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MODELLING THE DETERMINANTS OF INTERNATIONAL TOURISM DEMAND TO AUSTRALIA

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Abstract

Prior to the recent Asian currency and economic crises, tourism from Asia had rapidly become Australia's major tourism export industry. Tourists from Singapore, which is Australia's fifth major market, represented 6% of international tourist arrivals to Australia in 1996. The average annual growth rate of tourist arrivals from Singapore of around 20% over 1990-96 far exceeded the 10.5% average annual percentage growth rate of all tourist arrivals to Australia over the same period (Australian Bureau of Statistics, 1997). Despite the Asian currency and economic crises in 1997-98, tourist arrivals to Australia from Singapore has continued to grow slowly. It is imperative from the tourism marketing SWOT (strengths, weaknesses, opportunities and threats) analysis to consider the economic factors influencing international tourism demand for Australia by Singapore, and to undertake a primary competitor analysis of New Zealand. The purpose of the paper is to estimate the income, price and transportation cost elasticities of inbound tourism from Singapore to Australia using seasonally unadjusted quarterly data, to determine if Australia and New Zealand are substitute or complementary destinations for Singaporean tourists, and to examine issues such as nonstationarity, cointegration and spurious regressions.

Keywords: International tourism, elasticities, income, tourism prices, transportation costs, substitute and complementary destinations.

Introduction

Australia was ranked tenth in 1996 in world travel service exports, measured in terms of travel credits, and ranked ninth in travel surplus, in millions of U.S. dollars (International Monetary Fund, Balance of Payments Statistics Yearbook, 1997). In terms of world market share, Australia attracted 0.7% of international tourist arrivals and was ranked at number 30 in the world's top tourism destinations in 1996. Between 1990 and 1996, Australia experienced an average annual growth rate of 23% in tourist arrivals from Asia (Australian Bureau of Statistics, 1997).

Tourists from Singapore, which is Australia's fifth major market, represented 6% of international tourist arrivals to Australia in 1996. The average annual growth rate of tourist arrivals from Singapore in 1990-96 was around 20%, which had increased from an average growth rate of 12.6% in 1985-89. Singapore has the highest Gross Domestic Product per capita in South-East Asia. Like Hong Kong, South Korea and Taiwan, it has emerged as one of the four Newly Industrialised Economies (NIEs) of East Asia. Its impressive economic growth has taken off and has been sustained mainly through its outward-oriented export-led and import-substitution industrialization policies. Singapore is a small densely populated city state which ranked 6th as a tourism spender in East Asia and the Pacific in 1997 (World Tourism Organization, 1999). In terms of the share of Asia-Pacific destinations, Singapore resident departures to Australia was over 11% in 1996 (Pacific Asia Travel Association, 1996). Although tourist arrivals from the rest of Asia fell by about 30% due to the currency and economic crises, Singapore has remained the largest non-Japanese Asian tourist market for Australia (Stretton and Thomas, 1998). Despite the Asian crisis in 1997-98, tourist arrivals from Singapore continued to rise during this period, but the growth rate fell substantially from 7.4% in 1996/97 to 3.3% in 1997/98.

The main reason stated on their disembarkation cards by inbound tourists for visiting Australia is for holiday and recreation. The majority of visitors are independent tourists who are not travelling with any tour groups. In 1998, 46% of Singaporean visitors were between the ages of 20 and 39, and the gender balance was almost equal for this age group. Many Singaporean tourists to Australia are repeat tourists, which is supported by surveys undertaken by the Bureau of Tourism Research (BTR): 74% of about 1,300 interviewed Singaporean tourists (aged 15 years and above) responded that they had previously been to Australia (Bureau of Tourism Research, 1999). Invariably, Perth, the capital of Western Australia, attracts most, or roughly one-third, of tourists from Singapore, followed closely by Sydney. This attraction to Perth can be attributed to proximity, same time zone and frequent daily flights. Until recently, there were as many as 2 flights per day between Singapore and Perth, with 3 flights on Sundays. The number of flights between Perth and Singapore has recently increased to 3 flights per day throughout the week. Not surprising, BTR's survey showed that the dominant activities undertaken in Australia by tourists are shopping and visiting friends and relatives.

Most economic variables are available at least on a quarterly basis. With this in mind, the purpose of the paper is to use time series econometric modelling of inbound tourism based on seasonally unadjusted quarterly data to obtain estimates of income, price and transportation cost elasticities of travel to Australia by Singaporean residents. Very few published empirical tourism studies have used quarterly data. The number of observations used in recent studies (see, for example Bakalis et al (1994); Di Matteo and Di Matteo (1993); Kulendran (1996); Morris et al (1995); Seddighi and Shearing (1997)) ranges from 44 to 90.

The primary purpose of this paper is to use ordinary least squares to estimate the important influences of several economic factors on tourism demand by Singapore for Australia. The results will be compared with the estimated coefficients obtained using the cointegration model, which accommodates the presence of unit roots (nonstationarity) in the variables. Finally, the empirical section will evaluate the sensitivity of tourist arrivals from Singapore to changes in the economic variables.

Data and Methodology

Growth in international tourism is closely aligned to economic variables, which at a microeconomic level influence the consumer's decision to undertake overseas travel. Empirical research on international tourism demand has overwhelmingly been based on aggregate time series data, which permits estimation of income and price elasticities on inbound tourism (see Lim, 1997). A simple origin-destination demand model for international tourism can be written as:

$$D_t = f(Y_t, TC_t, P_t) \qquad (1)$$

where

D_t is a measure of travel demand at time t (t = 1, … , T);

Y_t is a measure of income of the tourist-generating or origin country at time t;

TC_t is a measure of transportation costs from the origin to destination country at time t;

P_t is a measure of tourism price of goods and services at time t.

Equation (1) is often expressed in log-linear (or logarithmic) form to capture the multiplicative effects in the levels of the variables. Furthermore, the estimated elasticities are obtained as the coefficients of the following equation:

$$\ln D_t = \alpha + \beta \ln Y_t + \gamma \ln TC_t + \delta \ln P_t + u_t \qquad (2)$$

where β, γ and δ are elasticities, and u_t is a zero mean independently and identically distributed error term. The estimation of equation (2) requires data on tourist arrivals, income, transportation costs and prices. In this study, aggregate tourist arrivals from Singapore to Australia are used to represent international tourism demand by Singaporean residents. Numerous variables have been used in previous tourism studies to represent income (see Lim, 1997). In this paper, real Gross Domestic Product (GDP) per capita of Singapore at 1990 prices (S$ millions) is used as a proxy for the income of tourists.

The amount of international travel demanded is also likely to depend to a significant extent on prices. Tourism expenditures compete with other goods and services for the consumer's budget. Thus, any divergence between the price of goods and services in the destination country (Australia) and the domestic price of goods and services in the origin country (Singapore) is likely to have implications for the tourist industry in Australia. Transportation cost is typically the single most important item in the overall travel costs for a tourist.

Some methodological issues and data problems arise concerning the measurement of the tourism price and transportation cost variables. Many past tourism studies have used the ratio of the consumer price indices (CPI) of the destination country and the CPI of the origin country as a proxy for the tourism price variable. The choice of such a measure is debatable. It is argued in

Lim (1997, p. 842) that: "In measuring relative price movements in the origin and destination, it is desirable to have indices constructed using a basket of goods purchased by tourists." However, the use of the CPI ratio as a proxy for the tourism price variable is appropriate when data on the tourist price indices are not available.

The exchange rate has also been used to represent tourism prices in the empirical literature, since such information is readily available to tourists and is generally known in advance. Alternatively, the CPI ratio could be adjusted for differences in exchange rates between the origin and destination currencies. The exchange rate-adjusted CPI ratio, also known as the real exchange rate, is included here as a proxy for tourism prices. Transportation costs are represented by two variables. Real round-trip normal coach economy class airfares from Singapore to Sydney, published in Neutral Units of Construction (formerly known as Fare Construction Units) and in Singaporean currency, are used as a proxy for transportation costs. Real return-trip coach economy low apex fares, excursion fares, or discount fares are preferable as proxies for transportation costs, but they are published only occasionally. A lagged dependent variable, namely previous values of tourist arrivals, is also included to capture the simple dynamics of tourism. The presence of a significant lagged dependent variable implies the existence of lagged values of all the explanatory variables in the model.

Given New Zealand's proximity to Australia, it would be useful to examine the effects of the relative price changes in New Zealand and Australia on international travel demand for Australia. If a fall in the relative tourism prices in New Zealand reduces the demand for international tourism demand for Australia, New Zealand could be considered as Australia's competing (or substitute) destination for the Singaporean tourist market. Specifically, Singapore may consider New Zealand as a substitute overseas destination for Australia. When a fall in New Zealand relative tourism prices increases international tourism demand for Australia, the two countries are complementary destinations for Singaporean tourists. It is imperative from the tourism marketing SWOT (strengths, weaknesses, opportunities and threats) analysis to examine whether New Zealand is Australia's substitute or complementary destination. The inclusion of the CPI ratio and the real exchange rate of Australia and New Zealand as proxy variables for competitive prices is to accommodate such a possibility.

The regression analysis undertaken in this paper is based on seasonally unadjusted quarterly data. Since the exchange rate data are available only from 1980, inbound tourism from Singapore to Australia is examined for the period 1980(4) to 1996(4). Data for all the variables are obtained from various statistical publications by the Australian Bureau of Statistics, Singapore Department of Statistics, Statistics New Zealand Infos database, IMF Balance of Payments Statistics Yearbook, ABC World Airways Guide and OAG World Airways Guide.

Empirical Results and Analysis

The graphs of the logarithms of the variables for the period 1980(4) to 1996(4) are given in Figures 1 and 2. Several of the series display upward trends. If income, tourism prices and transportation costs are important factors that affect international tourism demand, economic theory postulates that the coefficient of the income variable will be positive, and the coefficients of tourism (or relative) prices, exchange rate, real exchange rate and transportation costs will be negative. Moreover, if New Zealand is a substitute foreign destination for Australia, the coefficient of the relative price variable will be positive. The opposite is true for the coefficient of the relative price variable if New Zealand and Australia are complementary destinations for tourists from Singapore. As a model is a set of assumptions, and the variables included in the model are well known and firmly grounded in demand theory, no further discussion of these variables would seem to be warranted (see Lim, 1997).

Using the EViews 3 (1997) software package to estimate a single-equation model by ordinary least squares, the results shown in Tables 1 to 4 are obtained for twelve dynamic non-nested variations of equation (2), as follows:

$$\ln D_t = \alpha + \beta \ln Y_t + \gamma \ln\{F1_t \text{ or } F2_t\} + \delta \ln\{RP_t, ER_t \text{ or } RER_t\} + \phi \ln D_{t-1} + \theta \ln CP_t + u_t$$

where

$\ln D_t$ = logarithm of short-term quarterly tourist arrivals (or demand) from Singapore to Australia at time t;

$\ln Y_t$ = logarithm of Singaporean real GDP per capita at time t;

$\ln F1_t$ = logarithm of real round-trip coach economy airfares in Neutral Units of Construction (NUC) between Singapore and Sydney at time t;

$\ln F2_t$ = logarithm of real round-trip coach economy airfares in Singapore currency between Singapore and Sydney at time t;

$\ln RP_t$ = logarithm of relative prices [or CPI (Australia)/CPI (Singapore)] at time t;

$\ln ER_t$ = logarithm of exchange rate (Singaporean dollar per Australian dollar) at time t;

$\ln RER_t$ = logarithm of real exchange rate [or CPI (Australia)/CPI (Singapore) * 1/ER] at time t;

$\ln CP_t$ = logarithm of competitive prices [using CPI (Australia)/CPI (New Zealand) or CPI (Australia)/CPI (New Zealand) * 1/ER] at time t;

u_t = independently distributed random error term, with zero mean and constant variance σ_u^2 at time t;

$\alpha, \beta, \gamma, \delta, \phi, \theta$ = parameters to be estimated;

$\beta > 0, \gamma < 0$, $\delta < 0$, $0 < \phi < 1, \theta > 0$ (substitutes) and $\theta < 0$ (complements) are the prior restrictions on the parameters.

In Tables 1 and 2, the CPI ratio of Australia and New Zealand is used as a proxy for competitive prices, whereas the real exchange rate of Australia and New Zealand is included as a proxy for competitive prices in Tables 3 and 4. Real GDP per capita (measure of income) has a positive and highly significant effect in all the models. Tables 1 and 2 show that all the estimated coefficients are significant at the 5% level for model 1. Between one and as many as four insignificant coefficients are obtained for the other models at the 5% level. The results of model 1 and 4 in Table 1 and 2, respectively, support the view that inbound tourism is positively related to the income of the origin country and negatively related to tourism prices. Furthermore, the significant negative estimate of the competitive price variable suggests that New Zealand is a complementary destination for Australia. However, the estimated coefficients of transportation costs and the lagged dependent variable in model 1 do not have the correct signs, even though they are significant. In fact, none of the estimated coefficients of the lagged dependent variable has the correct sign in any models.

The adjusted R-squared $(\overline{R}^2)$ values, as measures of goodness of fit, are quite high and all exceed 0.89. Since none of the six models in Tables 1 and 2 has serial correlation in the residuals, as indicated by the Lagrange multiplier test for serial correlation (LM(SC)), the OLS estimates are consistent. Serial correlation is present (marginally) in models 8 and 11 of Tables 3 and 4. Thus, models 1 and 4 have the largest number of significant estimated coefficients (with the correct sign) and no serial correlation.

As a guide to model selection, the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) are often used, in which case the model with the smallest AIC and SBC values is preferred. Since model 1 has the smaller information criterion, it is considered to be the 'best' estimated regression model to represent international tourism demand by Singapore for Australia. If the model is re-specified by deleting the transportation cost and the lagged dependent variables, there is a problem with serial correlation in the residuals. The serial correlation problem is also encountered when only the lagged dependent variable is deleted from model 1. However, by omitting the transportation cost variable only, the estimated model has no serial correlation and the estimates are quite similar to the initial results obtained for model 1, namely (with absolute t-statistics in parentheses):

$$\ln D_t = -24.6 + 4.76 \ln Y_t - 2.12 \ln RP_t - 0.30 \ln D_{t-1} - 4.11 \ln CP_t$$
$$\quad (7.17) \quad (9.69) \qquad (2.44) \qquad (3.16) \qquad (3.01)$$

$\overline{R}^2 = 0.905, \qquad AIC = 0.233, \qquad SBC = 0.400.$

It is generally recognised that seasonality in tourist arrivals gives rise to distinct patterns in the series. For instance, using seasonal dummy variables (see Lim and McAleer, 2000), the 4th quarter tourist arrivals from Singapore tends to be high whereas the growth rates of arrivals decline to the lowest level in the 1st quarter. In this case, the seasonal pattern is assumed to be constant, that is, seasonality is deterministic. However, the test of the presence of seasonal unit roots has also been examined in Lim and McAleer (2000) using the Hylleberg, Engle, Granger and Yoo (1990) (HEGY) test, indicating a varying and changing seasonal pattern for tourist arrivals from Singapore to Australia. More specifically, the results suggest that quarterly tourist arrivals from Singapore have unit roots at the zero and semi-annual frequencies but not at the annual unit frequency.

The inclusion of two seasonal dummy variables, D_{2t} and D_{4t} in model 1 yields the following results (with absolute t-ratios in parentheses):

$$\underset{}{\ln D_t} = \underset{(5.08)}{-10.1} + \underset{(5.56)}{1.54 \ln Y_t} + \underset{(2.16)}{0.31 \ln F1} - \underset{(2.28)}{0.87 \ln RP_t} + \underset{(7.92)}{0.53 \ln D_{t-1}} - \underset{(3.04)}{1.85 \ln CP_t} + \underset{(9.75)}{0.39 D_{2t}} + \underset{(16.5)}{0.90 D_{4t}}$$

$\overline{R}^2 = 0.985$, AIC = -1.503, SBC = -1.236.

Respecification of model 1 by accommodating seasonal factors has led to a better estimated model. The lagged dependent variable is significant with the correct sign, and the model has no evident serial correlation.

Tests of unit roots and cointegration for tourist arrivals from Singapore to Australia are reported in Lim and McAleer (2001). Tests of nonstationarity using the augmented Dickey-Fuller test provides useful information to explain the long-run relationships of these variables. Unit roots are present in all variables and they are integrated of order one, I(1). Johansen's maximum likelihood procedure, which is used to estimate and test the cointegrating relations, shows that a long-run relationship exists among international tourism demand, real income, real airfares (in Singapore currency) and the exchange rate for tourist arrivals from Singapore to Australia. In contrast to model 1 using univariate OLS estimation, the cointegrating regression of the long-run demand for international travel to Australia by tourists from Singapore is given as follows (with absolute t-ratios in parentheses):

$$\underset{}{a = 16.5} + \underset{(6.44)}{1.59y1} - \underset{(3.60)}{2.29rf2} - \underset{(5.99)}{1.27er}$$

where

a = logarithm of tourist arrivals from Singapore to Australia;

y1 = logarithm of real GDP per capita in Singaporean dollar;

rf2 = logarithm of real round trip coach economy airfares in Singaporean dollar;

er = logarithm of exchange rate.

In the cointegration model, the transportation cost variable is significant, while using the exchange rate as the proxy renders the tourism price variable significant. The competitive price variable was not included in the earlier study. According to the error-correction model (ECM), changes in tourist arrivals from Singapore react in the short-run to the seasonal dummy variables and the one-period lagged change in tourist arrivals, with all variables significant at the 5% level.

Table 5 shows that all of the diagnostic tests for the selected model 1 and the cointegration model are insignificant, except for Chow 1 (for breakpoint) in the single equation model. Thus, Chow's first test rejects the null hypothesis of parameter constancy for the tourism demand single equation model before and after the first quarter of 1990.

It is evident from model 1 that real GDP per capita of Singapore and tourism prices have significant positive and negative effects, respectively, on inbound tourism to Australia from

Singapore. In order to test whether tourist arrivals from Singapore are sensitive to changes in the origin's income and tourism prices (namely, the income elasticity exceeds 1.0 and the tourism price elasticity is less than –1.0), respectively, the null and alternative hypotheses to be tested are specified as follows:

$H_0 : \beta = 1, \qquad H_1 : \beta > 1;$

$H_0 : \delta = -1, \qquad H_1 : \delta < -1.$

The t-ratio for the null hypothesis for the income variable in model 1 is 1.95. Since the null hypothesis of a unitary income elasticity is not rejected (marginally) at the 5% significance level, inbound tourism from Singapore is income inelastic. In addition, the t-ratio for the tourism price variable in model 1 does not reject the null hypothesis at the 5% significance level (with a t-ratio of 0.34), implying that international tourism demand is price inelastic

Conclusion

Singapore has the second highest per capita GDP in Asia of US$29,610 in 1999, after Japan, which ranked sixth in the world (World Bank, 2000). The affluence of Singaporean residents, the country's proximity to Australia, and Australia's reputation as a safe and clean country, have meant that Australia is one of the top overseas holiday destinations for Singaporeans. Using a dynamic log-linear single equation model, the empirical results show that real income per capita of Singapore and the relative (or tourism) prices of the two countries have significant influences on inbound tourism from Singapore to Australia.

If international travel demand for Australia by different tourist source markets enters the cycle of introduction, growth, maturity and decline (also known as the product life cycle), the Singapore market is at the growth stage of the life cycle. The empirical results suggest that Australia and New Zealand are complementary destinations for Singaporean tourists. An important marketing implication is the possible extension of the growth stage through joint marketing efforts by the Tourist Commissions of both Australia and New Zealand. The two Commissions could promote more frequent repeat tourists to Oceania and expand the current market by encouraging new tourists to participate in the tourism product, service and experience they can offer jointly.

The findings of the paper also show that international tourism demand by Singapore for Australia is income and price inelastic. But according to the cointegration model, the long-run real income, real airfare and exchange rate (proxy for price) effects are elastic. This paper highlights an empirical issue involving the estimation of demand models using non-stationary data. A clear message here is a need to distinguish between spurious and cointegrating regressions. The single equation regression model modelled in this paper may be deceptive in suggesting that such a relationship exists between tourist arrivals, real income and tourism prices. Cointegration provides a way of avoiding a deceptive inference associated with a spurious regression (see, for example, the discussion in Kulendran, 1996 and Morley, 2000). However, it is also worthwhile bearing in mind that the number of observations available is reduced in a differenced series and therefore a large sample size is usually required to be able to use a cointegration model sensibly.

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References

ABC World Airways Guide, Various issues. T. Skinner, London.

Australian Bureau of Statistics, 1980-1999, Various Issues of Overseas Arrivals and Departures, Canberra.

Bakalis, S., A. Morris and K. Wilson (1994), Tourism Trends to 2000 from the Antipodes to the Old Continent, in A.V. Seaton (ed.), *Tourism, The State of the Art*, New York: Wiley, 415-427.

Bureau of Tourism Research (1999), *1998 International Visitor Survey*, Canberra.

EViews 3 (1997), Quantitative Micro Software, California : Irvine.

Di Matteo, L. and R. Di Matteo (1993), The Determinants of Expenditures by Canadian Visitors to the United States, *Journal of Travel Research*, 31, 34-42.

Hylleberg, S., R.F. Engle, C.W.J. Granger and B.S. Yoo (1990), Seasonal Integration and Cointegration, *Journal of Econometrics*, 99, 215-238.

International Monetary Fund (1997), *Balance of Payments Statistics Yearbook*, Part 2, Washington D.C.: IMF.

Kulendran, N. (1996), Modelling Quarterly Tourist Flows to Australia using Cointegration Analysis, *Tourism Economics*, 2(3), 203-222.

Lim, C. (1997), Review of International Tourism Demand Models, *Annals of Tourism Research*, 24, 835-849.

Lim C. and M. McAleer (2000), A Seasonal Analysis of Asian Tourist Arrivals to Australia, *Applied Economics*, 32, 499-509.

Lim C. and M. McAleer (2001), Cointegration Analysis of Quarterly Tourism Demand by Hong Kong and Singapore for Australia, to appear in *Applied Economics*.

Morley, C. (2000), Demand Modelling Methodologies: Integration and Other Issues, *Tourism Economics*, 6(1), 5-19.

Morris, A., K. Wilson and S. Bakalis (1995), Modelling Tourism Flows from Europe to Australia, *Tourism Economics*, 1(2), 147-167.

OAG World Airways Guide, Various issues, London: T. Skinner.

Pacific Asia Travel Association, Various issues of Annual Statistical Report, San Francisco.

Seddighi, H.R. and D.F. Shearing (1997), The Demand for Tourism in North East England with special reference to Northumbria: An Empirical Analysis, *Tourism Management*, 18(8), 499-511.

Singapore Department of Statistics, Various issues of *Monthly Digest of Statistics*, Singapore: Department of Statistics.

Stretton, R. and I. Thomas (1998), Asian turmoil blows away tourist numbers faster than predicted, *Australian Financial Review*, June 12, p. 12.

World Bank (2000), *World Development Indicators*, International Bank for Reconstruction and Development, Washington D.C.: World Bank.

World Tourism Organization (1998), *Yearbook of Tourism Statistics*, Volume 1 (49th ed.), Madrid: World Tourism Organization.

World Tourism Organization (1999), *Tourism Market Trends: East Asia and the Pacific 1989-1998*, Madrid: World Tourism Organization.

Table 1

Demand Elasticities for Inbound Tourism from Singapore to Australia

Explanatory Variables[a]	Model 1	Model 2	Model 3
Constant	-28.68 (7.38)	-9.00 (2.11)	-13.40 (2.20)
Y	4.66 (9.71)	3.30 (9.19)	3.31 (6.80)
F1	0.70 (2.07)	-0.38 (0.85)	0.10 (0.19)
RP	-2.53 (2.92)	_	_
ER	_	-1.39 (2.82)	_
RER	_	_	0.53 (1.05)
D_{t-1}	-0.34 (3.62)	-0.40 (4.02)	-0.35 (3.40)
CP*	-4.84 (3.52)	0.21 (0.27)	0.09 (0.07)
$\bar{R}^2$	0.912	0.911	0.901
F	121.76	120.62	107.06
LM(SC)	1.407	1.504	0.670
AIC	0.194	0.202	0.310
SBC	0.394	0.403	0.511

[a] All variables are in logarithms, with absolute t-statistics in parentheses.
* Using the CPI ratio of Australia and New Zealand as a proxy variable.

Table 2

Demand Elasticities for Inbound Tourism from Singapore to Australia

Explanatory Variables[a]	Model 4	Model 5	Model 6
Constant	-31.27 (4.99)	-5.80 (0.95)	-7.96 (1.00)
Y	4.96 (9.66)	3.14 (8.23)	3.11 (5.82)
F2	0.63 (1.28)	-0.58 (1.10)	-0.37 (0.63)
RP	-2.47 (2.73)	_	_
ER	_	-1.32 (3.21)	_
RER	_	_	0.75 (1.76)
D_{t-1}	-0.30 (3.20)	-0.41 (4.15)	-0.36 (3.47)
CP*	-4.73 (3.28)	0.18 (0.25)	0.69 (0.56)
$\overline{R}^2$	0.908	0.912	0.901
F	116.16	121.70	107.77
LM(SC)	0.161	1.964	0.475
AIC	0.237	0.194	0.304
SBC	0.437	0.395	0.505

[a] All variables are in logarithms, with absolute t-statistics in parentheses.
* Using the CPI ratio of Australia and New Zealand as a proxy variable.

Table 3

Demand Elasticities for Inbound Tourism from Singapore to Australia

Explanatory Variables[a]	Model 7	Model 8	Model 9
Constant	-18.11 (5.62)	-9.19 (2.45)	-11.84 (3.10)
Y	3.46 (7.68)	3.25 (9.21)	3.12 (7.63)
F1	0.49 (1.37)	-0.28 (0.74)	0.14 (0.39)
RP	-0.55 (1.16)	_	_
ER	_	-1.39 (3.71)	_
RER	_	_	0.68 (2.83)
D_{t-1}	-0.31 (3.05)	-0.41 (4.21)	-0.38 (3.77)
CP*	0.61 (1.30)	0.54 (1.46)	0.78 (1.90)
$\overline{R}^2$	0.896	0.914	0.906
F	101.79	125.21	114.34
LM(SC)	0.594	3.782	1.403
AIC	0.356	0.168	0.251
SBC	0.556	0.369	0.452

[a] All variables are in logarithms, with absolute t-statistics in parentheses.
* Using the real exchange rate of Australia and New Zealand as a proxy variable.

Table 4

Demand Elasticities for Inbound Tourism from Singapore to Australia

Explanatory Variables[a]	Model 10	Model 11	Model 12
Constant	-17.95 (3.38)	-6.34 (1.14)	-9.61 (1.69)
Y	3.69 (8.61)	3.13 (8.53)	3.12 (7.47)
F2	0.18 (0.36)	-0.47 (0.99)	-0.13 (0.28)
RP	0.50 (1.04)	_	_
ER	_	-1.35 (4.02)	_
RER	_	_	0.72 (3.09)
D_{t-1}	-0.28 (2.78)	-0.42 (4.31)	-0.38 (3.76)
CP*	0.51 (1.08)	0.53 (1.43)	0.77 (1.87)
$\bar{R}^2$	0.893	0.914	0.906
F	98.551	126.20	114.17
LM(SC)	1.124	4.449	1.071
AIC	0.385	0.161	0.252
SBC	0.585	0.362	0.453

[a] All variables are in logarithms, with absolute t-statistics in parentheses.
* Using the real exchange rate of Australia and New Zealand as a proxy variable.

Table 5

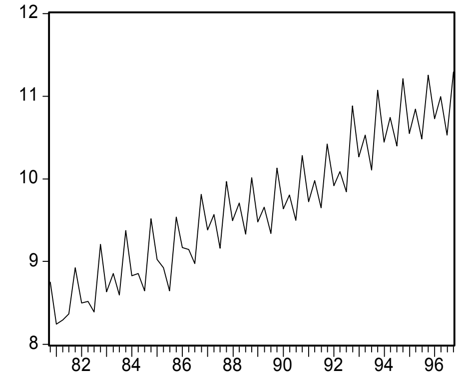
Diagnostic Test Results for Inbound Tourism from Singapore using Single Equation and Cointegration Models

Diagnostics	Single Equation Model	Cointegration Model
$F_{LM(SC)}$	1.047 (0.25)	2.02 (0.14)
$F_{(H)}$	1.017 (0.44)	0.79 (0.72)
LM(N)	1.325 (0.52)	0.78 (0.68)
$F_{(CHOW\ 1)}$	2.713 (0.02)	0.71 (0.74)
$F_{(CHOW\ 2)}$	0.955 (0.55)	0.52 (0.95)

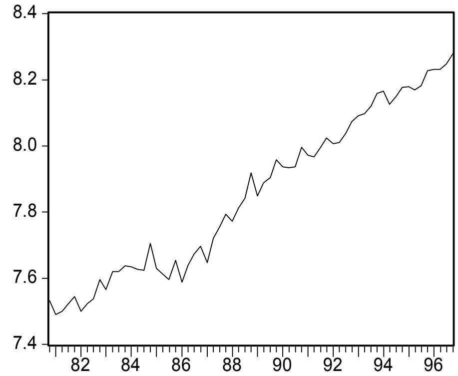
Notes:
$F_{LM(SC)}$ and $F_{(H)}$ are Lagrange multiplier tests for serial correlation and heteroskedasticity, respectively; LM(N) refers to the Jarque-Bera Lagrange multiplier test for normality; $F_{(CHOW\ 1)}$ and $F_{(CHOW\ 2)}$ are Chow's first and second tests for structural change, respectively; figures in parentheses denote probability values.

Figure 1

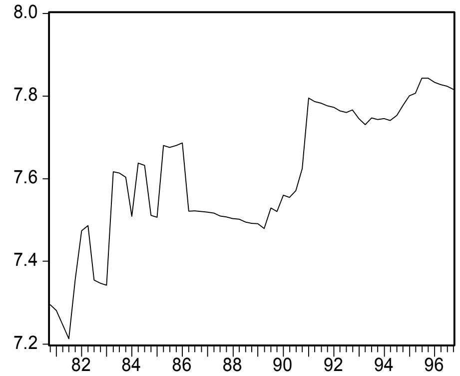
Logarithms of Tourist Arrivals, Real GDP Per Capita, Transportations Costs and Competitive Prices, Singapore 1980-1996



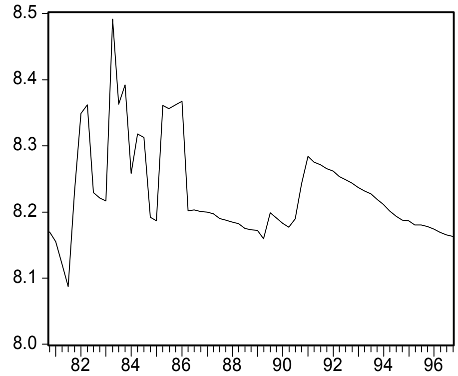
Tourist Arrivals from Singapore



Real GDP per capita



Real Round-Trip Airfare in NUC



Real Round-Trip Airfares in Singapore Currency

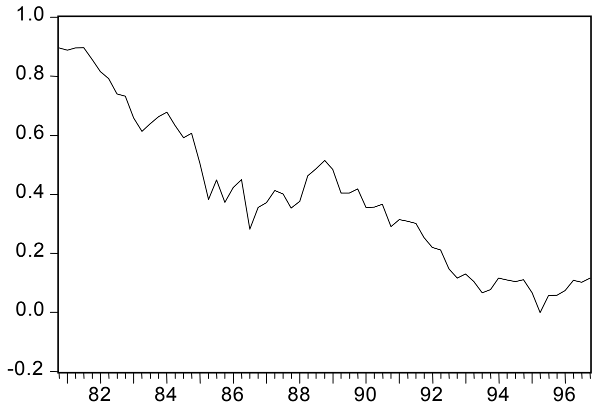
CPI ratio of Australia & New Zealand

Real Exchange Rate of Australia & New Zealand

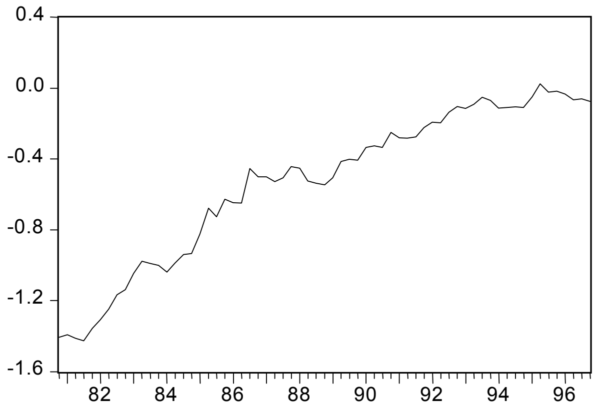
Figure 2

Logarithms of Tourism Prices, Singapore, 1980-1996

Relative Prices



Exchange Rate



Real Exchange Rate