Tourism, real output and real effective exchange rate in Malaysia: a view from rolling sub-samples

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ABSTRACT

The objective of this study is to examine the tourism-growth nexus for Malaysia with the cointegration and Granger causality tests. This study covers the monthly data from January 1989 to May 2010. The Johansen's cointegration and the residuals-based test for cointegration with regime shift consistently suggest that tourist arrivals, real output, and real effective exchange rate in Malaysia are cointegrated. In terms of Granger causality, this study finds different sources of causality. In the short run, real output and real effective exchange rate Granger-cause tourist arrivals, while tourists arrivals also Granger-cause real output and real effective exchange rate. In the long run, this study shows that all the variables are bi-directional causality. Moreover, we also extend the study to analyse the stability of causality between tourism and real output by using rolling regression procedure into the Granger causality test. Interestingly, the rolling Granger causality test demonstrates that the growth-led tourism hypothesis is valid and stable, while tourism-led growth hypothesis is valid and but unstable in particular after 2005. Although tourism contributes to economic growth, it is not a persistence source for long-term economic growth in Malaysia.

Keywords: tourism-led growth hypothesis; Malaysia; rolling regression
JEL Classification: C32; O11; O53

1. INTRODUCTION

The issue of economic prosperity of a nation is frequently relate to the contribution of the agricultural and manufacturing sectors as well as the influx of foreign direct investment (Sinclair, 1998). Today tourism is one of the largest and rapid growing sectors in the world. Many developing economies over the world relied heavily on this services sector for the purpose of sustainable economic growth (Clancy, 1999; Belloumi, 2010). Over the past few decades, empirical studies on the relationship between tourist arrivals and economic growth or more specifically the tourism-led growth hypothesis has been extensively research, but the direction of its causality remains as yet an unsolved conundrum. Reviewing the existing literatures, some tourism-growth studies such as Oh (2005) for Korea, Cortés-Jiménez and Pulina (2006) for Italy, and Tang and Jang (2009) for the United States claimed that economic growth Granger-causes tourism, because high growth countries may have many business and employment opportunities. However, others studies taken the view that tourism

Granger-causes economic growth through its effect on foreign exchange, employment, tax revenues, and others potential benefits to the visiting countries (Balaguer and Cantavella-Jordá, 2002; Durbarry, 2004; Gunduz and Hatemi-J, 2005; Belloumi, 2010). Deaton (1995) pointed out that knowing the direction of causality is not just for understanding the process, but it is also vital for designing of appropriate policy (see also Oh, 2005). Therefore, examine the validity of tourism-led growth hypothesis or vice versa has become a pivotal issue for economists as well as the policymakers.

The goal of this study is to investigate the tourism-led growth hypothesis for Malaysia over the period of January 1989 to May 2010. Malaysia is one of the impressive growth economies in the Association of South East Asia Nation (ASEAN). Over 53 years of independence, the structure of the Malaysian economy has changed from the agricultural sector to the manufacturing and services sectors. Together with some prudent policies and practical development planning, the economy has been growing steadily. In addition, the Malaysian government aware the importance of tourism industry in gauging foreign exchange revenue, creating job opportunities and generating economic growth, thus Tourism Development Corporation (TDC) was established on 10 August 1972 as an agency to develop tourism industry in Malaysia. Then, the Malaysian Tourism Promotion Board (MTPB) was established to replace TDC to continue promoting the numbers of international tourist arrivals to Malaysia. In 2005, Malaysia has been awarded the second most visited destination in Asia with the record of 16.4 million visitors (see New Straits Times, 2005). Three years later, in 2008 the international tourist arrivals to Malaysia mushroomed to 22.1 million visitors. However, as an impact of global financial crisis the number of international tourist arrivals to Malaysia decreased moderately to 18.3 million visitors in February 2010.

As far as Malaysia is of concern, there are studies have focused on tourism-growth in Malaysia, but these studies are not without problem. The major problem with much of the earlier tourism-growth studies in Malaysia is that they have not paid much attention to the empirical assessment of the causal relationship between tourism and economic growth for the Malaysian economy. At best, several studies (e.g., Evan et al., 2008; Lean and Tang, 2010; Tang, 2011) have been carried out to analyse the tourism-led growth hypothesis in Malaysia using the Granger causality test in a bi-variate framework. Nonetheless, the causality results suggested by these studies are not consensus. A major reason for the non-consensus causality results may due to the omission of relevant variable(s) bias – exchange rate (Lütkepohl, 1982; Oh, 2005).

This study contributes to the tourism-growth literature in three main aspects. The first contribution is that we employ dynamic time series modelling within a multivariate causal framework to analyse the relationship between tourist arrivals, real output, and real effective exchange rate in Malaysia. The second contribution is that we allow for the effects of structural break in the unit root and cointegrating relationship. In testing for the order of integration for each series, we apply the Zivot and Andrews (1992) and Lumsdaine and Papell (1997) unit root tests with one and two structural breaks. After determined the order of integration for each variables, we employ the Johansen and Juselius (1990) test for cointegration, and also the residuals-based test for cointegration with a regime shift (Gregory and Hansen, 1996) to investigate the presence of potential long-run equilibrium relationship between tourist arrivals, real output, and real effective exchange rate in Malaysia. The third contribution is that, apart from applying the Granger causality test between tourism and real output, we also examine whether the causality between tourism and real output are stable over time. There is no reason to believe that the causal relationship remains unchanged over time (Tang, 2008, 2010). To do this, we incorporate the rolling regression procedure into the Granger causality test. In doing so, we can identify whether tourism is a persistence source for economic growth and it also has direct implication to modelling effective growth policy in Malaysia.

The balance of this paper is organised as follows. The next section will briefly review some recent literatures on the tourism-growth nexus. Section 3 presents the data and methodologies used in this study. Section 4 reports the empirical results and discussion of this study. Ultimately, the conclusion and policy recommendations will be presented in Section 5.

2. A BRIEF REVIEW OF RECENT LITERATURES

Given the policy relevance of testing the relationship between tourism and economic growth, there are sizeable empirical studies on topic; therefore it is implausible to comprehensively review all the studies within the ambit space of this paper. The aim of this section is only to review some selected recent studies on the tourism-growth studies with particular emphasis on studies that used cointegration and/or Granger causality tests. Since 2000, there are many published studies investigated the relationship between tourism and economic growth. However, the results pertaining to the direction of causality remain ambiguous. A summary of empirical studies on the tourism-growth nexus is delineated in Table 1.

Balaguer and Cantavella-Jordá (2002) used the Johansen's cointegration and Granger causality tests to examine the relationship between tourism, economic growth and exchange rate for Spain from the period of 1975:1 to 1997:1. They find that the tourism is cointegrated with economic growth and real exchange rate. In addition, the Granger causality results suggested a uni-directional causality run from tourism to economic growth. Thus provided some evidences to support the tourism-led growth hypothesis in the Spanish economy. For the sake of brevity, other studies such as Lanza et al. (2003) for 13 OECD countries, Durbarry (2004) for Mauritius, Gunduz and Hatemi-J (2005) for Turkey, Lee and Chang (2008) for OECD countries, Lee and Hung (2010) for Singapore, Belloumi (2010) for Tunisia, Brida et al. (2010) for Uruguay, and Kreishan (2010) for Jordan also find a uni-directional causality runs from tourism to economic growth using the cointegration and Granger causality tests. Therefore, the findings of these studies support the existence of tourism-led growth hypothesis.

On the other hand, Oh (2005) examined the validity of tourism-led growth hypothesis for Korea using the two-step Engle and Granger (1987) residuals-based cointegration and Granger causality tests with a bi-variate model (i.e., tourism and economic growth). At odd to the conventional findings presented above, the study demonstrated that tourism and economic growth are not cointegration for Korea. Thus, he used the first difference Vector Autoregressive (VAR) system to ascertain the causal relationship between the variables. The Granger causality test results exhibited that tourism does not Granger-causes economic growth, but economic growth Granger-causes tourism. With this finding, he surmised that tourism-led growth hypothesis is not valid, while tourism development in Korea is heavily depends on its economic growth and development. A step further to the conventional studies, Tang and Jang (2009) examined the tourism-led growth hypothesis in the United States with the major tourism related industries (i.e., airlines, casinos, hotels, and restaurants) and gross domestic product (GDP). They find that only airlines and GDP are cointegrated and the direction of causality is runs from GDP to tourism rather than reciprocal causal relationship. In line with the finding of Oh (2005), they also find some support on growth-driven tourism hypothesis with the United States sub-industry level data. Dritsakis (2004) conducted a study to analyse the validity of the tourism-led growth hypothesis for Greece within a multivariate framework (i.e., tourism, economic growth, and real exchange rate) over the period 1960:1 to 2000:4. The study employed the Johansen's cointegration and Granger causality approaches to achieve the objective of the study. Unlike the earlier studies, the study shows that the variables are cointegrated and there is a reciprocal causal relationship between tourism and economic growth in Greece. Interestingly, Kim et al. (2006), and Lee and Chien (2008) also find the similar conclusion for Taiwan.

Table 1: Summary of literature review on tourism-led growth

No	Authors	Research Period	Countries	Methods	Major findings of causal effect
1.	Balaguer and Cantavella-Jordá (2002)	1975:1 – 1997:1	Spain	Johansen and Juselius (1990); Granger causality – VECM	Tourism $\rightarrow$ Growth
2.	Lanza et al. (2003)	1977 – 1992	13 OECD	Johansen and Juselius (1990)	Tourism $\rightarrow$ Growth
3.	Dritsakis (2004)	1960:1 – 2000:4	Greece	Johansen and Juselius (1990); Granger causality – VECM	Tourism $\leftrightarrow$ Growth
4.	Durbarry (2004)	1952 – 1999	Mauritius	Johansen and Juselius (1990); Granger causality - VECM	Tourism $\rightarrow$ Growth
5.	Oh (2005)	1975:1 – 2001:1	Korea	Engle and Granger (1987); Granger causality – VAR	Growth $\rightarrow$ Tourism
6.	Gunduz and Hatemi-J (2005)	1963 – 2002	Turkey	Toda and Yamamoto (1995) – MWALD	Tourism $\rightarrow$ Growth
7.	Kim et al. (2006)	1971:1 – 2003:2	Taiwan	Johansen and Juselius (1990); Granger causality – VAR	Tourism $\leftrightarrow$ Growth
		1956 – 2002			Tourism $\leftrightarrow$ Growth
8.	Salleh et al. (2007)	1970 – 2004	Malaysia	Pesaran et al. (2001)	Growth $\rightarrow$ Tourism
9.	Lee and Chien (2008)	1959 – 2003	Taiwan	Johansen and Juselius (1990); Weak exogeneity – VECM	Tourism $\leftrightarrow$ Growth
10.	Lee and Chang (2008)	1990 – 2002	OECD	Pedroni (1999); Granger causality – VECM	Tourism $\rightarrow$ Growth
			Non-OECD		Tourism $\leftrightarrow$ Growth
11.	Evan Lau et al. (2008)	1972 – 2004	Sarawak (Malaysia)	Johansen and Juselius (1990); Granger causality – VECM	Tourism $\rightarrow$ Growth
12.	Tang and Jang (2009)	1981:1 – 2005:4	United States	Johansen and Juselius (1990); Granger causality – VECM	Growth $\rightarrow$ Tourism
13.	Katircioglu (2009)	1960 – 2006	Turkey	Pesaran et al. (2001); Johansen and Juselius (1990)	No relationship
14.	Kadir and Karim (2009)	1995:1 – 2005:2	Malaysia	Johansen and Juselius (1990)	Growth $\rightarrow$ Tourism
15.	Lee and Hung (2010)	1978 – 2007	Singapore	Pesaran et al. (2001); Granger causality – VECM	Tourism $\rightarrow$ Growth
16	Belloumi (2010)	1970 - 2007	Tunisia	Johansen and Juselius (1990); Granger causality – VECM	Tourism $\rightarrow$ Growth
17.	Lean and Tang (2010)	1989:1 – 2009:2	Malaysia	Toda and Yamamoto (1995) – MWALD	Tourism $\leftrightarrow$ Growth
18.	Brida et al. (2010)	1987:1 – 2006:4	Uruguay	Johansen and Juselius (1990);	Tourism $\rightarrow$ Growth
19.	Kreishan (2010)	1970 – 2009	Jordan	Johansen and Juselius (1990); Granger causality – VAR	Tourism $\rightarrow$ Growth
20.	Katircioglu (2010)	1960 – 2007	Singapore	Pesaran et al. (2001); Granger causality – VECM	Tourism $\rightarrow$ Growth
21.	Payne and Mervar (2010)	2000:1 – 2008:3	Croatia	Toda and Yamamoto (1995) – MWALD	Growth $\rightarrow$ Tourism
22.	Tang (2011)	1995:1 – 2009:2	Malaysia	Kremer et al. (1992); Granger causality – VECM	Growth $\rightarrow$ Tourism

Note: $\rightarrow$ and $\leftrightarrow$ represent uni-directional and bi-directional Granger causality, respectively.

In the Malaysian context, studies have reached different conclusion about the direction of causality between tourism on economic growth. Salleh et al. (2007) and Kadir and Karim (2009) find some support to the hypothesis of growth-driven tourism in Malaysia by using the Pesaran et al. (2001) bounds testing approach for cointegration and Johansen's cointegration test. A major flaw of these studies is that they used cointegration test to ascertain the direction of causality, without taking into account a formal Granger causality. This is because the presence of cointegration does not indicate the direction of causality. Therefore, the causality results of these studies are susceptible. In order to avoid the methodological flaw, Evan Lau et al. (2008) applied the Johansen's cointegration and Granger causality tests to analyse the relationship between tourism and economic growth in Sarawak, Malaysia. They find that tourism and economic growth are cointegrated. However, the results of Granger causality test suggest that there is only long-run causality runs from tourism to economic growth. Unlike the previous studies, Lean and Tang (2010) analyse the tourism-led growth hypothesis in Malaysia using the Granger causality test developed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – TYDL. They find bi-directional causality between tourism and economic growth in Malaysia. Moreover, they also suggest that the tourism-led growth hypothesis is valid and stable over time in Malaysia. The most recent study, Tang (2011) argued that not all tourism markets affect positively economic growth in Malaysia. Therefore, he revisited the tourism-led growth hypothesis for Malaysia using disaggregated tourism markets dataset. Importantly, they find that tourism-led growth is only valid in certain tourism markets, but economic growth Granger-causes all tourism markets. Therefore, the growth-driven tourism is more appearance in the case of Malaysia.

3. DATA, EMPIRICAL MODEL AND METHODOLOGY

3.1 Data and empirical model

This study employs the monthly data for total international tourist arrivals (VA) to Malaysia, real Industrial Production Index (IPI, 2005 = 100) as a proxy for output growth, and real effective exchange rate to analyse the tourism-growth nexus for Malaysia. The Consumer Price Index (CPI, 2005 = 100) is uses to convert the variables into real term. This study covers the sample period from January 1989 to May 2010 and the dataset are collected from the *International Financial Statistics* (IFS) published by the International Monetary Fund (IMF) and CEIC Databases. All the variables will be transformed into natural logarithm form to induce stationarity in the variance-covariance matrix (see Chang et al. 2001; Fatai et al. 2004).

Following earlier empirical studies on the tourism-growth nexus (i.e. Balaguer and Cantavella-Jordá, 2002; Dritsakis, 2004; Katircioglu, 2010; Belloumi, 2010; Payne and Mervar, 2010), the generic long-run relationship between tourist arrivals, real output, and real effective exchange rate can be specified as follows:

$$\ln VA_t = a_0 + a_1 \ln Y_t + a_3 \ln REER_t + e_t \qquad (1)$$

where $\ln VA_t$, $\ln Y_t$ and $\ln REER_t$ are the natural logarithm of total international tourist arrivals to Malaysia, real output, and real effective exchange rate, respectively. While, the residuals e_t are assume to be normally distributed, serially uncorrelated, and white noise.

3.2 Unit root analyses

This study employs two conventional and two structural breaks unit root tests, namely Augmented Dickey-Fuller (ADF), Kwaitkowski-Phillips-Schmidt-Shin (KPSS), Zivot-Andrews (ZA) and Lumsdaine-Papell (LP) tests. Perron (1989) and Zivot and Andrews (1992) documented that the conventional unit root tests tend to not reject the null hypothesis of a unit root when the series confronted with structural break(s). Therefore, the use of conventional unit root tests tends to yield non-reliable results. To circumvent this problem, this study employs ZA one structural break unit root test to re-affirm the order of integration for each series under consideration. As the conventional ADF and KPSS unit root tests are well described in the existing literatures, the unit root tests discussion will only focus on ZA and LP unit root test. The advantage of ZA and LP unit root tests are that they do not require pre-specified the breakpoint and thus the potential breakpoint will be determined endogenously. Zivot and Andrews (1992) suggested three potential structural break models for economic series. Model A allows for a change in the intercept of the series, Model B allows for a change in the slope of the trend and finally Model C allows for changes in both the intercept and the slope of the trend of the series. The ZA unit root test can be examined by estimating all the following three models:

$$\text{Model A: } \Delta y_t = \alpha + \theta t + \delta_1 DU1_t + \beta y_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta y_{t-i} + \varepsilon_{1t} \quad (2)$$

$$\text{Model C: } \Delta y_t = \alpha + \theta t + \delta_1 DU1_t + \delta_2 DT1_t + \beta y_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta y_{t-i} + \varepsilon_{3t} \quad (3)$$

where Δ is the first difference operator, $\Delta y_t = (y_t - y_{t-1})$ and $y_t = [\ln VA_t, \ln Y_t, \ln REER_t]'$. The residuals (ε_{it}) are assumed to be spherically distributed and white noise. As in the conventional ADF unit root test, we incorporate the Δy_{t-i} variables into the testing equations (2) and (3) to remove the autocorrelation problem between the error terms. The dummy variables are defined as: $DU1_t = 1$ and $DT1_t = t - TB1$ if $t > TB1$ and 0 otherwise. $TB1$ is within $1 < TB1 < T$, where T is the sample size, $TB1$ denotes the time at which the structural break occurs. The optimal lag length (*k*) is determined by Akaike's Information Criterion (AIC) and the potential breakpoint is chosen where the ADF *t*-statistics is maximised in absolute term.

However, ZA unit root test will be rendered low power when the series contain more than one structural break. In order to overcome this problem, we perform the LP unit root test for two structural breaks. Similarly, this study also uses Model AA and Model CC to confirm the order of integration for each series. The testing model for LP unit root test with two breaks can be written as follows:

$$\text{Model AA: } \Delta y_t = \alpha + \theta t + \delta_1 DU1_t + \psi_1 DU2_t + \beta y_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta y_{t-i} + \varepsilon_{1t} \quad (4)$$

$$\text{Model CC: } \Delta y_t = \alpha + \theta t + \delta_1 DU1_t + \delta_2 DT1_t + \psi_1 DU2_t + \psi_2 DT2_t + \beta y_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta y_{t-i} + \varepsilon_{3t} \quad (5)$$

Here, $DU1_t = 1$ and $DT1_t = t - TB1$ if $t > TB1$ and 0 otherwise. Then $DU2_t = 1$ and $DT2_t = t - TB2$ if $t > TB2$ and 0 otherwise. $TB1$ and $TB2$ are the first and second breakpoints, respectively, where $TB2 > TB1 + 2$. Similarly, the optimal lag length (*k*) is determined by Bayesian Information Criterion (BIC) and the potential breakpoint is chosen where the ADF *t*-statistics is maximised in absolute term. Eventually, both ZA and LP unit root tests for one and two breaks are computed by the RATS programming codes.

3.3 Cointegration analyses

We begin by testing the presence of cointegration between tourist arrivals, real output, and real effective exchange rate with the multivariate Johansen and Juselius (1990) test. The Johansen's cointegration test can be implemented by estimating the following vector error-correction model (VECM):

$$\Delta W_t = \Phi H_t + \Pi W_{t-1} + \Gamma_1 \Delta W_{t-1} + \cdots + \Gamma_{k-1} \Delta W_{t-k+1} + \mu_t \qquad (6)$$

Here, Δ is the first difference operator, $(W_t - W_{t-1})$. W_t is a vector of three endogenous variables of interest $[\ln VA_t,\ \ln Y_t,\ \ln REER_t]'$. H_t is a vector of constant and deterministic trend, and Φ is a matrix of unknown parameters for the deterministic vector H_t. The residuals μ_t are assumed to be normally distributed and white noise and *k* is the lag length in the VECM system. $\Gamma_i = -(\mathrm{I} - \mathrm{A}_1 - \mathrm{A}_2 - \cdots - \mathrm{A}_i)$ $(i = 1, 2, \ldots, k-1)$ and $\Pi = -(\mathrm{I} - \mathrm{A}_1 - \mathrm{A}_2 - \cdots - \mathrm{A}_k)$. The (3×3) Π matrix contains information of the long-run equilibrium relationships between the variables under consideration. In addition to that, we can decompose $\Pi = \alpha\beta'$, where α denotes the speed of adjustment to disequilibrium, while β is the cointegrating vector. If Π is a non-zero matrix, there will be *r* cointegrating vector that form a linear combination of the W_t that are stationary.

In addition to the standard Johansen's cointegration test, we also employ the residuals-based cointegration test with one structural break developed by Gregory and Hansen (1996). To test the presence of cointegrating relation between the variables, they proposed to estimate the following models by Ordinary Least Squares (OLS). Gregory and Hansen (1996) noted that structural change can take several forms of which Model 2 (C) allows for structural break in the intercept only, Model 3 (C/T) allows for structural break in the intercept with trend variable and finally Model 4 (C/S) is a regime shift model that is allows for structural break in both intercept and also slope of the cointegrating vector.

Model 2 (C) :

$$\ln VA_t = \kappa + \kappa_1 D_t + \beta_1 \ln Y_t + \beta_2 \ln REER_t + \varepsilon_{1t} \qquad (7)$$

Model 3 (C/T) :

$$\ln VA_t = \kappa + \kappa_1 D_t + \theta t + \beta_1 \ln Y_t + \beta_2 \ln REER_t + \varepsilon_{2t} \qquad (8)$$

Model 4 (C/S) :

$$\ln VA_t = \kappa + \kappa_1 D_t + \theta t + \beta_1 \ln Y_t + \beta_2 \ln REER_t + \varphi_1 \ln Y_t D_t + \varphi_2 \ln REER_t D_t + \varepsilon_{3t} \qquad (9)$$

Here, the parameters κ, β_1 and β_2 in Model 2, 3 and 4 are the cointegrating coefficients before the structural break exists, while κ_1 denotes the change in the intercept, φ_1 and φ_2 denotes the change in the slope of the cointegrating vector. The dummy variables for Gregory-Hansen cointegration test can be defined as: $D_t = 1$ if $t > TB$ and 0 otherwise. TB is within $1 < TB < T$, where *T* is the sample size, TB is the time at which the structural break occurs. The residuals $\left(\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}\right)$ are assumed to be spherically distributed and white noise. To investigate for cointegration between $\ln VA_t$, $\ln Y_t$ and $\ln REER_t$ with structural break, Gregory and Hansen (1996) suggested the following tests:

$$ADF^* = \inf_{\tau \in T} ADF(\tau)$$
$$Z_t^* = \inf_{\tau \in T} Z_t(\tau)$$
$$Z_\alpha^* = \inf_{\tau \in T} Z_\alpha(\tau)$$

Similar to the ZA unit root test, the potential break point is unknown priori, therefore a search within an interval $\left(0.15T \le \tau \le 0.85T\right)$, where T is the number of observations will be conducted. Eventually, the potential breakpoint is chosen where the ADF^*, Z_t^* and Z_α^* are maximised in absolute term.

3.4 Granger causality analysis

At this stage, we construct the multivariate Granger causality test to examine the direction of causality between tourist arrivals, real output, and real effective exchange rate in Malaysia. In the event that the variables are cointegrated, the Granger causality test will be performed using the following VECM:

$$\begin{bmatrix} \Delta \ln VA_t \\ \Delta \ln Y_t \\ \Delta \ln REER_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} + \begin{bmatrix} A_{11,1} & A_{12,1} & A_{13,1} \\ A_{21,1} & A_{22,1} & A_{23,1} \\ A_{31,1} & A_{32,1} & A_{33,1} \end{bmatrix} \times \begin{bmatrix} \Delta \ln VA_{t-1} \\ \Delta \ln Y_{t-1} \\ \Delta \ln REER_{t-1} \end{bmatrix} + \cdots + \begin{bmatrix} A_{11,k} & A_{12,k} & A_{13,k} \\ A_{21,k} & A_{22,k} & A_{23,k} \\ A_{31,k} & A_{32,k} & A_{33,k} \end{bmatrix} \times$$

$$\begin{bmatrix} \Delta \ln VA_{t-k} \\ \Delta \ln Y_{t-k} \\ \Delta \ln REER_{t-k} \end{bmatrix} + \begin{bmatrix} \phi_1 \\ \phi_2 \\ \phi_3 \end{bmatrix} \times \left[ECT_{t-1}\right] + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix} \qquad (10)$$

Here, Δ is the first difference operator and *k* is the optimal lag length for the VECM system determine by the Bayesian Information Criterion (BIC). ECT_{t-1} is the one period error-correction term derived from the long-run cointegration equation. However, the one period error-correction term will be excluded from the system if the variables are not cointegrated. The residuals $\left[e_{1t}, e_{2t}, e_{3t}\right]$ are serially uncorrected with zero mean and finite covariance matrix. If the variables are cointegrated, the VECM frameworks offer three sources of causation – (a) short-run causality, (b) long-run causality, and (c) strong (overall) causality. This is the uniqueness of testing for Granger causality within the VECM frameworks. To examine the short-run Granger causality, we use the joint χ^2- statistics on the first difference lagged explanatory variables. From equation (10), $A_{12,k} \ne 0 \forall_k$ and $A_{13,k} \ne 0 \forall_k$ implies Granger causality running from real output and real effective exchange rate to tourism; while $A_{21,k} \ne 0 \forall_k$ and $A_{23,k} \ne 0 \forall_k$ meaning that tourism and real effective exchange rate Granger-cause real output. On the other hand, the long-run causality is indicates by the *t*-significance of the one period lagged error-correction term, ECT_{t-1}. Ultimately, the strong causality can be tested by using the joint χ^2- statistics on both the first difference explanatory variables and the one period lagged error-correction term. For example, $\phi_1 = 0$ and $A_{12,k} \neq 0 \forall_k$ implies strong Granger causality from real output to tourism, while $\phi_2 = 0$ and $A_{21,k} \neq 0 \forall_k$ indicating strong Granger causality from tourism to real output.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Unit root tests results

According to the time series econometric literatures, the regression results may be spurious if the estimated variables are non-stationary (see for example, Granger and Newbold, 1974; Phillips, 1986).

Table 2: The results of unit root tests with structural break(s)

Panel A: Zivot and Andrews test for unit roots with one structural break						
	Output		Tourist arrivals		Effective exchange rate	
	Model A	Model C	Model A	Model C	Model A	Model C
TB1	2007:05	2005:02	1995:06	1999:04	1997:07	1997:07
$t\left(\hat{\lambda}_{\inf}\right)$	–4.602	–4.904	–4.730	–5.717***	–5.985***	–5.960***
Lag length	12	12	2	2	1	1
Critical values						
1%	–5.34	–5.57				
5%	–4.80	–5.08				

Panel B: Lumsdaine and Papell test for unit roots with two structural breaks						
	Output		Tourist arrivals		Effective exchange rate	
	Model AA	Model CC	Model AA	Model CC	Model AA	Model CC
TB1	1995:04	1994:03	1996:06	1997:08	1997:07	1997:07
TB2	2007:05	2005:02	1999:04	2001:08	2003:04	2003:08
$t\left(\hat{\lambda}_{\inf}\right)$	–4.749	–5.658	–5.721	–6.870**	–7.697***	–7.729***
Lag length	12	12	2	2	1	1
Critical values						
1%	–6.94	–7.34				
5%	–6.24	–6.82				

Note: The asterisks * and ** denote significance level at 1 and 5 per cent level, respectively. RATS programming codes are used to compute the above unit root tests and the Bayesian Information Criterion (BIC) is used to select the optimal lag length.

Thus, it is interesting to examine the order of integration for each variable to avoid spurious regression phenomenon. As documented in the previous section, this study will employ three unit root tests to affirm the order of integration for each series. First, we begin with the discussion of conventional ADF and KPSS unit root tests results.[1] At level, the ADF test statistics failed to reject the null hypothesis of a unit root at the 10 per cent level for all series under investigation $\left[\ln Y_t, \ln VA_t, \ln REER_t\right]$, while at the first difference all series are stationary at the 5 per cent significance level. Coherently, the KPSS null stationary unit root test results also suggest that tourist arrivals $\left(\ln VA_t\right)$, real output $\left(\ln Y_t\right)$, and real effective exchange rate $\left(\ln REER_t\right)$ for Malaysia are stationary at the first difference form. Nevertheless, it is well documented that in the presence of structural break(s) the conventional unit root tests may be low power in determining the order of integration.

Next, we begin to perform the ZA unit root test with one structural break. The ZA results are reported in Panel A of Table 2. The ZA unit root test statistics for tourist arrivals and real effective exchange rate reject the null hypothesis of a unit root at the 1 per cent significance level, while the ZA statistic for real output cannot reject the null hypothesis of a unit root. Thus, the ZA results indicate that at the 1 per cent significance level, tourist arrivals and real effective exchange rate are *I*(0), while real output is *I*(1) process.. Nevertheless, this study also perform the LP unit root test for two structural break to affirm the order of integration because ZA test may be inappropriate when the estimated variables confronted with more than one structural breaks. The results of LP unit root test are reported in Panel B of Table 2. Deviated from the ZA one break unit root test, the LP statistics for real output and tourist arrivals cannot reject the null hypothesis of a unit root at the 1 per cent level, while LP test also suggest that real effective exchange rate is stationary at level. The LP test suggests that real output and tourist arrivals are integrated of order one, while real effective exchange rate remain stationary at level. As a result, we conclude that the order of integration for the variables under investigation is either *I*(0) or *I*(1) process. This finding is contradicted with the conventional wisdom that most of the macroeconomic series are non-stationary at level, but they are stationary only after taken first differencing (Nelson and Plosser, 1982).

4.2 Cointegration analyses results

Although the order of integration for the variables under integration is mixed, testing for cointegration is necessary and valid. In practical application, Harris (1995) narrated that it is quite common to test for the presence of cointegration even when the unit root tests suggest that the order of integration of the variables are unbalanced because unit root tests are often suffer from size distortion and statistical power problems. Technically, Enders (1994) noted that the Johansen's cointegration test can be used to handle variables with difference order of integration. Moreover, Cheung and Hung (1998) also narrated that Johansen's cointegration test is nothing more than a multivariate generalisation of the ADF unit root tests. Hence, as long as the variables are cointegrated, the order of integration for individual variables is less worry (see also Muscatelli and Hurn, 1992; Tang, 2010).

To test for the presence of cointegration, we begin by employing the multivariate cointegration test developed by Johansen and Juselius (1990). To implement the Johansen's cointegration test, we have to decide the optimal lag order and also the deterministic term (i.e., constant and trend) in the VECM system because the Johansen's cointegration results are very sensitive to these two factors (Abeysinghe and Tan, 1999). For optimal lag order, we first set the maximum lag order at 15 months based on the formula suggested by Schwert

[1] To conserve space, the conventional ADF and KPSS unit root tests results are not reported here, but it is available upon request.

(1989) - $\ell_{12} = \text{int}\left\{12\left(T/100\right)^{0.25}\right\}$, where int is the integer and T is the sample size. Then, we use the system-wise BIC statistic to choose an optimal lag order. The BIC statistics suggest that lag one is the best. With this evidence, we perform the Johansen's cointegration test with lag one for Model 2, 3 and 4. These cointegration results are tabulated in Panel A of Table 3. Ironically, the decision regarding the deterministic components is the VECM system is not easy to determine in advance and it is also cannot be determined arbitrarily. Thus, this study adopts the modified Pantula's principle suggested by Hjlem and Johansson (2005) to choose one of the three models for cointegration test.[2] Among three models, the modified Pantula's principle suggests that Model 2 is the most appropriate model. In addition, both likelihood ratio (LR) statistics in this model (i.e. trace and maximum eigenvalues) reject the null hypothesis of no cointegration at the 5 per cent level. Nevertheless, the LR statistics fail to reject the null hypothesis of one cointegration rank. Therefore, we surmise that tourist arrivals, real output, and real effective exchange rate in Malaysia are cointegrated with one cointegrating rank.

Table 3: The results of cointegration tests

Panel A: Johansen cointegration test				
Hypothesis		Likelihood Ratio (LR) test		
H_0	H_1	Model 2	Model 3	Model 4
$LR(\lambda_{\text{trace}})$				
$r=0$	$r \geq 1$	36.926**	35.196**	49.487***
$r=1$	$r \leq 2$	14.395	12.881	19.640
$r=2$	$r \leq 3$	3.258	1.884	5.682
$LR(\lambda_{\max})$				
$r=0$	$r=1$	22.531**	22.314**	29.847**
$r \leq 1$	$r=2$	11.136	10.997	13.958
$r \leq 2$	$r=3$	3.258	1.884	5.682

Panel B: Gregory and Hansen (1996) test for cointegration with structural break						
Model	ADF^*	Break	Z_t^*	Break	Z_α^*	Break
2 (C)	–4.676 (1)	Feb-03	–7.271 ***	Nov-06	–80.345***	Oct-06
3 (C/T)	–5.219 (2)*	Sep-95	–9.246***	May-95	–122.328***	May-95
4 (C/S)	–5.501 (1)**	Nov-97	–8.387***	Apr-98	–102.438***	Apr-98

Note: The asterisks ***, ** and * denote the significance at 1, 5, and 10 per cent levels, respectively. The optimal lag order for the Gregory and Hansen test for cointegration is determined by Bayesian Information Criterion (BIC). The GAUSS software has been used to compute the Gregory and Hansen cointegration test.

[2] See Hjelm and Johansson (2005) and Tang (2009a) for more details discussion of the modified Pantula principle.

However, the Johansen-Juselius cointegration test is not subject to parameters instability. In order to test for parameter stability, we employ the parameter non-constancy test developed by Hansen (1992). The results of Hansen's test for parameters stability are reported in Table 4.

Table 4: Hansen (1992) test for parameters stability

	Lc	*MeanF*	*SupF*
Test statistics	2.150***	17.502***	26.075***
p-values	0.0100	0.0100	0.0100

Note: The asterisk *** denote the significance at the 1 per cent level. The GAUSS programme was used to compute the Hansen (1992) instability test.

Remarkably, three tests - Lc, $MeanF$ and $SupF$ consistently reject the null hypothesis of parameters stability at the 1 per cent level. Hence, the verdict is in favour of parameter instability of the cointegrating vector and the Johansen cointegration results (i.e., see Panel A of Table 3) may be problematic. As a sensitivity check, this study also applied the Gregory and Hansen (1996) cointegration test with one structural break in the cointegration vector. The results for Gregory-Hansen cointegration test are reported in Panel B of Table 3. As mentioned in the earlier section, there are three models – C, C/T and C/S for Gregory-Hansen cointegration tests. In Model C, at the 10 per cent level, the ADF-type result indicates that the variables are not cointegrated. Nevertheless, the PP-type cointegration results show by Z_t^* and Z_α^* jointly indicate that tourist arrivals, real output and real effective exchange rate in Malaysia are cointegrated at the 1 per cent significance level.[3] On the other hand, in both Models C/T and C/S, at the 10 per cent significance level, all of the test statistics – ADF, Z_t^* and Z_α^* are jointly reject the null hypothesis of no cointegrating relationship. This implies that the variables are moving together in the long-run and confirmed the cointegration results are valid and reliable as both cointegration tests suggested the same conclusion.[4] These cointegration results are consistent with the finding of Evan et al. (2008), and Tang (2011).

4.3 Granger causality results

The finding of cointegration implying that there must be at least one direction of causality between tourist arrivals, real output, and real effective exchange rate (Granger, 1988). Nonetheless, it does not indicate the direction of causality. Thus, to shed light on the direction of causality, we conduct the Granger causality test with the VECM system instead of vector autoregressive (VAR) system because the variables are cointegrated.

[3] Hallam and Zanoli (1993) and Obben (1998) noted that when there is inconsistency between the ADF-type and PP-type results, the conclusion from the PP-type test is preferred because the PP-type test is usually more powerful than the ADF-type test.

[4] To check for the robustness of the cointegration results, we also perform the bounds testing approach for cointegration introduced by Pesaran et al. (2001). Evidently, the computed F-statistics for cointegration is 9.450, thus it is greater than the 1 per cent upper bounds critical value tabulated in Pesaran et al. (2001). This result is corroborated to the cointegration results reported in Table 3. Therefore, we could surmise that the evidence of cointegration is valid and robust. To save space, the full results are not report in the main text, but it is available upon request.

Table 5: The results of temporal Granger causality test within the VECM

Dependent variable	Sources of causality						
	Short-run causality			Long-run causality	Strong (overall) causality		
	$\Delta \ln VA_t$	$\Delta \ln Y_t$	$\Delta \ln REER_t$	ECT_{t-1}	$\Delta \ln VA_t, ECT_{t-1}$	$\Delta \ln Y_t, ECT_{t-1}$	$\Delta \ln REER_t, ECT_{t-1}$
	χ^2 - statistics			t-statistics	χ^2 - statistics		
$\Delta \ln VA_t$	–	31.926***	49.410***	–2.763***	–	41.847***	59.243***
$\Delta \ln Y_t$	10.294***	–	4.539	–2.522**	18.019***	–	10.494**
$\Delta \ln REER_t$	35.705***	5.501	–	–2.933***	42.732***	15.638***	–

Note: The asterisks ***, ** and * denote the significance at the 1, 5 and 10 per cent levels, respectively.

Table 5 reports the results of short-run, long-run, and strong Granger causality, respectively. We begin our analysis with the short-run causality results. It can be seen that real output and real effective exchange rate are statistically significant at the 1 per cent level in the tourist arrivals equation. Moreover, tourist arrivals also statistically significant at the 1 per cent level in both real output and real effective exchange rate equations. Ironically, either real effective exchange rate or real output is statistically insignificant at the 10 per cent level. These results imply that in the short-run tourism-output and tourism-exchange rate are bilateral causality, but output-exchange rate is neutral causality. Turning to the t-statistics of the coefficients for one period lagged error-correction term, it can be seen that the coefficients are negative sign and statistically significant at the 5 per cent level in all equations. These suggest that the variables are not overshooting and hence the long-run equilibrium is attainable (Kremers, et al. 1992). In addition, the results also implied that tourist arrivals, real output and real effective exchange rate in Malaysia Granger-cause each other (i.e., bilateral causality) in the long-run. These evidence are highly consistent with the results provided in the strong Granger causality column (Table 5) where the χ^2 - statistics reject the null hypothesis of non-Granger causality in all equations at the 5 per cent level.

To this end, our Granger causality analysis has been restricted to full sample analysis by implicitly assumed that the causal relationship is stable over the sample period. Relate to the interesting issue pointed out by Tang (2008, 2010), the causal relationship between variables might not be stable owing to the frequent changes of global economics and political environments (see also Granger, 1996). With this regards, the Granger causality test using full sample period may not capture such changes. Hence, the test may not be an appropriate or accurate measure for the validity of either tourism-led growth or growth-led tourism for Malaysia since it is possible that the causal relationship exists in certain periods but does not exist in other periods. To circumvent this problem, we extend our study to sub-sample causality analysis by incorporating the rolling regression procedure into the Granger causality test. To apply the rolling regression, we have to pre-determine the size of rolling window. As far as we known, there is no formal statistical procedure to determine an optimal window size. In earlier work, the setting of the window size seemed to be arbitrary (Thoma, 1994; Ibrahim and Aziz, 2003). In this study, we set the rolling window size as 100, 120 and 150 observations because the Monte Carlo results provided by Mamingi (1996) suggest that the frequency of Granger causality distortion is very low (i.e., 0.2 per cent) if the sample size of 100 or more is used.[5] For interpretation, the computed χ^2 - statistic will be normalised by the 10 per cent critical value, hence if the normalised χ^2 - statistic is above unity, then the null hypothesis of non-Granger causality can be rejected. In other words, if the tourism-led growth or growth-led tourism is valid, then a large number of normalised χ^2 - statistics that greater than unity will be observed when the sample rolls forward. The plots of rolling Granger causality test statistics for $H_0 : \Delta \ln Y_t, ECT_{t-1} \nrightarrow \Delta \ln VA_t$ and $H_0 : \Delta \ln VA_t, ECT_{t-1} \nrightarrow \Delta \ln Y_t$ are reported in Figure 1 and 2, respectively.[6]

For the sake of brevity, the plots in Figure 1 show that the normalised χ^2 - statistics for growth-led tourism hypothesis tend to be greater than unity irrespective of which rolling

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[5] Note that Aaltonen and Östermark (1997) and Swanson (1998) also used the rolling window size of more than 100 observations.

[6] Thus far, we have differentiated between the short- and long-run causality. However, the Granger causality results in Table 5 show that the short- and long-run causality appeared to be in conflict. There is no reason why the decision of both short- and long-run causalities must be consistent because the tests are looking in direction source of causation. Therefore, the rolling Granger causality test on strong causality is preferred to avoid the conflicting problem.

window size is applied. Therefore, the growth-led tourism hypothesis is vindicate and stable over time for the Malaysian economy, although there is evidence of minor instability during the 1997-1998 due to the Asian currency turmoil and also the capital control regime.

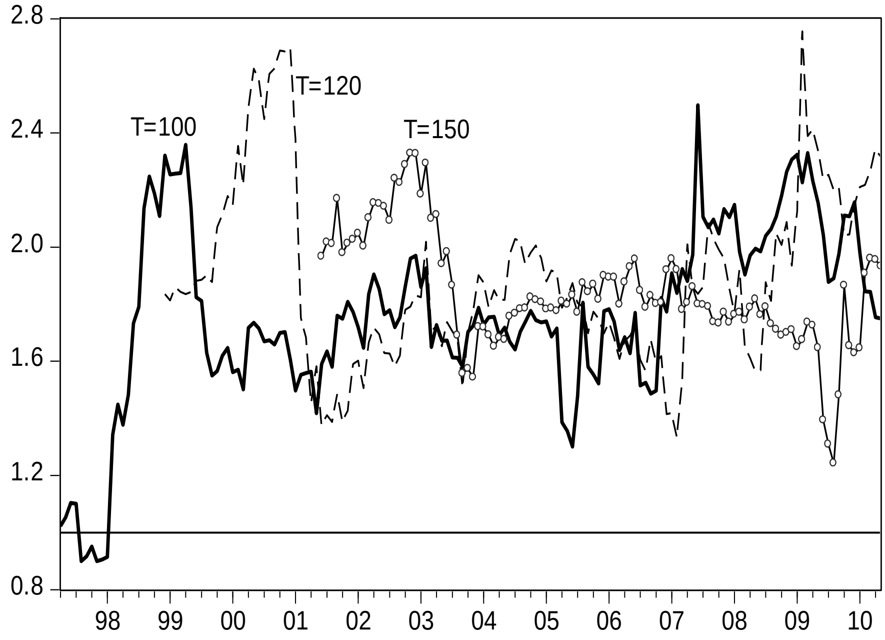

Figure 1: *The plots of normalised* χ^2 *- statistics for "growth-led tourism"*

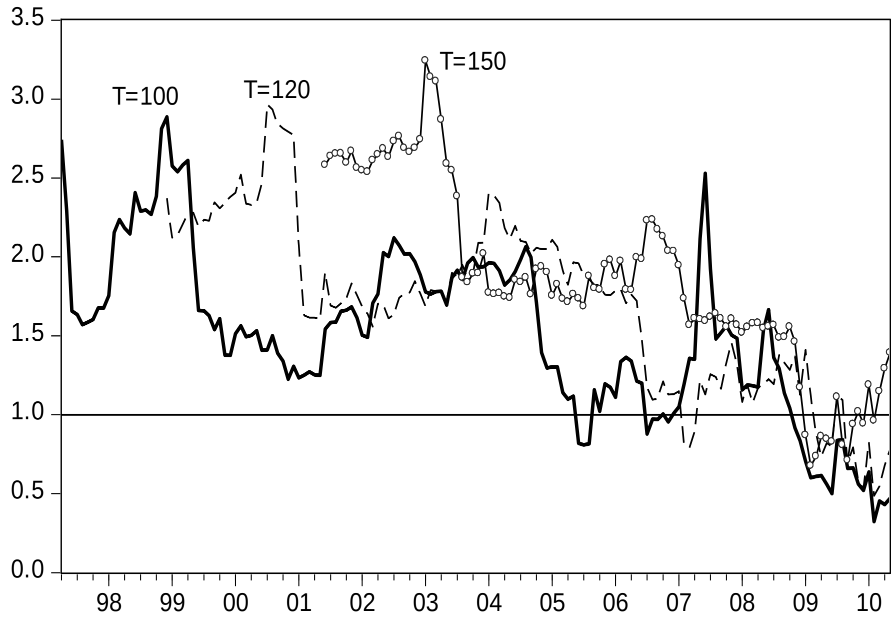

Figure 2: *The plots of normalised* χ^2 *- statistics for "tourism-led growth"*

On the other hand, the visual inspection of the plots in Figure 2 illustrate that the normalised χ^2- statistics for tourism-led growth hypothesis also exceed unity and stable, but this only happen before 2005. Then, the normalised χ^2- statistics decrease gradually and show some evidences of instabilities, for example mid-2005, mid-2006, mid-2007, and late-2008 to 2010. These instabilities may due to several events such as (a) change of exchange rate regime from fixed to managed float for Ringgit exchange rate on July 2005, (b) public insecurity represented by the high crime rates in 2006 (Tang, 2009b), and also the Global financial crisis from mid-2007 to 2010. Therefore, we surmise that tourism-led growth hypothesis is valid in Malaysia (Table 5), but it is unstable in particular after year 2005 owing to a series of socio-economic shocks.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The concern of this study is to empirically investigate the dynamic relationship between tourist arrivals, real output, and real effective exchange rate for Malaysia using the cointegration and Granger causality frameworks. This study covers the monthly data from January 1989 to May 2010. In order to yield reliable and robust empirical results, a thorough investigation has been conducted in this study. With these investigations, some remarkable findings that link to important policies implications have been obtained. We employ the Johansen's cointegration test and also the residuals-based test for cointegration with a regime shift to determine the presence of cointegrating relationship. The cointegration results demonstrate that tourist arrivals, real output, and real effective exchange rate in Malaysia are cointegrated over the sample period.

To complement with the finding of cointegration, we also perform two Granger causality tests (i.e., full sample and rolling window) with the VECM framework to shed some light on the causal relationship between tourist arrivals, real output, and real effective exchange rate in Malaysia. The full sample Granger causality results suggest that real output and real effective exchange rate Granger-cause tourists arrivals, moreover tourist arrivals also Granger-cause real output and real effective exchange rate in the short-run. However, tourist arrivals, real output, and real effective exchange rate are bilateral causality in the long-run. Indeed, the rolling window Granger causality test results exhibit that growth-led tourism hypothesis is valid and stable over the sample period. Similarly, the tourism-led growth hypothesis is also valid for Malaysia, but it is unstable in particular after year 2005 owing to a number of instability signs. It is also important to point out here that the identified breaks suggest that the role of tourism on economic growth and development in Malaysia is vulnerable as it is very sensitive to the change of exchange rate regime, public security, and also economic crises. In order to enjoy the benefit of tourism on economic growth, policymakers should stabilise prices, exchange rate, and improve the public security levels such as reduce crime rates. By doing so, we may attract more international tourist arrivals to Malaysia and eventually the sustainable economic growth can be achieved through the development of tourism industry.

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