify certain policy targeting on the adaptation of tourism development while preserving the environment. In addition, local communities should be aware on the legislation involved when dealing with the consumption and also utilization of natural resources as the awareness would lead to a better environmental protection in the long-run.

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