Temporal Granger causality and the dynamics examination on the tourism-growth nexus in Malaysia

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March 2011

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ABSTRACT

This study applied the cointegration, error-correction modelling and persistence profile to analyse the dynamic relationship between real tourism receipts, real income and real exchange rate in Malaysia. This study covers the annual sample period from 1974 to 2009. This study finds that the variables are cointegrated. In the short run, this study finds that neutrality causality between real tourism receipts and real income, while they are bi-directional Granger causality in the long run. Nevertheless, this study finds uni-directional causality running from real exchange rate to real tourism receipts and real income in both short- and long run.

Keywords: Causality; Exchange rate; Malaysia; Tourism-led growth; Persistence profile
JEL Classification Codes: C22; O11; O53

1. INTRODUCTION

Tourism is one of the prominent source for stimulating economic growth and development through its impact on foreign exchange revenues, new business and employment opportunities, and tax revenues (Elkan, 1975; Clancy, 1999; Belloumi, 2010). Tourism is the third largest industry in the world after oil and automobiles, thus many developing economies relied on tourism for sustainable economic growth (Sinclair, 1998). Malaysia has no exception too. The structure of the Malaysian economy has undergone a massive transformation from the agricultural-based economy in the early stage to the manufacturing and services sectors. From 2000 onward, the contribution of services sector to the Malaysian economy is more than 50 per cent of Gross Domestic Product (GDP), while the contribution of agricultural and manufacturing sectors are about 8 per cent and 30 per cent of GDP, respectively. Among services sector in Malaysia, tourism is the major industries.

Table 1: Tourist arrivals and tourism receipts

Years	Tourist arrivals (in person)	Tourism receipts (RM million)
1990	7,445,908	4,500
1995	7,468,749	9,175
1998	5,550,748	8,580.4
1999	7,931,149	12,321.3
2000	10,221,582	17,335.4
2001	12,775,073	24,221.5
2002	13,292,010	25,781.1
2003	10,576,915	21,291.1
2004	15,703,406	29,651.4
2005	16,431,055	31,954.1
2006	17,546,863	36,271.1
2007	20,972,822	46,070
2008	22,052,488	49,561.2
2009	23,646,191	53,367.7

Source: Malaysia Tourism Promotion Broad (MTPB)

Table 1 shows total international tourist arrivals and tourism receipts since the beginning of the 1990s. Both tourist arrivals and tourism receipts in Malaysia have generally shown an upward trend, with minor exceptions for 1998 and 2003 due to the Asian financial crisis, the capital control regime, and the outbreak of Severe Acute Respiratory Syndrome (SARS). Over 2005-2009, tourism industry in Malaysia accumulated about 217 billion ringgit of tourism receipts, which accounted for around 6.9 per cent of GDP. Tourist arrivals in Malaysia increased substantially, from 16.4 million visitors in 2005 to 23.6 million visitors in 2009. Moreover, Malaysia was ranked as the second most visited Asia countries in 2005 after China (Zain, 2005). On top of that, her world ranking increased from rank 11th in 2007 to rank 9th in 2009 with the record of 23.6 million visitors (World Tourism Organisation (UNWTO), 2010). Obviously, tourism industry in Malaysia is outstanding and this stems the need to look into the implication of tourism on economic growth in Malaysia.

The objective of this study is threefold. The first objective is to examine the presence of a long-run equilibrium relationship between real tourism receipts, real income and real exchange rates in Malaysia. The second objective is to assess the temporal Granger causality between the variables of interest. According to Deaton (1995) 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, the direction of causality between the variables of interest has important policy implication. If there is uni-directional Granger causality runs from tourism to income, encourage tourism development will stimulate economic growth. However, if there is uni-directional Granger causality runs from income to tourism or if there is neutral causality in either direction, meaning that tourism is not the source of growth for Malaysia. Third, this study also examines the dynamic interaction between variables once the variable(s) and/or the system expose to shock. Knowledge of shock is very important for policymaker interested in the formulation of effective on tourism and growth policies.

This study contributes to the existing tourism-growth literature in at least three ways. First, we use tourism receipts rather than tourist arrivals. Many studies on Malaysia and also abroad used tourist arrivals as a proxy for tourism to examine the tourism-led growth hypothesis (e.g. Lean and Tang, 2010; Tang 2011a). Nevertheless, one country may experience high rates of tourist arrivals, but low rates of tourism earning. Hence, tourist arrivals may not be a good proxy for tourism earning. This is in line with the compelling argument pointed out by Tang (2011a) that not all tourist arrivals contribute to economic growth. Some of the international arrivals are looking for business and employment opportunities. Therefore, it would be more appropriate to use tourism receipts than tourist arrivals in examine the validity of tourism-led growth hypothesis. The second contribution of this study is that apart from using the conventional unit root tests such as Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), this study also employs unit root tests with one and two structural breaks introduced by Zivot and Andrews (1992) and Lumsdaine and Papell (1997). In essence, Perron (1989) has pointed out that the conventional unit root tests may be inappropriate or less robust when the series confronted with structural breaks. Third, apart from cointegration and Granger causality tests, this study also employs the variance decomposition, impulse response function and persistence profile analyses to assess the dynamic interaction between the variables and the speed of convergence to the long-run equilibrium when the system expose to shock. Therefore, the estimation results of this study are more complete and reliable.

The balance of this study is organised as follow. The methodology of this study will be discussed in next section. Section 3 discusses the empirical results of this study. Finally, conclusion and policy recommendations will be reported in Section 4.

2. METHODLOGY

2.1 Unit root tests

In this section, we present the unit root testing procedure with one and two structural breaks. For the case of one structural break, Zivot and Andrews (1992) proposed three versions of endogenous break models to investigate the null hypothesis of a unit root. Model A allows for a break in the intercept, Model B allows for a break in the trend function and Model C allows for a break in both the intercept and the slope of the trend function. The testing models for one break unit root test can be stated as follows:

Model A: $\Delta y_t = \kappa + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + e_t$ (1)

Model B: $\Delta y_t = \kappa + \alpha y_{t-1} + \beta t + \phi_1 DT1_t + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + e_t$ (2)

Model C: $\Delta y_t = \kappa + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \phi_1 DT1_t + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + e_t$ (3)

Where, Δ is the first difference operator, *p* is the optimal lag length and the residuals e_t are assumed to be normally distributed and white noise. The right-hand-side term Δy_{t-i} in Equation (1) to (3) is to remove the serial correlation problem if any. $DU1_t$ is a dummy variable for a break in the intercept, while $DT1_t$ is a dummy variable for a break in the slope of the trend function occur at time $TB1$, where $DU1_t = 1$ and $DT1_t = t - TB1$ if $t > TB1$ and 0 otherwise. Ultimately, the potential breakpoint $(TB1)$ is chosen where the t-statistic for y_{t-1} is maximised in absolute value.

Next, Lumsdaine and Papell (1997) suggested a testing procedure for unit root with two structural breaks by extending the procedure suggested by Zivot and Andrews (1992). Hence, they also proposed three versions of endogenous breaks models to investigate the null hypothesis of a unit root. Model AA allows for two breaks in the intercept only, Model CC allows two breaks in both the intercept and the slope of the trend function and Model CA allows for one break in both the intercept and the slope of the trend function, and the second break in just the intercept. Likewise, the potential breakpoints can be ascertain by the most significant t-statistics for y_{t-1}. The testing models can be stated as follows:

Model AA: $\Delta y_t = \kappa + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \theta_2 DU2_t + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + e_t$ (4)

Model CC: $\Delta y_t = \kappa + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \theta_2 DU2_t + \phi_1 DT1_t + \phi_2 DT2_t + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + e_t$ (5)

Model CA: $\Delta y_t = \kappa + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \theta_2 DU2_t + \phi_1 DT1_t + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + e_t$ (6)

Where *p* is the optimal lag length and the residuals e_t are assumed to be normally distributed and white noise. $DU1_t$ and $DU2_t$ are dummy variables for breaks in the intercept, while $DT1_t$ and $DT2_t$ are dummy variables for breaks in the deterministic trend occur at time $TB1$ and $TB2_t$. Ultimately, $DU1_t = 1$ 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 $TB2 > TB1 + 2$.

2.2 Cointegration test

To examine the presence of a long-run equilibrium relationship between real tourism receipts, real income and real exchange rates in Malaysia, we employ the bounds testing approach for cointegration developed by Pesaran et al. (2001). The bounds testing approach for cointegration can be applied irrespective of whether the variables are purely *I*(0), purely

$I(1)$ or mutually cointegrated. On the basis of Monte Carlo experiment, Pesaran and Shin (1999) found the bounds testing approach for cointegration is more efficient in small sample which is the case in this study. To implement the bounds testing approach for cointegration, we estimate the following autoregressive distributed lag (ARDL) model.

$$\Delta \ln TR_t = a_0 + \pi_1 \ln TR_{t-1} + \pi_2 \ln Y_{t-1} + \pi_3 \ln RER_{t-1} + \sum_{j=1}^{p} a_{1j} \Delta \ln TR_{t-j} + \sum_{j=0}^{q} a_{2j} \Delta \ln Y_{t-j}$$
$$+ \sum_{j=0}^{r} a_{3j} \Delta \ln RER_{t-j} + \varepsilon_{1t} \tag{7}$$

$$\Delta \ln Y_t = b_0 + \pi_1 \ln TR_{t-1} + \pi_2 \ln Y_{t-1} + \pi_3 \ln RER_{t-1} + \sum_{j=1}^{p} b_{1j} \Delta \ln Y_{t-j} + \sum_{j=0}^{q} b_{2j} \Delta \ln TR_{t-j}$$
$$+ \sum_{j=0}^{r} b_{3j} \Delta \ln RER_{t-j} + \varepsilon_{2t} \tag{8}$$

$$\Delta \ln RER_t = c_0 + \pi_1 \ln TR_{t-1} + \pi_2 \ln Y_{t-1} + \pi_3 \ln RER_{t-1} + \sum_{j=1}^{p} c_{1j} \Delta \ln RER_{t-j} + \sum_{j=0}^{q} c_{2j} \Delta \ln TR_{t-j}$$
$$+ \sum_{j=0}^{r} c_{3j} \Delta \ln Y_{t-j} + \varepsilon_{3t} \tag{9}$$

Here ln denotes the natural logarithm and p, q and r are the optimal lag length. The residuals ε_{it} are assumed to be spherically distributed and white noise. $\ln TR_t$ is the real tourism receipts, $\ln Y_t$ is the real income, and $\ln RER_t$ is the real exchange rates. From equations (7) to (9), we can test the presence of long-run equilibrium between real tourism receipts, real income and real exchange rate in Malaysia by using the standard F-test on the absence of lagged level variables $\left[\ln TR_{t-1}, \ln Y_{t-1}, \ln RER_{t-1}\right]$. In addition, Pesaran et al. (2001) suggested two set of critical values (i.e. upper and lower bounds critical values) for cointegration. Unfortunately, the suggested critical values are inappropriate for small sample as the case for this study (T = 36). Therefore, this study uses the small sample critical values simulated by Narayan (2005). If the calculated F-statistic is greater than the upper bounds critical value, we can rejects the null hypothesis of no cointegration $\left(H_0 : \pi_1 = \pi_2 = \pi_3 = \pi_4 = 0\right)$, otherwise the variables are not cointegrated.

2.3 Temporal Granger causality test

The temporal Granger causality test was design to examine the direction of causality between variables. If we find that the variables are not cointegrated, the Granger causality test is conducts using the first difference vector autoregressive (VAR) model. Nevertheless, if we find that the variables are cointegrated, then the Granger causality must be conducted using the vector error-correction model (VECM) (Granger, 1988). The difference between VAR and VECM is the one period lagged error-correction term derived from the long-run cointegrating relationship. The VECM framework for Granger causality test can be written as follow:

$$\Delta \ln TR_t = \upsilon_1 + \sum_{i=1}^{p} \gamma_i \Delta \ln TR_{t-i} + \sum_{i=1}^{q} \vartheta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{r} \varpi_i \Delta \ln RER_{t-i} + \psi_1 ECT_{t-1} + \xi_{1t} \tag{10}$$

$$\Delta \ln Y_t = \upsilon_2 + \sum_{i=1}^{p} \vartheta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{q} \gamma_i \Delta \ln TR_{t-i} + \sum_{i=1}^{r} \varpi_i \Delta \ln RER_{t-i} + \psi_2 ECT_{t-1} + \xi_{2t} \tag{11}$$

$$\Delta \ln RER_t = \upsilon_3 + \sum_{i=1}^{p} \varpi_i \Delta \ln RER_{t-i} + \sum_{i=1}^{q} \gamma_i \Delta \ln TR_{t-i} + \sum_{i=1}^{r} \vartheta_i \Delta \ln Y_{t-i} + \psi_3 ECT_{t-1} + \xi_{3t} \tag{12}$$

Where ECT_{t-1} is the one period lagged error-correction term. The residuals ξ_{it} are assumed to be normally distributed and white noise. p, q and r are the optimal lag length. If the variables are cointegrated, there is short- and long-run causation through the first difference lagged explanatory variables and the one period lagged error-correction term, respectively. In Equation (10), to test $\Delta \ln Y_t$ does not Granger-causes $\Delta \ln TR_t$ in the short run, we examine the significance of the $\Delta \ln Y_{t-i}$ by testing the null $H_0 : \vartheta_1 = \vartheta_2 = \cdots = \vartheta_i = 0$ using the likelihood ratio (LR) test. While to test $\Delta \ln Y_t$ does not Granger-causes $\Delta \ln TR_t$ in the long run, we examine the significance of $\Delta \ln Y_{t-i}$ and ECT_{t-1} by testing the null $H_0 : \vartheta_1 = \vartheta_2 = \cdots = \vartheta_i = 0$ and $\psi_1 = 0$ using LR test. Rejection of the null hypothesis implies that economic growth Granger-causes tourism receipts. Likewise, in Equation (11), to test tourism receipts does not Granger-causes economic growth in the short run, we applied a joint LR test on the null $H_0 : \gamma_1 = \gamma_2 = \cdots = \gamma_i = 0$. However, the long-run Granger causality from tourism receipts to economic growth can be tested by using a joint LR test on the null $H_0 : \gamma_1 = \gamma_2 = \cdots = \gamma_i = 0$ and $\psi_2 = 0$. Also, rejection of the null hypothesis indicates that tourism Granger-cause economic growth. Clearly, the similar procedure can be applied to examine the short- and long-run causal effect of other variables in the system such as the causal effect of real exchange rates on real tourism receipts and economic growth or on the other way around.

3. EMPIRICAL RESULTS

3.1 Data and unit root results

The three variables used in this study namely real tourism receipts, real GDP, and real effective exchange rates for Malaysia are collected from the *International Financial Statistics* (IFS) published by the International Monetary Fund (IMF), the *World Development Indicators* (WDI) reported by World Bank, and CEIC database. This study covers the annual sample from 1974 to 2009 based on data availability. According to Granger and Newbold (1974), regression results with non-stationarity and/or non-cointegrated variables are spurious. It is also true that the bounds testing approach for cointegration can be applied even when the variables are belong to $I(0)$ or $I(1)$ process. Ironically, this cointegration approach cannot be applied if the variables are integrated of an order higher than $I(1)$ process. Therefore, pre-testing of unit root is requires to ensure that none of a variable is integrated of order two, $I(2)$. To determine the order of integration, we first apply the ADF and PP unit root tests. Both ADF and PP unit root tests indicate that real tourism receipts is stationary at level, while real income and real exchange rates in Malaysia are stationary after first differencing.[1]

[1] To conserve space, the results of ADF and PP unit root tests will not display here, but it is available upon request.

Table 2: The results of unit root tests

	Unit root tests with structural break(s)					
	Zivot and Andrews (1992)			Lumsdaine and Papell (1997)		
	$\ln TR_t$	$\ln Y_t$	$\ln RER_t$	$\ln TR_t$	$\ln Y_t$	$\ln RER_t$
Model	C	A	C	CA	CC	CA
*TB*1	1994	1993	1997	1994	1986	1993
*TB*2				2004	1998	1997
*DU*1	0.195**	0.095**	0.239***	0.367***	–0.103***	–0.068**
*DT*1	–0.017*	–	–0.024***	–0.046***	–0.026***	–0.035***
*DU*2	–	–	–	0.329***	–0.197***	0.385***
*DT*2	–	–	–	–	0.038***	–
Test statistics	–5.13	–4.06	–5.70	–6.57	–5.54	–8.71
Lag length	3	1	0	3	3	0
Exact critical values						
1 per cent	–8.5663	–6.8389	–7.7904	–8.4780	–8.2408	–8.8746
5 per cent	–7.5511	–6.1571	–6.6382	–7.6673	–7.2448	–6.7682
10 per cent	–7.2620	–5.7050	–6.2014	–7.1848	–6.9680	–5.9909

Note: The asterisk ***, ** and * denote significant at the 1, 5 and 10 per cent level, respectively. The exact critical values are simulated with 1000 replications with the procedure explained in Zivot and Andrews (1992). The model specifications for unit root tests are selected based on the significant dummy variable(s) which is in line with the procedure suggested by Chang and Nieh (2004).

As noted in the earlier section, both ADF and PP unit root tests are low power when the series confronted with structural break(s). To circumvent this problem, we perform the Zivot-Andrews one break unit root test and the Lumsdaine-Papell two breaks unit root test. Given the sample size of this study is relatively small (36 observations), the distribution of the test statistics can deviate substantially from the asymptotic distribution (Zivot and Andrews, 1992). Therefore, the available asymptotic critical values are inappropriate for small sample. To overcome this size distortion problem, we calculate the "exact" critical values with the bootstrapping procedure suggested by Zivot and Andrews (1992). The results for Zivot-Andrews, Lumsdaine-Papell and the exact critical values for the two unit root tests are reported in Table 2. Contrary to the ADF and PP results, the test statistics for Zivot-Andrews and also Lumsdaine-Papell are less than the 1 per cent exact critical values. Thus, both tests cannot reject the null hypothesis of a unit root. These results indicate that the three variables are not integrated of an order higher than $I(1)$.

3.2 Cointegration and Granger causality results

After determined the stationarity properties for each series, the next stage is to examine the presence of a long-run equilibrium between real tourism receipts, real income and real exchange rates in Malaysia using the bounds testing approach for cointegration. Table 3 shows the calculated F-statistics for cointegration. For the equation in which real tourism receipts is modelled with real income and real exchange rate – $F_{TR}\left(TR \mid Y, RER\right)$, the calculated F-statistic is greater than the 1 per cent upper bounds critical values available in Narayan (2005).

Table 3: The results of bounds testing for cointegration

Critical values bounds of the F-statistics						
	90 per cent level		95 per cent level		99 per cent level	
k	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$
2	3.393	4.410	4.183	5.333	6.140	7.609
Calculated F-statistics						
$F_{TR}\left(TR \mid Y, RER\right)$		9.025***				
$F_{Y}\left(Y \mid TR, RER\right)$		2.415				
$F_{RER}\left(RER \mid TR, Y\right)$		2.052				

Note: The asterisk *** denotes significant at the 1 per cent level. The critical values bounds for the F-statistics are obtained from Narayan (2005). k is the number is explanatory variables. The optimal lag length is determined by the Akaike's Information Criterion (AIC).

Nevertheless, when income or exchange rate is the dependent variable, the calculated F-statistic for cointegration is less than the upper bounds critical values. As a conclusion, the bounds testing approach for cointegration suggest that there is one cointegrating relationship among the three variables.

Table 4: The results of long run coefficients

Explanatory variables	Coefficients	Standard error	t-statistics
Pesaran and Shin (1999) – Autoregressive Distributed Lag (ARDL):			
Constant	–9.4392***	2.2653	–4.1668
$\ln Y_t$	1.4055***	0.2217	6.3400
$\ln RER_t$	1.1403**	0.5465	2.0866
Stock and Watson (1993) – Dynamic Ordinary Least Squares (DOLS):			
Constant	–9.0312***	1.6813	–5.3716
$\ln Y_t$	1.3617***	0.1676	8.1261
$\ln RER_t$	1.2590***	0.4152	3.0323
Phillips and Hansen (1990) – Fully Modified Ordinary Least Squares (FMOLS):			
Constant	–11.1770***	1.3664	–8.1801
$\ln Y_t$	1.5650***	0.1372	11.4055
$\ln RER_t$	0.7619**	0.3621	2.1044

Note: The asterisk *** and ** denotes significant at the 1 and 5 per cent levels, respectively.

Given that the variables are cointegrated when real tourism receipts is the dependent variable, we estimate the long-run elasticities using three different long-run estimator, namely the ARDL procedure suggested by Pesaran and Shin (1999), the Dynamic Ordinary Least

Squares (DOLS) suggested by Stock and Watson (1993), and the Fully Modified Ordinary Least Squares (FMOLS) proposed by Phillips and Hansen (1990). The use of more than one long-run estimator allows us to check the robustness of long-run results. The long-run elasticities are reported in Table 4. Despite the magnitudes are slightly different among the three long-run estimators, the overall long-run results are fairly robust on the effect of real income and real exchange rates on real tourism receipts. For example, the three estimators consistently exhibit that real income and real exchange rate are positively influence real tourism receipts in Malaysia. In addition, the results are also statistically significant at the 5 per cent level. More specifically, the effect of real income on real tourism receipts is ranging from 1.36 to 1.57, implying that a 1 per cent increase in income leads to between 1.36 per cent and 1.57 per cent increase in real tourism receipts. Similarly, a 1 per cent increase in exchange rate (i.e. Malaysia Ringgit depreciates) leads to between 0.8 per cent and 1.3 per cent increase in real tourism receipts.

Next, we also perform the short-run elasticities using the VECM framework. The short-run results are reported in Table 5. The one period lagged error-correction term $\left(ECT_{t-1}\right)$ is negative sign $\left(-0.7089\right)$ and also statistically significant at the 1 per cent level. This implies that the variables are not overshooting and thus the finding of cointegration is valid and robust (Kremers et al., 1992). Contrary to the long-run elasticities, the results of short-run elasticities reveal that income does not affect real tourism receipts while real exchange rate has a negative impact on real tourism receipts in Malaysia.

Table 5: The results of short run coefficients

Explanatory variables	Coefficients	Standard error	t-statistics
Constant	–0.0137	0.0523	–0.2619
$\Delta \ln TR_{t-1}$	0.1644	0.1358	1.2103
$\Delta \ln Y_t$	0.1498	0.3680	0.4071
$\Delta \ln RER_t$	–0.2218	0.2744	–0.8084
$\Delta \ln RER_{t-1}$	–1.0623***	0.2797	–3.7976
ECT_{t-1}	–0.7089***	0.1322	–5.3600
Diagnostic tests:			
$R^2 = 0.5968$	$\chi^2_{NORM} = 1.1127$	$\chi^2_{SERIAL}\left[1\right] = 0.1046$	$\chi^2_{ARCH}\left[1\right] = 0.0014$
$\bar{R}^2 = 0.5130$	$\chi^2_{RESET} = 2.5643$	$\chi^2_{SERIAL}\left[2\right] = 0.8726$	$\chi^2_{ARCH}\left[2\right] = 0.4978$

Note: The asterisk *** and ** denotes significant at the 1 and 5 per cent levels, respectively.

As we noticed that the variables are cointegrated, thus the temporal Granger causality test must be conducted with the VECM framework to capture both the short- and long-run causality. Table 6 provide the LR test statistics for short-run and long-run causality. Beginning with the results of short-run causality, we find uni-directional Granger causality runs from real exchange rate to real tourism receipts and real income. However, there is neutrality between real tourism receipts and real income in the short run. Turning to the long-run causality, the evident suggest uni-directional Granger causality runs from real exchange rate to real tourism receipts and real income in the long-run. On the other hand, we find that real tourism receipts and real income is bi-directional Granger causality. Inevitably, our empirical results support tourism-led growth hypothesis as tourism Granger-causes economic growth and it is a long-term growth catalyst for Malaysia.

Table 6: The results short- and long-run Granger causality test – VECM

Null hypothesis	Source of causation	
	Short-run causality	Long-run causality
	Likelihood ratio (LR) statistics	
$\Delta \ln TR \nrightarrow \Delta \ln Y$	0.0498	9.0939**
$\Delta \ln Y \nrightarrow \Delta \ln TR$	0.2007	24.6528***
$\Delta \ln TR \nrightarrow \Delta \ln RER$	1.9474	1.9537
$\Delta \ln RER \nrightarrow \Delta \ln TR$	14.3202***	29.7509***
$\Delta \ln Y \nrightarrow \Delta \ln RER$	0.0752	0.1114
$\Delta \ln RER \nrightarrow \Delta \ln Y$	15.0650***	15.5859***

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

3.3 Variance decomposition and impulse response function

The variance decomposition analysis is the out of sample tests for the Granger exogeneity or endogeneity of the dependence variable. Moreover, it provides the information of relative strength in comparison to other variables in the system. The results of variance decomposition analysis are reported in Table 7.

The results reveal that in the short-run (i.e. three years), real exchange rates is relatively the most exogenous variable follow by real income and real tourism receipts. Likewise, in the long-run (i.e. ten years) the exogeneity sequent remains the same. After two years, 97.7 per cent of the variation in the forecast error variance for exchange rate is attributed to its own innovations, while 85.4 per cent and 76 per cent of the variation in the forecast error variance for real income and real tourism receipts, respectively are attributed to their own innovations. In the long run (at the end of ten years), we find that the forecast error variance for real tourism receipts, real income and real exchange rates are 37.5 per cent, 66.4 per cent and 99.2 per cent, respectively. In explaining the variation of real tourism receipts in Malaysia, real income is relatively more important than real exchange rate in both the short and long-run. On the other hand, the combination of real tourism receipts and real exchange rate explained 33.6 per cent of the variance in the forecast error variance for income after 10 years. Specifically, 17 per cent and 16.7 per cent of the in forecast error variance for real income are explained by real tourism receipts and real exchange rates, respectively. Obviously, both variables are equally important in explaining the variation of real income in Malaysia. This is in line with the Granger causality evidence provided in Table 6 where real tourism receipts and real exchange rate Granger-cause real income growth in the long run. In addition, the effect of real tourism receipts and real income on real exchange rate in Malaysia is rather small either short or long-run. Almost all of the variation in the forecast error variance for real exchange rate is explained by its own innovations. Real income explains less than 1 per cent, while real tourism receipts explain less than 4 per cent of the variation in the forecast error variance for real exchange rates in Malaysia. Likewise, the Granger causality results also reveal that real tourism receipts and real income do not Granger-cause real exchange rate in both the short- and the long-run.

Table 7: The results of forecast error variance decomposition analysis

Relative variance of tourism			
Year	Tourism	Income	Exchange rate
1	100.00	0.00	0.00
2	76.02	22.05	1.93
3	60.69	37.01	2.30
4	52.43	43.64	3.93
5	48.19	47.39	4.42
10	37.47	57.73	4.80
Relative variance of income			
1	2.68	97.32	0.00
2	7.86	85.35	6.79
3	12.66	76.28	11.06
4	14.73	71.76	13.51
5	15.47	69.86	14.67
10	16.95	66.39	16.66
Relative variance of exchange rate			
1	3.43	0.09	96.48
2	2.18	0.10	97.72
3	1.63	0.18	98.19
4	1.31	0.19	98.50
5	1.09	0.19	98.72
10	0.59	0.19	99.22

Note: The Cholesky ordering: tourism, income and exchange rate.

Next, we perform the impulse response function to examine the dynamic interaction between the variables in the system. The plots of impulse response function of real tourism receipts, real income and real exchange rate to one-standard deviation shocks in real tourism receipts, real income and real exchange rate are displayed in Figure 1 to 3. Begin with Figure 1 we observe that over the entire period of ten years, shock to income exerts a positive effect on real tourism receipts in Malaysia. However, a shock in real exchange rate leads to a decrease in real tourism receipts for the first two years and stabilised after four years. This result is also corroborated with the short- and long-run elasticities reported in Table 3 and 4. This implies that the initial depreciation of Malaysian ringgit will cause a transitory drop in tourism receipts, while after four years such effect change to positive. In Figure 2, we observe that over the entire ten years period, real tourism receipts exert a positive effect on real income, while real exchange rate exerts a negative impact on real income in Malaysia. A shock to real tourism receipts increases real income in the first three years, and stabilise thereafter. Then, a shock to real exchange rate decreases real income in the first two years and stabilise thereafter. Finally, Figure 3 shows that a shock to real tourism receipts and real income has very little effect on real exchange rate. The effect is almost approaching zero. Again, the impulse response function analysis also indicates that real exchange rate is exogenous, but it is very important in explaining the variation in real tourism receipts and real income for Malaysia. Therefore, tourism-growth studies that omitted of real exchange rate from the system can lead to bias estimation result (see Balaguer and Cantavella-Jorda, 2002; Gunduz and Hatemi-J, 2005; Belloumi, 2010; Katircioğlu, 2010).

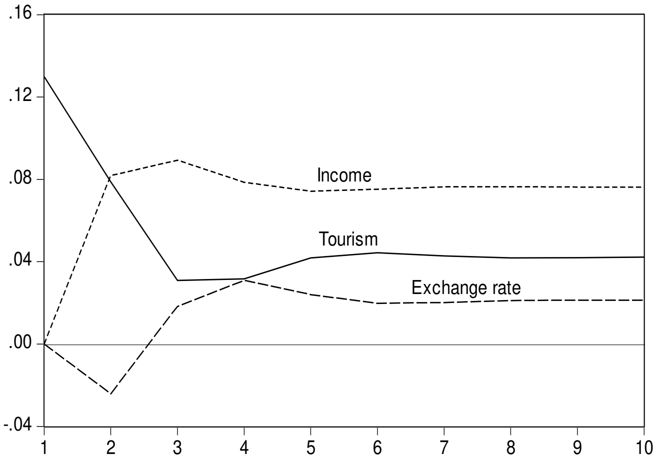

Figure 1: *Impulse responses of tourism to a one-standard deviation shocks in tourism, income and exchange rate*

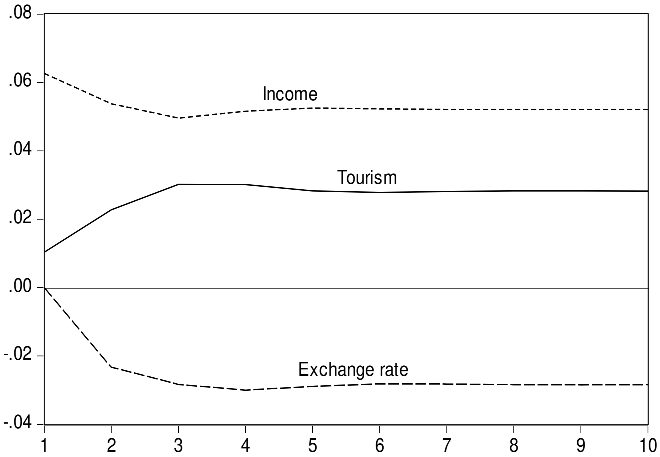

Figure 2: *Impulse responses of income to a one-standard deviation shocks in income, tourism and exchange rate*

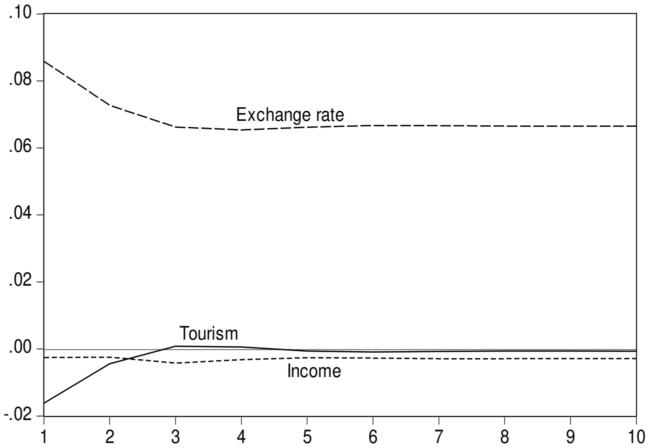

Figure 3: *Impulse responses of exchange rate to a one-standard deviation shocks in exchange rate, tourism and income*

3.4 Persistence profile analysis

To this end, we have performed variance decomposition and impulse response function to examine the response of variable-specific shock. Here, we conduct the persistence profile analysis introduced by Pesaran and Shin (1996) to analyse the speed of convergence to the equilibrium if the cointegrating relationship expose to a system-wise shock. The value of persistence profile is unity on impact, but it tends to be zero as the forecast time horizon tends to infinity. If the cointegrating relationship between real tourism receipts, real income and real exchange rate in Malaysia is stable and valid, the profile should approach zero in a short time horizon. Therefore, the persistence profile is not only important for measuring the speed of convergence, but it also shed some light to the validity of cointegrating relationship.

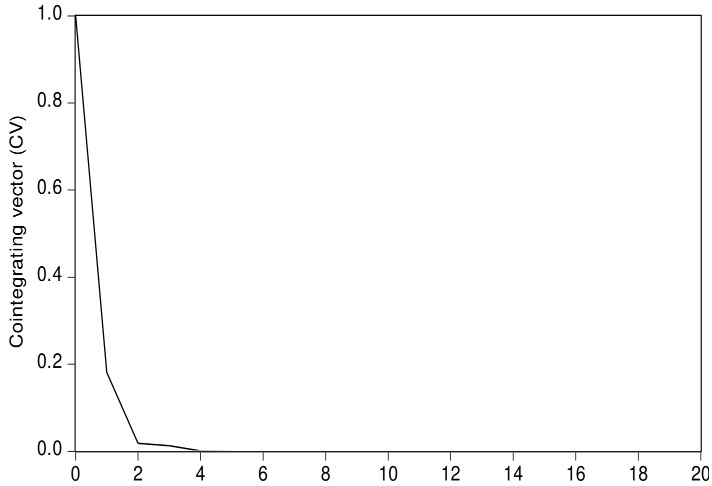

Figure 4: *Persistence profiles of the effect of a system-wide shock to the cointegrating vector (CV)*

Figure 4 illustrates the single persistence profile obtained from the real tourism receipts data as cointegration results show the variables are cointegrated only when real tourism receipts is the dependent variable (see Table 3). Evidently, the generated persistence profile decline sharply toward its equilibrium value (zero) at about three years after a system-wise shock. In addition, the results of impulse response function for all variables also reveal that the effects of shocks are negligible after three to four years. These results indicate that there is a valid cointegrating relationship between real tourism receipts, real income and real exchange rate in Malaysia. The presence of valid cointegrating relationship also affirms that the model used in this study is correctly specified although there might be omitted of other potential variable(s) (see Perman, 1991). Therefore, the estimation results of this study are robust.

4. CONCLUSION AND POLICY RECOMMENDATIONS

The goal of this study is to investigate the temporal Granger causality and dynamic relationship between real tourism receipts, real income and real exchange rate in Malaysia over the period from 1974 to 2009. We employ the cointegration and Granger causality tests in complement with the variance decomposition, impulse response function and persistence profile analyses to achieve the objective of this study. The main findings of this study are as follows. First, the bounds testing approach for cointegration recommend one cointegrating relationship between real tourism receipts, real income and real exchange rates in Malaysia. Second, to enhance the robustness of our finding, this study employs three long-run estimators, namely ARDL, DOLS and FMOLS to estimate the long-run elasticities. We found that both real income and real exchange rates had a positive and significant effect on real tourism receipts in Malaysia. Third, the Granger causality test is used to examine the direction of causality between the variables. In the short run, there is uni-directional Granger causality runs from real exchange rate to real tourism receipts and real income, but neutral Granger causality between real tourism receipts and real income. However, in the long-run we find a bi-directional Granger causality evidence between real tourism receipts and real income, but a uni-directional Granger causality runs from real exchange rates to real tourism receipts and real income. Fourth, apart from using Granger causality, we undertook variance decomposition and impulse response function to analyse the response of each variable that is attributed to its own shock and to shocks in other variables in the system. This is also known the variable-specific shock. In explaining shocks to real tourism receipts in Malaysia, real income is more important than real exchange rates. Meanwhile real tourism receipts and real exchange rates are equally important in explaining shocks to real income. Furthermore, the impulse response function reveals that shock to real income and real exchange rate have positive effects on real tourism receipts in the short and long run. In addition, shock to real tourism receipts has a positive effect on real income, while shock to real exchange rate has a negative effect on real income in Malaysia. Finally, persistence profile indicated that the real tourism receipts system is stable and valid as the profile decline sharply toward the equilibrium within a period about three years after a system-wise shock. This affirms that the tri-variate cointegrating system used in this study is valid.

For policymaking, we could draw at least two significant policy implications from the findings of this study. First, tourism is the long-term source for economic growth in Malaysia as the Granger causality results suggest that real tourism receipts and real income is bi-directional causality. Therefore, policymakers should encourage development of tourism industry to consistently stimulate long-term economic growth in Malaysia. In order to enjoy the tourism-led growth model, the Ministry of Tourism in Malaysia should design more competitive tourism packages to woo tourist arrivals from various countries in the world. Apart from that, the issues of safety and security must be taken into account as tourist arrivals are very sensitive to these. According to Tang (2011b), crime is negatively affects the arrivals of international tourist to Malaysia. Lean and Smyth (2009) also showed that issues which brought about public safety and health scares (e.g. high crime rates, bombing issue in Bali in Indonesia, SARS outbreak, Avian flu outbreak, and cholera outbreak) would adversely affected the in-bound international tourist arrivals. Second, our results show that the effect of real exchange rate on tourism is positive, thus a stable real exchange rate is important to avoid exchange rate risk bare by international tourists. Ultimately, this will attract more international tourist arrivals to Malaysia.

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