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Economic Growth, Tourism and Selected Macroeconomic Variables: A Triangular Causal Relationship in Malaysia

Cheam Chai Li
Rosli Mahmood
Hussin Abdullah
Ong Soon Chuan

Tourism is one of the largest and fastest growing industries in the world, which makes it a potential strategic factor for economic growth. This adds to the strong interest in the role of tourism in Malaysia's economic growth as it is the second-largest contributor to foreign exchange earnings after manufacturing. In addition, empirical results associated with Granger causality among economic growth, tourism and exports within the neoclassical framework are inconsistent. The objectives of this study, thus, are to determine: the long-run relationship; the long-run and short-run Granger causality; and the long-run triangular Granger causality between economic growth and tourism receipts corresponding to selected macroeconomic variables such as government tourism expenditure, physical capital, education, health and exports as control variables. The long-run Granger causality in vector error correction model (VECM) shows economic growth, tourism receipts and health complement each other (bidirectional causality), while unidirectional causalities are found between government tourism expenditure, physical capital, education and exports to economic growth. In addition, enhancing physical capital, education, health, exports and government tourism expenditure precede tourism receipts; all these in turn indirectly lead to economic growth, thus witnessing triangular relationships among them.

Keywords: *Economic Growth, Tourism, Neoclassical Model, Johansen Cointegration, Granger Causality, VECM, Malaysia*
JEL Classification: *C01, C32, L83, 047, O53*

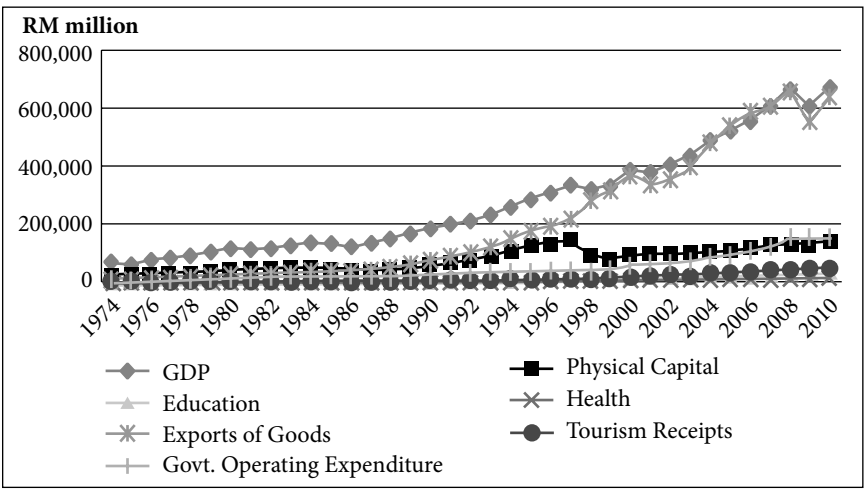
Cheam Chai Li is at the College of Business Management, UiTM Kelantan, Bukit Ilmu, 18500 Machang, Kelantan, Malaysia, email: clcheamnet@yahoo.com
Rosli Mahmood is at the College of Business, Universiti Utara Malaysia, 06010 Sintok, Kedah, email: rosli@uum.edu.my
Hussin Abdallah is at the College of Arts and Sciences, Universiti Utara Malaysia, 06010, Sintok, Kedah, email: hussin2141@uum.edu.my
Ong Soon Chuan is at the College of Business and Entrepreneurship, Universiti Malaysia Kelantan, 16010 Pengkalan Chapter, Kelantan, Malaysia, email: chuan@umk.edu.my

1. Introduction

Over the years, much attention has been given to traditional exports—primary and manufacturing—to measure economic growth in countries. Nevertheless, in recent decades, tourism has become the fastest growing industry globally. Incomes obtained from international tourist arrivals can be important sources of gains for public and private sectors through the multiplier effects and can result in business expansion. Not only that, international tourism also provides employment opportunities for domestic workers. The entire process stimulates economic activity in the host country and brings about further economic expansion. Apart from that, tourism through exports also contributes to foreign exchange earnings, which in turn could result in tourism-led growth.

Malaysia is following the same trend. It emerged from being a traditional economy to one of the fastest growing economies in the Association of Southeast Asian Nations (ASEAN) region around the 1970s. As shown in Figure 1, since 1974, its gross domestic product (GDP) has grown substantially. Between 2000 and 2006, the economy had an annual average growth rate of 5.3 per cent, which rose to 6.7 per cent in 2007 (Country Analysis Report: Malaysia, October 2008). However, a slowdown was observed in 2008–09 because of the world economic crisis. Thanks to Malaysia's strong economic fundamentals, it

Figure 1 GDP and Selected Macroeconomic Variables in Malaysia, 1974–2010



Source: Department of Statistics, Malaysia (1974–2010).

Table 1 Major Foreign Earnings in Malaysia (RM billion)

	2004	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
Manufactured goods	390.4	435.7	473.2	474.7	491.9	430.6	486.7
Tourism	30.7	32.0	37.6	47.5	50.2	55.0	56.5
Palm oil	20.1	19.4	21.6	32.0	46.0	36.4	45.6
Crude oil	21.3	29.4	30.8	31.9	43.0	25.4	30.8
LNG	17.1	20.8	23.3	26.2	40.7	31.2	38.1
Rubber	5.2	5.8	8.2	7.3	8.1	4.5	9.2
Sawn timber	*5.3	*5.9	4.3	4.1	3.5	3.0	–
Sawn logs			2.3	2.1	2.1	2.0	–

Source: MOTOUR, various reports.

Notes: * Sawn timber and sawn logs; RM = Malaysia ringgit.

only experienced a modest recession in 2009, and the following years brought about a strong recovery.

Why has the tourism industry in Malaysia been chosen as the topic of this article? Table 1 shows the standing of major industries in Malaysia in terms of their foreign exchange contribution from 2004 to 2010. Tourism maintains its rank as the second-largest foreign exchange earner, after manufacturing, followed by exports of palm oil, crude oil, liquefied natural gas (LNG), rubber and timber. This shows how important tourism is to Malaysia's economic growth. In addition, according to the Central Bank (Bank Negara of Malaysia), strong growth can be attributed to the outgrowth in the service sectors, especially in the tourism industry (along with robust domestic demand, private consumption and investment activity during the year) (Country Analysis Report: Malaysia, October 2009). As such, tourism can be viewed as strategic to the growth of the economy.

However, some questions arise: are tourism receipts a long-run engine of economic growth in Malaysia? Should Malaysia promote tourism to achieve long-run economic growth? What are the types of Granger causality between tourism receipts and economic growth? The empirical results between tourism and growth show mixed findings in Malaysia thus far. Three types of Granger causality are found by various researchers. Lau et al. (2008) find tourism-led growth; Kadir et al. (2010) and Tang (2011c) find growth-led tourism; while Lean and Tang (2010) and Tang (2011a, 2011b) find bidirectional causality.

Apart from this, the relationship between economic growth (GDP) and other crucial macroeconomic variables, such as government tourism expenditure, physical capital, human capital (education expenditure and health expenditure)

and manufactured exports (as shown in Figure 1), exhibited positive trends as the economy expanded from 1974 to 2010. And, interestingly, the movements of these variables display some sort of patterns (Khan and Chua, 2002). Therefore, this study will look at the type of Granger causality among these variables on economic growth and tourism receipts in the triangular Granger causality. Furthermore, there has been limited empirical study on the triangular relationship among economic growth, tourism receipts and selected macroeconomic variables such as government tourism expenditure, gross fixed capital formation, education expenditure, health expenditure and manufactured exports.

Government expenditure, in general, is said to play a crucial role in promoting economic growth, particularly in a developing country. It is necessary to ensure returns from the large amount of limited resources distributed to tourism, as government expenditure is not unlimited. The role of government tourism expenditure in accelerating economic growth in Malaysia has not been much attended to in the empirical literature. The current available empirical literature is related to the relationships between aggregate and disaggregate government expenditure (such as health, education and defence) to economic growth, and the findings are still being debated among scholars in Malaysia. Some researchers find the relationship unidirectional (Tan, 2003), while others find it bidirectional (Tang, 2009; Tuck, 2009) or with no causality (Furuoka, 2008; Sinha, 1998).

Mankiw et al. (1992), the neoclassical growth advocators, find that the inclusion of accumulated human and physical capital into the augmented Solow model provides an excellent data description. However, when incorporating tourism receipts within production function theory to measure economic growth, Adamou and Clerides (2010), Cortes-Jimenez and Pulina (2006, 2010), Eugenio-Martin et al. (2004), Figini and Vici (2010), Seetanah et al. (2011), Sequeira and Campos (2007), Sequeira and Nunes (2008), Sica (2005) and Tiwari (2011) find the relationship inconsistent. And there are no studies that incorporate tourism receipts and government tourism expenditure within the neoclassical growth model in Malaysia.

As for export-led growth, since the concept is almost similar to tourism-led growth in Feder's (1982) model, the study adds this variable in the model as it has a potential important correlation to economic growth, as well as to avoid omitted variable bias.

Thus, it appears that, generally, tourism receipts and selected macroeconomic variables (namely, government tourism expenditure, physical capital, human capital in education, human capital in health and exports as the control variables

in the model) are adopted to measure their relationship with economic growth. This is because Malaysia's long-term increments in both economic growth and tourism receipts have provided sufficient time to examine the interactions among the variables in the triangular relationship. Hence, the specific objectives of the study are:

1. To determine the long-run relationship among economic growth, tourism, physical capital, human capital and exports.
2. To determine the long-run and short-run Granger causal relationships among economic growth, tourism, physical capital, human capital and exports.
3. To determine the long-run triangular directions of Granger causal relationships among macroeconomic variables (government tourism expenditures, physical capital, human capital and exports), economic growth and tourism receipts.

The article is organised as follows. The second section reviews the literature pertaining to the topic discussed; Section 3 explains the model, data and methodology used in the study; Section 4 reports the empirical results; and Section 5 concludes and gives suggestions to policy-makers based on the empirical findings.

2. Literature Review

Durbarry (2004) was the first one to explain export-led growth (ELG) and tourism-led growth (TLG) using the production function in Mauritius. The variables in the study included physical and human capital and disaggregated exports (with international tourism as one of the forms of export). He claimed that tourism has contributed to Mauritius's economic growth in a positive significant manner.

Tourism receipts (TR) as a determinant of growth and development has attracted much research (Brida et al., 2008; Dritsakis, 2004; Durbarry, 2004; Kim et al., 2006; Oh, 2005; Sinclair, 1998) but the empirical findings are inconsistent. The most recent empirical evidence of a relationship between tourism and economic growth within neoclassical theory can be found in Table 2. In general, the findings are mixed. Some find a positive relationship (Cortes-Jimenez, 2006; Durbarry, 2004; Eugenio-Martin et al., 2004, etc.), while Chang et al. (2010) find tourism growth does not always lead to economic growth.

Table 2 Tourism as a Determinant of Economic Growth within Growth Theory

Authors	*Time*	*Country*	*Methodology*	*Variables*	*Results*
Durbarry (2004)	1952–99	Mauritius	Error correction mechanism (ECM)	International tourism receipts, physical capital and human capital, disaggregated exports.	LR: T ↔ Y
Eugenio-Martin et al. (2004)	1985–98	21 Latin American Countries	Dynamic panel data model	Tourist arrivals, investment, public spending in education, general government consumption and social variables	LR: T → Y Tourism leads to growth, especially for low and middle-income countries
Cortes-Jimenez and Pulina (2006)		Italy (1954–2000), Spain (1964–2000)	ECM, Granger causality	International tourism receipts (T), real per capita GDP, physical and human capital, exports	LR: Spain: T → Y
Katircioglu (2007)	1977–2003	North Cyprus	Johansen cointegration, vector error correction model (VECM), Granger causality	GDP, government capital formation (GCF), labour (L), net tourism receipts (NTR)	There is a long-run relationship between economic growth and tourism growth. However, tourism-led growth is invalid, GDP ↔ GCF; labour → GDP.
Cortes-Jimenez and Pulina (2010)		Italy (1964–2000) and Spain (1954–2000)	VECM (Johansen), Granger causality	Real output, physical and human capital, exports of goods (XG) and tourism exports (TX)	LR: Spain: T ↔ Y; Italy: T → Y SR: Spain: Y → T
Ka (2009)	1990–2006	Mauritius	Two-stage ECM	Trade openness (XM), tourism (T), physical (K) and human capital (H)	LR: T → Y, K → Y, H → Y

(Table 2 continued)

(Table 2 continued)

Seetanah et al. (2011)	1990–2006	40 African countries	Panel vector autoregression (VAR)	Income (Y), gross fixed capital formation (K), secondary school enrolment (H), openness-ratio of export plus import (O), tourist arrivals (T), economic freedom (EF).	T is the important sector of African development, although K, O and H remain the main drivers. There is bidirectional causality between T and Y; and unidirectional causality from H, EF and K to Y.
Seetanah (2011)	1990–2007	19 island economies	Generalised method of moments (GMM) and panel data, Granger causality (Hurlin and Venet, 2001)	Gross fixed capital formation (IVTGDP), secondary school enrolment (SER), openness (XMGDP), economic freedom (EF) and tourism arrivals (TOUR), tourism receipts per capita (TRECEIPT)	Tourism development is an important factor in explaining economic performance in island economies. There is bidirectional causality between tourism development and growth.

Source: Authors' summary based on the literature review.

Public expenditure is incorporated in the works of many researchers (Barro, 1991; Barro and Sala-i-Martin, 1992; Devarajan et al., 1996; Easterly and Rebelo, 1993; Hulton, 1996), but the empirical evidence has been mixed (Cooray, 2009). The empirical findings in Malaysia have shown conflicting results in the relationship between government expenditure and economic growth (Tang, 2008). As far as this article goes, it is based on a limited study specifically measuring the relationship between government tourism expenditure (GT) and economic growth within the conventional neoclassical growth model.

Physical capital (K) is an important determinant of growth in a neoclassical growth model. It provides linkages between imported technology and economic growth (Grossman and Helpman, 1991a, 1991b, 1995) and can be measured by estimating capital stock (Ka, 2009) which has been widely accepted as an economic growth prerequisite (Lewis, 1955; Nurkse, 1962). However, in terms of using a vector autoregression (VAR) framework to study the effect of public capital (public investment) on economic growth, the findings show mixed results (Creel and Poilon, 2008). Some studies find no relationship between the two (McMillin and Smyth, 1994; Otto and Voss, 1996); some find a positive relationship (Groote et al., 1999; Kamps, 2005; Ligthart, 2000); and some a negative relationship (Otto and Voss, 2002).

Another source of growth besides physical capital in the production function is human capital (H). The importance of human capital has long been stressed by economists (Mankiw et al., 1992). Plenty of researches have been done to see how human capital accumulation sustains economic growth (Barro, 2001; Jones and Manuelli, 1990; Lucas, 1988; Rebelo, 1991; Stokey, 1991). The inclusion of the human capital variable can possibly change economic growth's theoretical modelling or empirical analysis, and ignoring this variable could lead to inappropriate conclusions (Mankiw et al., 1992). However, the empirical literature on the importance of human capital and economic growth is mixed and far from conclusive (Al-Yousif, 2008). The role of human capital in the form of education has been well recognised theoretically by Goodie (1959) and Schultz (1961), and empirically by Brist and Caplan (1999) and Rada and Taylor (2006). Schultz (1961) has also viewed health as another important form of human capital. The proxies used in studies are either secondary school enrolment rates (Barro, 1991; Mankiw et al., 1992), or government expenditure on education (Blankenau and Simpson, 2004; Chang et al., 2010; Govindaraju et al., 2010) or government expenditure on health (Al-Yousif, 2008; Lee and Hung, 2010).

As for exports (X), the new growth theory says that with an expansion in exports, input allocation will be economically efficient, and this leads to productivity growth. From the perspective of supply, exports can generate economic growth through economies of scale (Helpman and Krugman, 1985),

competition (Krueger, 1980), foreign exchange earnings (McKinnon, 1964) and diffusion of technical knowledge (Grossman and Helpman, 1991a). However, numerous studies have shown that the potential link between exports and economic growth (export-led growth) are inconclusive (Giles and Williams, 2000; Tiwari, 2011).

3. Model, Data and Methodology

The model for the study is based on Solow's (1956–57) neoclassical model. It was extended by Mankiw et al. (1992) for human capital; by Feder (1982) for exports and non-exports sector; and by Ram (1986) and Grossman (1988) for the government sector. Thus, the model for the study is about the multivariable relationships shown in a linear logarithmic regression as follows:

$$LY_t = \omega_0 + \omega_1 LTR_t + \omega_2 LGT_t + \omega_3 LK_t + \omega_4 LHe_t + \omega_5 LHh_t + \omega_6 LX_t + \nu_t \quad (1)$$

where t = time, ω_0= intercept terms, ω_1, ω_2, ω_3, ω_4, ω_5, ω_6 = coefficients and υ = error terms; and the proxies are: Y = real economic growth per capita, TR = real tourism receipts, GT = real government tourism expenditure, K = real physical capital per labour, He = real education per labour, Hh = real health per labour and X = real exports of goods.

The dataset consists of seven variables based on annual data from 1974 to 2010 to capture the long-run triangular Granger causality among economic growth, tourism receipts, government tourism expenditure and selected macroeconomic variables—physical capital, human capital (education and health) and exports.

In terms of research methodology, the orders of integration for each series in the study are first tested by using the Augmented Dickey–Fuller (ADF) test (Dickey and Fuller, 1979, 1981) for the intercept and time trends on the levels and first differences. This is to detect the presence of a unit root on the individual series at the levels and first differences.

Next, Johansen cointegration (Johansen, 1988; Johansen and Juselius, 1990) is employed to determine the long-run economic relationship between variables after the order of integration is determined. If the series are integrated at the same order, there should be at least one cointegrating vector in the system. The Johansen–Juselius technique is as follows:

Let,

$$\Delta X_t = \alpha + \prod_1 \Delta X_{t-1} + \prod_2 \Delta X_{t-2} + \ldots + \prod_{k-1} \Delta X_{t-k-1} + \prod_k X_{t-k} + \omega_t \quad (2)$$

where X_t and ω_t are (n*1) vectors and $\prod$ is an (n*n) matrix of parameters.

Johansen's (1988) methodology is required to calculate Equation (2) and the matrix rank of $\prod_k$. If rank $(\prod_k)$ = zero, the X_t linear combination of variables is non-stationary. In other words, the variables are not cointegrated. But since the matrix rank is non-zero eigenvalues (p), where p > 0, two likelihood ratio (LR) tests are used to perform this test as the value of p shows cointegrating vectors among the variables.

$$L_{trace} = -T \sum_{i=r+1}^{p} \ln((1-\lambda)_i) \tag{3}$$

The null hypothesis of distinct cointegrating vectors which is less or equal to *r* tested against a general alternative.

$$L_{max} = -T \ln((1-\lambda)_{r+1}) \tag{4}$$

The null hypothesis of *r* cointegrating vectors tested against the alternative of $r + 1$ cointegrating vector.

Where λ_r = estimated eigenvalues; and
T = number of valid observations.

Both tests refer to Osterwald-Lenum (1992) critical values.

Third, Granger causality in VECM is conducted to examine the causal relationship between variables such as follows:

$$\begin{bmatrix} \Delta LY_t \\ \Delta LTR_t \\ \Delta LGT_t \\ \Delta LK_t \\ \Delta LHe_t \\ \Delta LHh_t \\ \Delta LX_t \end{bmatrix} = \begin{bmatrix} \alpha_{01} \\ \alpha_{02} \\ \alpha_{03} \\ \alpha_{04} \\ \alpha_{05} \\ \alpha_{06} \\ \alpha_{07} \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} \alpha_{11i} & \alpha_{21i} & \alpha_{31i} & \alpha_{41i} & \alpha_{51i} & \alpha_{61i} & \alpha_{71i} \\ \alpha_{12i} & \alpha_{22i} & \alpha_{32i} & \alpha_{42i} & \alpha_{52i} & \alpha_{62i} & \alpha_{72i} \\ \alpha_{13i} & \alpha_{23i} & \alpha_{33i} & \alpha_{43i} & \alpha_{53i} & \alpha_{63i} & \alpha_{73i} \\ \alpha_{14i} & \alpha_{24i} & \alpha_{34i} & \alpha_{44i} & \alpha_{54i} & \alpha_{64i} & \alpha_{74i} \\ \alpha_{15i} & \alpha_{25i} & \alpha_{35i} & \alpha_{45i} & \alpha_{55i} & \alpha_{65i} & \alpha_{75i} \\ \alpha_{16i} & \alpha_{26i} & \alpha_{36i} & \alpha_{46i} & \alpha_{56i} & \alpha_{66i} & \alpha_{76i} \\ \alpha_{17i} & \alpha_{27i} & \alpha_{37i} & \alpha_{47i} & \alpha_{57i} & \alpha_{67i} & \alpha_{77i} \end{bmatrix}$$

$$\begin{bmatrix} \Delta LY_{t-i} \\ \Delta LTR_{t-i} \\ \Delta LGT_{t-i} \\ \Delta LK_{t-i} \\ \Delta LHe_{t-i} \\ \Delta LHh_{t-i} \\ \Delta LX_{t-i} \end{bmatrix} + \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \\ \theta_4 \\ \theta_5 \\ \theta_6 \\ \theta_7 \end{bmatrix} ECT_{t-1} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \\ e_{5t} \\ e_{6t} \\ e_{7t} \end{bmatrix} \tag{5}$$

The notations for Y, TR, GT, K, He, Hh and X are as mentioned in Equation (1); while ECT = error correction terms; i = the number of lagged terms; t = time; Δ = lag operators; e = disturbances in the equation; and α = constant terms/ parameters of the lagged values.

The VECM models will then show whether there is any long-run causality and short-run causality in the t-statistics and Wald test, respectively. For instance, in the long-run relationship, if θ_1, θ_2, θ_3, θ_4, θ_5, θ_6 and θ_7 in Equation (5) are statistically different from zero, the null hypotheses can be rejected. Similarly, in short-run causality, if the parameters of the lagged values are jointly different from zero, for instance, α_{21i} and α_{31i} in Equation (5) are jointly statistically different from zero, then the null hypothesis can be rejected. In addition, the coefficient of ECT_{t-1} (θ_1) presented in Equation 5 is the indicator for the speed of adjustment.

4. Empirical Results

The results of ADF tests are reported in Table 3. The results suggest that all variables are not stationary in level but stationary at the first differences at the 1 per cent level.

Prior to the Johansen cointegration test, the study first examines the optimum lag length selection. It is based on a VAR model which takes into consideration dynamic time series properties. The optimal lag length is determined by several criteria such as the likelihood ratio test (LR), final prediction error (FPE), Akaike information criterion (AIC), Schwarz Bayesian information criterion (SBIC) and Hannan–Quinn criterion (HQC). They are treated as endogenous variables

Table 3 ADF Test

Variables	*Level*	*1st Difference*
LY	–2.753679 (0)	–6.593372* (0)
LTR	–2.532315 (4)	–6.133888* (0)
LGT	–2.859763 (1)	–10.52982* (0)
LK	–1.758282 (0)	–4.243376* (0)
LHe	–1.508827 (0)	–5.127099* (0)
LHh	–1.356268 (0)	–5.620934*(0)
LX	–2.734529 (2)	–9.489676* (0)

Source: Authors' calculations using Eviews.

Notes: * denotes rejection of the null hypothesis at the 1 per cent level of confidence; figures in parentheses denote the number of lags.

Table 4 Johansen's Test for the Number of Cointegration Vectors

H_0	H_1	L_{trace}	L_{max}
r = 0	r = 1	146.0420*	57.94525*
r ≤ 1	r = 2	88.09672	36.40537
r ≤ 2	r = 3	51.69135	28.92735
r ≤ 3	r = 4	22.76401	11.34397
r ≤ 4	r = 5	11.42004	7.874073
r ≤ 5	r = 6	3.545971	3.349747
r ≤ 6	r = 7	0.196224	0.196224

Source: Authors' calculations using Eviews.
Notes: Trace and maximum eigenvalue tests both indicate one cointegrating equation at the 5 per cent level of significance; * denotes rejection of the null hypothesis at the 5 per cent level of significance; MacKinnon–Haug–Michelis (1999) p-values.

in VAR with a constant as exogenous. The results reveal that the majority of the tests favour an optimal lag length of one, at the 5 per cent level of significance. Thus, one lag is chosen in the study to test the cointegration among Y, TR, GT, K, He, Hh and X.

Table 4 reports the level of long-run cointegration between the variables. One significant cointegrating vector at the 5 per cent level is found in the trace statistics and maximum eigenvalue, indicating that all variables are cointegrated and causally related in the model.

The normalised cointegrated vector is reported in Equation (6) as follows:

$$\begin{aligned} LY_t = {} & 0.128914*LTR_t - 0.041741LGT_t + 0.196953*LK_t \\ & + 0.351896*LHe_t + 0.316371*LHh_t - 0.040377LX_t \end{aligned} \quad (6)$$

The equation describes the signs on the variables whether they are consistent with a priori expectation. The results show that four variables, TR, K, He and Hh, are positive and statistically significant at the 1 per cent level. This means that tourism receipts, physical capital, education and health are statistically significant in contributing to economic growth in the long run, thus answering research objective one. In terms of the degree of impact, it indicates that a 1 per cent change in TR, K, He and Hh will lead to 0.129 per cent, 0.197 per cent, 0.352 per cent and 0.316 per cent increase in Y, respectively.

The causality test results in VECM (depicted in Table 5) indicate the following: the t-statistics in the square bracket in the last column shows the existence of long-run causality; the Wald test in parenthesis indicates the presence of short-run causality; and the speed of adjustment is shown in $ECT_{t-1.}$

Table 5 VEC Granger Causality/Block Exogeneity Wald Tests

Dependent Variable	*Short-run Causality (Wald Tests)*							*Long-run Causality*
	ΔLY	ΔLTR	ΔLGT	ΔLK	ΔLHe	ΔLHh	ΔLX	ECT_{t-1}
ΔLY	–	3.125067***	5.919411**	5.877842**	7.747005*	2.421353	1.502371	–0.812645*
		(0.0771)	(0.0150)	(0.0153)	(0.0054)	(0.1197)	(0.2203)	[–3.80410]
ΔLTR	0.000304	–	0.236152	0.196307	0.206138	0.377348	0.042840	1.336214**
	(0.9861)		(0.6270)	(0.6577)	(0.6498)	(0.5390)	(0.8360)	[2.11261]
ΔLGT	0.000431	0.404242	–	0.028519	1.569483	4.005908**	0.042162	1.236539
	(0.9834)	(0.5249)		(0.8659)	(0.2103)	(0.0453)	(0.8373)	[1.05525]
ΔLK	4.592769**	4.801138**	2.779591***	–	1.191974	0.274230	1.238805	–1.077407**
	(0.0321)	(0.0284)	(0.0955)		(0.2749)	(0.6005)	(0.2657)	[–1.98848]
ΔLHe	0.178757	1.120005	0.000868	0.114883	–	0.013326	0.067013	0.339549
	(0.6724)	(0.2899)	(0.9765)	(0.7347)		(0.9081)	(0.7957)	[1.39800]
ΔLHh	1.311696	1.792344	0.289760	2.881915***	3.196869***	–	0.240360	0.826842*
	(0.2521)	(0.1806)	(0.5904)	(0.0896)	(0.0738)		(0.6239)	[3.06633]
ΔLX	0.027525	2.500561	0.190393	0.008938	0.824462	14.30149*	–	–0.299238
	(0.8682)	(0.1138)	(0.6626)	(0.9247)	(0.3639)	(0.0002)		[–0.29494]

Source: Authors' calculations using Eviews.

Notes: *, ** and *** denote rejection of the null hypothesis at the 1 per cent, 5 per cent and 10 per cent levels of significance, respectively; the values in [ ] and ( ) are the *t*-statistics and *p*-value, respectively.

Table 6 Summary of Long-run and Short-run Granger Causality

Long-run Causality	*Short-run Causality*
Y → TR and Hh	Y → K
TR → Y, Hh	TR → Y, K
GT → Y, TR, Hh	GT → Y, K, Hh
K → Y, TR, Hh	K → Y, He, Hh
He → Y, TR, Hh	He → Y
Hh → Y, TR,	Hh → X
X → Y, TR, Hh	X → -

Source: Authors' findings based on Table 5.

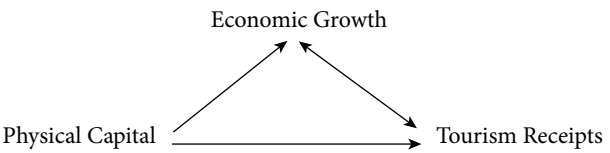
To achieve the second research objective, the long-run and short-run Granger causal relationships among economic growth, tourism receipts and the selected macroeconomic variables are summarised in Table 6.

Since the third objective of the study is to determine the long-run triangular relationship for economic growth, tourism receipts and the other variables (physical capital, education, health, exports and government tourism expenditure), the discussions are based on Figures 2–6. In these figures, a one-headed arrow indicates a unidirectional causal relationship, while a two-headed arrow shows a bidirectional causal relationship between two variables.

Long-run interactions among physical capital, tourism receipts and economic growth are found in the study. Figure 2 shows that both physical capital and tourism receipts are instruments of economic growth. Another major finding is that growth in physical capital stimulates and precedes tourism receipts, which is consistent with the findings from Seetanah et al. (2011). This suggests that physical growth also leads tourism receipts, which in turn leads to overall economic growth.

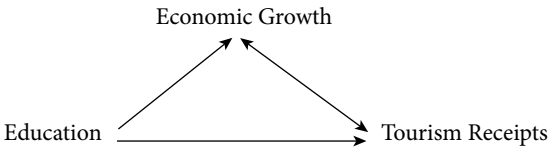
Besides, interactions among education, tourism receipts and economic growth are also found in the long run. The finding shows that growth in tourism receipts

Figure 2 Long-run Granger Causality among Economic Growth, Tourism Receipts and Physical Capital



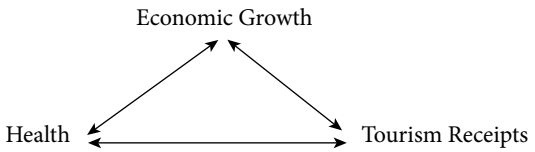
Source: Authors' findings based on Table 5.

Figure 3 Long-run Granger Causality among Economic Growth, Tourism Receipts and Education



Source: Authors' findings based on Table 5.

Figure 4 Long-run Bidirectional Causality among Economic Growth, Tourism Receipts and Health



Source: Authors' findings based on Table 5.

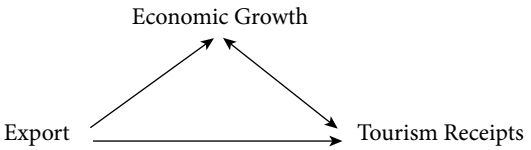
and education stimulates growth in the economy, which corroborates recent work by Katircioglu et al. (2010). In addition, the other finding from Figure 3 is that education precedes tourism receipts, thus suggesting that education leads to tourism receipts and eventually results in economic growth. This result is consistent with Seetanah et al. (2011).

Another finding is that there are interactions among health, tourism receipts and economic growth in the long run, as shown in Figure 4. Besides the reciprocal relationship between health, tourism receipts and economic growth, the results show that health and tourism receipts correlate to one another. This finding is similar to Lee and Hung (2010). This suggests that health leads to tourism receipts and tourism receipts also leads to health in Malaysia, and all these in turn lead to economic growth in the country.

The finding also reveals that exports precede tourism receipts as shown in Figure 5, which implies that the growth of exports leads to an expansion in tourism receipts. This is consistent with the findings from Kadir and Jusoff (2010). The interactions of exports and tourism receipts then lead to an enhancement of economic growth.

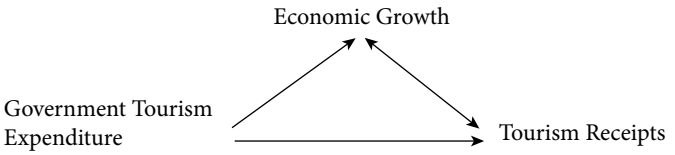
Last but not the least, Figure 6 shows a unidirectional causality from government tourism expenditure to tourism receipts in Malaysia, implying that an increase in the former enhances the latter. This is in line with the studies from

Figure 5 Long-run Granger Causality among Economic Growth, Tourism Receipts and Exports



Source: Authors' findings based on Table 5.

Figure 6 Long-run Granger Causality among Economic Growth, Tourism Receipts and Government Tourism Expenditure



Source: Authors' findings based on Table 5.

Kareem (2008); in addition, he also finds a bidirectional relationship between tourism receipts and government tourism expenditure. Just as in the previous findings, the interactions of government tourism expenditure and tourism receipts in turn lead to an expansion in economic growth.

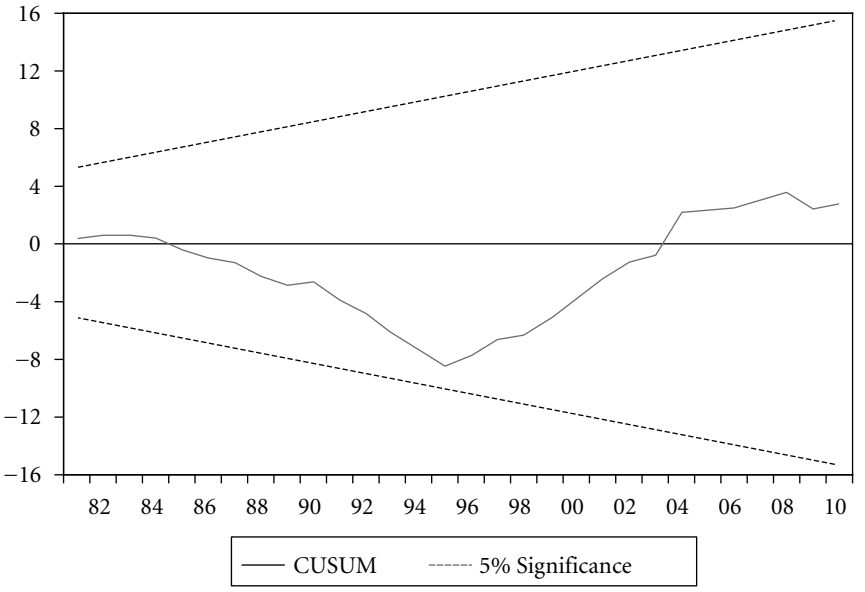
Robustness tests are diagnosed for Equation 1 and the results are shown in Table 7 and Figures 7 and 8.

Table 7 Robustness Tests

Tests		*Statistics*	*Probability*
a.	Jarque-Bera (normality test)	0.635	0.728
b.	Heteroscedasticity Test: ARCH:		
	F statistics	0.671934	0.4181
	Obs R-squared	0.697672	0.4036
c.	Bruesh–Godfrey Serial Correlation LM test:		
	F statistics	0.833069	0.3689
	Obs R-squared	1.033201	0.3094
d.	Ramsey RESET test:		
	t-statistics	1.091768	0.2839
	F-statistics	1.191957	0.2839
	Likelihood ratio	1.490350	0.2222

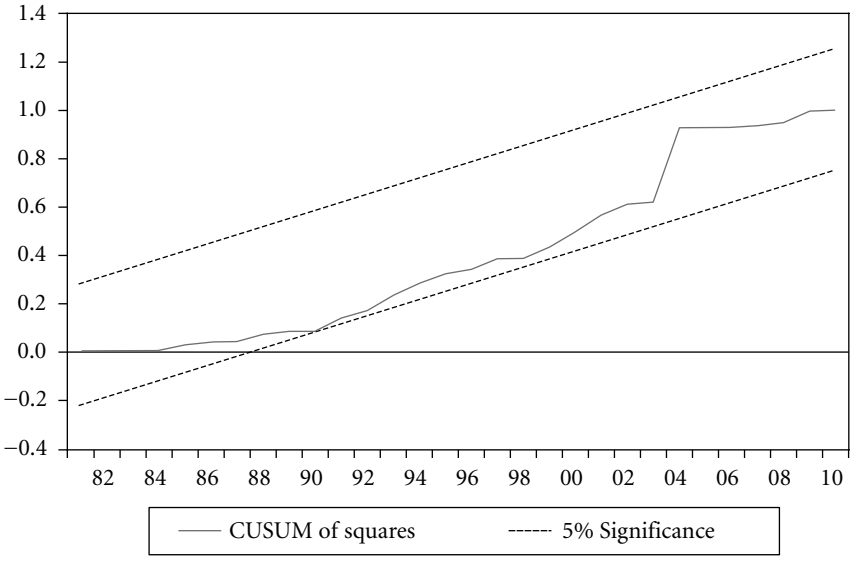
Source: Authors' calculations using Eviews.

Figure 7 Cumulative Sum (CUSUM)



Source: Authors' calculations using Eviews.

Figure 8 Cumulative Sum of Squares (CUSUMsq)



Source: Authors' calculations using Eviews.

The model in the study shows no non-normality of errors, no autocorrelation, no heteroscedasticity, a well-specified functional form and stable regressors. Therefore, it can be concluded that the model applied in the study is robust and its specification is an adequate representation of the data.

5. Conclusion

The primary aim of the study was to determine the long-run triangular relationship for economic growth, tourism receipts and other variables—physical capital, education, health, exports and government tourism expenditure—in Malaysia from 1974 to 2010 based on Granger causality in VECM. The triangular Granger causality analyses of the study provide several suggestions for Malaysia: (*i*) the promotion of physical capital, education, health, exports, tourism receipts and government tourism expenditure accelerate economic growth; (*ii*) robust economic growth is found to enhance tourism receipts and health; and (*iii*) physical capital, education, health, exports and government tourism expenditure also promote the growth of tourism receipts, and hence present an interesting indirect avenue for economic growth. In other words, economic growth is found to be led by physical capital, education, health and exports. In addition, these traditional variables are also found to precede tourism receipts and subsequently contribute to the triangular relationships. Therefore, this study recommends a bi-pronged government strategy where more funds are channelled into these traditional main sources of growth (physical capital, education, health and exports) to simultaneously enhance economic growth and tourism. This is because economic growth is important to the development of the economy in the long run, while tourism is the potential sector that would contribute to the multiplier effect in the whole economy.

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