Annual Tourism Demand by Malaysia for Australia

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Abstract: This paper investigates the multivariate long-run relationship between the demand for international travel to Australia from Malaysia and a group of leading macroeconomic variables, including Malaysian income, tourism prices in Australia, transportation costs between Malaysia and Australia, and the exchange rate between the two countries. The augmented Dickey-Fuller test for unit roots is examined in the univariate framework, while Johansen's maximum likelihood procedure tests for cointegration and estimates the number of cointegrating vectors in a multivariate framework. A single cointegrating relationship is found among the set of non-stationary macroeconomic variables.

1. INTRODUCTION

Univariate autoregressive-moving average (ARMA) processes, as in the time series methods developed by Box and Jenkins (1970), are often used to explain tourist arrival patterns to Australia from an origin country in terms of its own past movements. On the other hand, econometric models typically relate the influence of current and past values of economic variables to tourist arrivals.

This paper provides a cointegration analysis of multivariate time series, whereby several time series are modelled simultaneously. Aggregate economic variables, such as income, tourism prices, transportation costs and exchange rates, are used to explain tourist arrivals to Australia from Malaysia.

2. DATA

In the analysis of international tourism demand to Australia from Malaysia, tourist arrivals from the origin are chosen as a proxy for international tourism demand. The relation A = f(Y, P, T, ER) expresses tourist arrivals (A) from an origin (or tourist-source country) as a function of real income per capita (Y), tourism prices (P), transportation costs (T), and exchange rates (ER) between the origin and destination (or host) currencies. The sample period used is 1975 to 1996, which does not include the recent currency and economic crises in Asia. All data are expressed in logarithms to capture multiplicative time series effects (lower case letters denote logarithms of the variables). Annual data are used for Malaysia, as quarterly income data are unavailable during this period. In this paper, eight series are used for Malaysia. Tourist arrivals data are obtained from the Australian Bureau of Statistics short-term overseas arrivals and departures publications.

Data for Malaysian real income variables include real Gross Domestic Product (GDP) per capita and real private consumption expenditure per capita at 1987 prices in Malaysian Ringgit (MR millions). These variables are used to examine which of the proxy variables for real income plays an important role in explaining tourist arrivals to Australia from Malaysia. Tourism prices, which represent the cost of goods and services purchased by tourists in the destination, are measured by relative prices or real exchange rates. The relative price variable is given by the ratio of the consumer price indices (CPI) of the destination and origin countries. Logarithm of relative prices (lrp) indicates the difference between the logarithm of the price levels in Australia and the origin over the sample period:

$$\text{lrp} = \log\left\{\frac{\text{CPI(Australia)}}{\text{CPI(Origin)}}\right\}$$
$$= \log \text{CPI (Australia)} - \log \text{CPI (Origin)}.$$

The real exchange rate measures the effective prices of goods and services in the destination when the CPI ratio is adjusted for differences in exchange rates between the currencies in the origin and destination countries. Nominal exchange rate is expressed in terms of the number of units of origin currency needed to purchase one Australian dollar. The logarithm of the real exchange rate (lrer) is given by the logarithm of the exchange rate-adjusted relative price index:

$$\text{lrer} = \log\left(\frac{\text{CPI(Australia)}}{\text{CPI(Origin)}} * \frac{1}{\text{ER}}\right)$$
$$= \log \text{CPI (Australia)} - \log \text{CPI (Origin)} - \log \text{ER}$$

where ER = exchange rate in units of origin currency per Australian dollar.

Data sources include the Australian Bureau of Statistics, Malaysia Department of Statistics, Bank Negara Malaysia Quarterly Bulletin, Reserve Bank of Australia, IMF International Financial Statistics, and the World Bank.

As proxies for transportation costs, airfares data for Malaysia are obtained from OAG World Airways Guide (formerly known as the ABC World Airways Guide). Airfares are published in Fare Construction Units (which were later changed to Neutral Unit of Construction) and in the local currency. Published round-trip (or return) coach economy class (or Y class) airfares from Kuala Lumpur to Sydney are used in the analysis as they are available for the full sample period. Round-trip coach economy low apex fares, excursion fares and discounted fares are published only occasionally, and hence are not used in the analysis.

Although marketing and promotional efforts are expected to play an important role in attracting tourists from the origin country to Australia, information on promotional expenditure by Australia in Malaysia is not available. The Australian Tourist Commission sub-contracts an advertising firm in Hong Kong to undertake marketing in Asia, but the breakdown of promotional expenditure in Malaysia is not available.

The variables used in the analysis of international tourism demand for Australia are as follows:

la = logarithm of tourist arrivals from Malaysia to Australia;

ly1 = logarithm of real GDP per capita of Malaysia;

ly2 = logarithm of real private consumption expenditures per capita of Malaysia;

lrf1 = logarithm of real round-trip (return) coach economy airfares in Fare Construction Units;

lrf2 = logarithm of real round-trip (return) coach economy airfares in Malaysian currency;

ler = logarithm of exchange rate (Malaysian currency per Australian dollar);

lrp = logarithm of relative prices = log [CPI (Australia)/CPI (Malaysia)];

lrer = logarithm of real exchange rate (or exchange rate-adjusted relative prices).

Tourist arrivals, real income per capita, real airfares, relative prices and real exchange rates appear to be non-stationary and contain a deterministic and/or stochastic trend. This suggests that these variables contain important information to explain the changes in tourist arrivals to Australia. In the economic framework, the demand for international travel is positively related to income in the origin country, and negatively related to relative prices, transportation costs and the nominal exchange rate of the origin country. The variables may drift apart in the short-run but should move together in the long-run.

3. UNIT ROOT TESTS

Testing for cointegration among several variables is preceded by tests for unit roots of the individual series, namely real income per capita, real airfares, tourist arrivals, real exchange rates, relative prices and exchange rates, using the Augmented Dickey-Fuller (ADF) test based on the auxiliary regression:

$$\Delta y_t = \alpha + \delta t + \beta y_{t-1} + \sum_{i=1}^{k} \psi_i \Delta y_{t-i} + u_t .$$

The ADF tests for a unit root in y_t, namely the logarithm of real income per capita, real airfares, tourist arrivals, nominal exchange rates, relative prices or real exchange rates, at time t; t denotes the deterministic time trend; Δy_{t-i} are the lagged first differences to accommodate serial correlation in the errors, u_t; and α, δ, β and ψ_i are the parameters to be estimated. The null and alternative hypotheses for a unit root in y_t are:

$$H_0 : \beta = 0, \qquad H_1 : \beta < 0.$$

ADF tests are performed sequentially. First, the ADF test is calculated for the sample period, with and without a deterministic trend. The time trend is included in the auxiliary regression if the reported ADF t-statistics, with and without a deterministic trend, are substantially different from each other. In order to determine k, an initial lag length of 4 is selected, and the fourth lag is tested for significance using the standard asymptotic t-ratio. If the fourth lag is insignificant, the lag length is reduced successively until a significant lag length is obtained.

The calculated ADF statistics for real income, tourism prices, transportation costs and exchange rate for Malaysia exceed the critical value at the 5% significance level, so that the null hypothesis of a unit root is not rejected. By taking first differences, all variables, except for real income and relative prices, are transformed into stationary series. Thus, tourist arrivals, real airfares, exchange rate and real exchange rate are I(1), whereas real income and relative prices appear to be I(2) for Malaysia.

When the hypothesis of a unit root is not rejected, then a test for cointegration is performed. If these variables are cointegrated, then there is a stable long-run or equilibrium relationship among them. The null hypothesis to be tested using Johansen's maximum likelihood method is non-cointegration against the alternative of cointegration. In the empirical section below, the number of cointegrating relations among the I(1) variables of tourist arrivals, real airfares, exchange rate and real exchange rate is examined.

4. EMPIRICAL RESULTS

The data set for Malaysia consists of the I(1) variables la_t, lrf_t, ler_t and $lrer_t$ for the sample period 1975-1996. As annual data are used, up to 2 lags of $\Delta la, \Delta lrf1, \Delta lrf2, \Delta ler$ and $\Delta lrer$ are selected for the order of the series in the unrestricted VAR. Although the Trace statistic in Table 1 clearly rejects the null hypothesis of no cointegration, the null of one cointegrating vector is not rejected. Thus, the estimated long-run international tourism demand to Australia by Malaysian tourists is given as follows (with t-ratios in parentheses):

$$la = 43.3 - 3.85 lrf1 - 5.93 ler.$$
$$\qquad (5.94) \qquad (12.2)$$

Both real airfares (as measured by the logarithm of real round trip (return) coach economy airfares in Fare Construction Units and Malaysian CPI) and the exchange rate are significant at the 5% level of significance, and are highly elastic, as indicated by the estimated long-run elasticities. As both real income proxy variables (namely the logarithm of real GDP per capita and the logarithm of real private consumption expenditures per capita) are I(2), they are not included in the cointegration analysis.

Denoting the cointegrating residual by z, where z can be interpreted as the extent to which the system is out of equilibrium, it is included as an error correction term in an international tourism demand model. The cointegrating residual is an I(0) process.

The cointegrating residual for Malaysia is:

$$z = la + 3.85lrf1 + 5.93ler - 43.3.$$

The error correction model forces the long-run behaviour of the endogenous variables to converge to their cointegrating relationships, while accommodating short-run dynamics. The dynamic specification of the model suggests deleting the insignificant variables until a parsimonious representation is obtained.

A subset of the variables is tested for statistical significance to examine if they can be deleted from the model. The associated test statistics reported include the F-statistic and the log-likelihood ratio statistic. Each of the insignificant variables is deleted sequentially from the general dynamic model, while the error correction term is retained. The test statistics do not reject the null hypothesis that the selected coefficients are jointly zero at the 5% significance level.

Ordinary least squares estimates of the long-run international tourism demand model for Malaysia are shown in Table 2. The table indicates that changes in real airfares (in Fare Construction Units) lagged one period, the cointegrating residual and the constant term are statistically significant at the 5% level. The F-statistic and the log-likelihood ratio statistic indicate that the insignificant regressors, namely Δla_{t-1}, Δla_{t-2}, $\Delta lrf1_{t-2}$ and Δler_{t-1}, can be deleted from the model. However, Δler_{t-2} is retained as its deletion causes the error correction term to become statistically insignificant at the 5% level. Thus, the chosen error correction model includes the error correction term, the lagged change in real airfares and exchange rates, and a constant. The estimated coefficients of the error correction terms, namely $\hat{\delta}$, measure the speed of adjustment to restore equilibrium in the dynamic model. For Malaysia, these estimated coefficients are negative and significant.

Various diagnostic tests used include the Lagrange multiplier tests for serial correlation (LM(SC)), White's (1980) test for heteroscedasticity (H), the Jarque-Bera test for normality (LM(N)), and Chow's (1960) second test for predictive failure (namely, Chow 2). The Chow test for predictive accuracy uses observations for 1990-1996 for Malaysia. (Chow's first test, or Chow 1, for parameter constancy is not calculated due to insufficient annual observations.) Table 3 shows that all the diagnostic tests are insignificant for Malaysia. Chow 2 does not reject the null hypothesis of predictive accuracy of the international tourism demand models after 1990. Moreover, the estimated residuals of the dynamic models appear to be uncorrelated and the correlograms indicate that there is no significant serial correlation in the residuals of the selected error correction models.

5. CONCLUSION

Cointegration techniques permit the estimation and testing of long-run equilibrium relationships, as suggested by economic theory. Error correction models provide a way of combining both the dynamics of the short-run (changes) and long-run (levels) adjustment processes simultaneously. Using international tourist arrivals data from Malaysia to Australia as a measure of international tourism demand by tourists from this origin country, the long-run economic relationships among international tourism demand, real income and other macroeconomic variables were estimated.

This paper considered the extent to which annual changes in tourist arrivals from Malaysia are associated with variations in some important economic variables, namely income, tourism prices, transportation costs and exchange rates. Prior to testing for cointegration among the set of variables, the ADF test of non-stationarity was used to determine the order of integration of the individual time series. Johansen's Maximum Likelihood procedure was used for estimation and testing of the cointegrating relations based on vector autoregressive models. The methods used, and the results presented in this paper, provide some useful insights into the effects of income, prices, transportation costs and exchange rates on international tourism demand to Australia from Malaysia.

Annual data for Malaysia supports a long-run equilibrium relationship among international tourism demand, transportation costs and exchange rates. Surprisingly, real income does not seem to have a cointegrating relationship with these variables. The estimated cointegrating residual appears as the error correction term in an error correction model. An important finding from the estimated dynamic models is that the error correction terms are statistically significant for Malaysia.

Although not all the regressors in the error correction models are significant, there is no evidence of problems associated with serial correlation, heteroscedasticity, non-normal errors, or predictive failure when the observations are split at 1990, for Malaysia. The significant error correction term in the error correction model, and can be interpreted as evidence supporting cointegration. This suggests the existence of an equilibrium long-run relationship among important economic variables determining international tourism demand to Australia from Malaysia.

ACKNOWLEDGEMENTS

The first author wishes to acknowledge the financial support of the Small and Medium Enterprise Research Centre and the School of Finance and Business Economics at Edith Cowan University. The second author wishes to acknowledge the financial support of the Australian Research Council.

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Table 1

Johansen Trace Test for One Cointegrating Equation for Malaysia, 1975-1996

Variables	H_0	H_A	Trace	Critical Value (5%)	VAR	AIC, SBC
la, lrf1, ler	$r = 0$	$r = 1$	33.97	29.68	2	-5.12, -4.23
	$r \leq 1$	$r \geq 2$	14.72	15.41	2	

Table 2

Estimates of the Error Correction Model for Malaysia, 1975-1996

Regressor	Coefficient	t-statistic
Δla_{t-1}	0.07	-0.22
Δla_{t-2}	-0.22	0.79
$\Delta lrf1_{t-1}$	1.36	2.49
$\Delta lrf1_{t-2}$	0.52	1.00
Δler_{t-1}	0.23	0.47
Δler_{t-2}	0.61	1.29
z_{t-1}	-0.27	-2.28
Constant	0.12	2.06

Note: Dependent variable is Δla_t.

Table 3

Diagnostic Tests for Malaysia

Diagnostics	Statistics
LM(SC)	0.26 [0.78]
LM(H)	1.84 [0.29]
LM(N)	0.46 [0.79]
Chow 2	0.26 [0.94]

Notes: LM(SC) and LM(H) are Lagrange multiplier tests for serial correlation and heteroscedasticity, respectively; LM(N) refers to the Jarque-Bera Lagrange multiplier test for normality; Chow 2 is Chow's second test for predictive failure; figures in brackets denote probability values.