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MODELLING DOMESTIC TOURISM DEMAND IN AUSTRALIA: A DYNAMIC PANEL DATA APPROACH

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Abstract

Domestic tourism in Australia generates about 74% of total tourism revenue. Given that, this paper examines whether changes in Australian households' income and the prices of domestic travel can influence the demand for domestic travel. It reveals some notable results. First, Australian households will not choose to travel domestically when there is an increase in household income. Second, an increase in the current prices of domestic travel can cause the demand for domestic trips to fall in the next one or two quarters ahead. Finally, the coefficients for lagged dependent variables are negative, indicating perhaps, that trips are made on a periodic basis.

Keywords: *domestic tourism, Australia, households' income, domestic travel*
JEL classification numbers: *C23, L8*

INTRODUCTION

Domestic tourism dominates most of the tourism business in Australia. For the year ended 30th June 2007, there were 74 million domestic visitors in Australia, whereas the number of international tourist arrivals was only five million (*Travel by Australians: June 2007)*. Furthermore, domestic visitors spent 288 million nights in Australia, while international visitors only spent 160 million nights. In terms of generating tourism revenue, the total spending by domestic visitors in 2007 was AUD 43 billion, which was 1.5 times higher than the aggregate expenditure by international tourist arrivals. Furthermore, domestic tourism is the main contributor of income for people who worked in the tourism industry. In 2007, the average annual income of each person employed in tourism industry was AUD 26,404. Out of the figure, AUD 15,675 was contributed from domestic tourism whereas AUD 10,729 was generated from international tourism. Moreover, during 2004 and 2007, approximately 60% of the salary came from the expenditure by domestic tourists and 40% from the spending by international tourists.

Despite the fact that average expenditure per international tourist in Australia is higher (AUD 3,702 according to *International Visitors in Australia: March 2008*) than the average spending per domestic tourist, domestic tourism made significant economic contributions to the Australian economy. In 2006-2007, domestic visitors consumed 73.7% of the Australian produced

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tourism goods and services, whereas international tourists consumed 26.3% (*Tourism Satellite Account: 2006-2007*). Furthermore, Tourism Research Australia introduced the metrics Total Domestic Economic Value (TDEV) for domestic tourism and Total Inbound Economic Value (TIEV) for international tourist arrivals in Australia, for measuring the value of domestic and international visitors' consumption made during their trips in Australia. They found that, in 2008, TDEV was AUD64 billion whereas AUD24 billion for TIEV (*Travel by Australians: March 2008* and *International Visitors in Australia: March 2008*). Overall, the above figures indicate that sustaining domestic tourism is important as the industry plays a significant role in maintaining tourism businesses in Australia.

Another consideration is that, during the occurrence of world unexpected events, domestic tourism in Australia performed well whilst international tourism was negatively affected. For instance, when the terrorist attacks occurred in late 2001, the number of domestic tourists grew 1.66% while international tourist arrivals declined 5.68%. Similarly, during the outbreak of the SARS virus in 2003, domestic visitor numbers increased 0.23% whereas international tourist arrivals fell 2.25%. Hence, these two examples imply that domestic tourism can help to sustain tourism business in Australia when there is a fall in international tourism business due to the impacts of negative events.

However, since 2004, the number of domestic overnight tourist nights in Australia experienced a gradual decline while there was a surge in the number of Australians travelling overseas (Table 1). For example, in 2005, the numbers for domestic tourism fell by 2.93% whereas the number of Australians travelling overseas increased by 16.62%. Furthermore, another issue of concern is that domestic visitor nights are expected to have a stagnant growth from 2010 to 2016 while Australian's demand for outbound tourism is anticipated to increase (see Table 2).

The different performance between domestic and Australian outbound tourism has raised the question as to what factors could cause Australians to choose overseas travel rather than domestic trips. The underlying reason could be related to the strong economic growth in Australia. Between 2000 and 2006, the average annual percentage growth in gross domestic product (GDP) per capita was 5.6% and 2.3% for real disposable income per capita. In the same period, consumer spending in Australia looked positive, as household consumption grew 6.2% annually. As household income has increased during a period of high economic growth in Australia, Australian residents would be willing to spend on more luxury and exotic overseas trips.

Table 1: Domestic and Outbound Visitors in Australia, 2004-2007

Year	Number of domestic visitors ('000)	% change in domestic visitors	Number of Australian travelled overseas ('000)	% change in Australian travelled overseas
2004	74,356	-1.14	3,937	19.54
2005	72,178	-2.93	4,591	16.62
2006	71,934	-0.34	4,835	5.31
2007	73,571	2.28	5,127	6.04

Source: *Travel by Australians*, June 2004 – June 2007 issues, Tourism Research Australia. International Visitors in Australia, June 2004 – June 2007 issues, Tourism Research Australia.

Table 2: Forecast of the Growth of Domestic Visitor Nights and Australians Travelled Overseas for the Year 2010-2013

Year	Growth in domestic visitor nights (%)	Growth in Australians travelling overseas (%)
2010	0.0	6.8
2011	0.5	5.8
2012	0.4	4.9
2013	0.4	4.0
2014	0.4	3.9
2015	0.5	3.4
2016	0.4	3.3

Source: Based on *Forecast* (Issue 2) 2007, Tourism Research Australia

The uncertainty about the future of the Australian economy, given factors such as rising mortgage interest rates and inflation, may affect the demand for domestic tourism. According to Tourism Research Australia, the recent high prices of Australia's goods and services, particularly petrol, reduced the amount of income for discretionary spending and placed downward pressure on the number and duration of domestic tourism trips (*Forecast*: *Issue 2, 2007*). Furthermore, Crouch et al. (2007) expressed concern that changes in discretionary income, which could be caused by declining real wages, changes in interest rates and/or changes in living costs, could substantially affect tourism demand.

In general, domestic tourism is an important component of business for tourism in Australia because it has the largest shares of total tourist numbers and expenditure. Because of this, it is imperative to sustain this business and avoid losing its competitiveness. In the following paper, we examine Australian domestic tourism demand by investigating whether changes in economic conditions in Australia would affect the demand.

METHODS

Research on tourism demand has grown rapidly since the 1960s. Li et al. (2005) asserted that there were great developments in tourism demand analysis in terms of the diversity of research interests, the depth of theoretical foundations and advances in research methodologies. For instance, between the 1960s and 1994, most tourism research employed static econometric approaches such as Ordinary Least Squares (OLS) and Generalised Least Squares (GLS) to model international tourism demand (for example, Gray, 1966; Loeb, 1982; Rugg, 1973 and Sheldon, 1994). Since 1995, there is growing interest for tourism researchers in introducing more advanced time-series econometric models, such as the error correction model (ECM) and time-varying parameters (TVP), into the literature of modelling international tourism demand (for example, Kulendran and King, 1997, and Song and Wong, 2003).

On the other hand, there is an escalating literature on modelling tourism demand using time-series models. Martin and Witt (1989) was a pioneering paper which introduced simple time-series models, such as naïve, simple autoregressive, smoothing exponential and trend curve analysis, into the literature. According to this paper, simple time-series models such as naïve and autoregressive (AR) models can generate relatively better forecasts than more sophisticated econometric models. Since then, the literature has eventually employed more advanced time-series models, such as sea-

sonal ARIMA and conditional volatility models, to model tourism demand (for example Kim and Moosa, 2001, Kulendran and Wong, 2005, and Shareef and McAleer, 2007).

Lim (1997) discovered that most of the tourism demand research employed log-linear models because the models provide estimated elasticities which are easy to interpret. Nevertheless, the application of log-linear models in the studies of tourism demand may not be appropriate because such models assume constant elasticity throughout time. Several empirical papers have reported that the demand elasticities are varying across different time periods. For instance, even though income and price are the important determinants of international tourism demand, Crouch (1994) discovered that the effects of these two determinants on international tourism demand varied across 77 studies from the 1960s to 1980s. Furthermore, Morley (1998) argued that income elasticities are time-varying. The author found that income elasticities for tourists from New Zealand, USA, UK and Canada travelling to Australia were higher in 1980 than in 1992, implying that these tourists were more income sensitive to travel to Australia in 1980 compared to 1992.

To take account of dynamic changes in demand elasticities, advanced time-series econometric approaches, such as the error correction model (ECM), time-varying parameters (TVP), vector autoregressive (VAR) models and time-series models augmented with explanatory variables (or ARIMAX), have been introduced in the literature (Li et al., 2005). Li et al. (2005) also found that the applications of such models can improve the estimations of tourism demand models. For instance, the TVP model is able to take account of dynamic changes of tourists' behaviour over time (Song and Wong, 2003).

Apart from econometric time-series regressions, panel data analysis has also appeared in the tourism demand research literature (Eilat and Einav, 2004, Garin-Munoz and Amaral, 2000, Ledesma-Rodriguez et al., 2001, Naude and Saayman, 2005 and Romilly et al., 1998). The panel data models that were used in the literature are pooled logit regression, the generalized method of moments (GMM) procedure of Arellano and Bond (1991), generalised least squares (GLS) panel data regressions, and ordinary least square (OLS) panel data regressions (which comprise of fixed and random effects models). Furthermore, the existing research papers have carried out diagnostic tests to examine the robustness of panel data models. For instance, Ledesma-Rodriguez et al. (2001) have conducted panel unit roots and Hausman-Taylor tests in the study of Tenerife's international tourism demand. A study by Naude and Saayman (2005) has investigated the existence of serial correlation in Africa's tourist arrival data using the Arellano-Bond test of first and second autocorrelations. Furthermore, Garin Munoz and Amaral (2000) employed the Wald test to evaluate the joint significance of independent variables in panel data models for Spanish tourism demand.

Panel data analysis has several advantages. It combines cross-sectional and time-series data, and provides larger degrees of freedom (Song and Witt, 2000). In addition, panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency (Baltagi, 2001).

However, comparing the volume of econometric and time-series analyses in tourism literature, Song and Li (2008) discovered that panel data approach has rarely been employed in tourism demand research. Moreover, thus far, there is virtually no empirical research investigating domestic tourism demand using a panel data approach.

This study uses a dynamic panel model. The benefit of such model is that it

contains a lagged dependent variable which can be used to measure tourists' habit persistency. To illustrate the point, the panel data with serial correlation model is developed as follows:

$$y_{jt} = v'_{jt}\delta + \alpha_j + \varepsilon_{jt}, \quad (1)$$

$\varepsilon_{jt} = \rho\varepsilon_{j,t-1} + \eta_{jt}$, $|\rho| < 1$ and η_{jt} are independent and identically distributed.

where:

y_{jt} = demand for domestic tourism in State j

c = a common constant term

v = a vector of explanatory variables.

t = time subscript.

α_j = individual-specific effect of each State j

δ = a coefficient matrix

ε = error term.

Equation (1) can be re-written as shown below.

$$y_{jt} = \rho y_{jt-1} + (v_{jt} - \rho v_{jt-1})'\delta + \alpha_j(1-\rho) + \eta_{jt} \quad (2)$$

or

$$y_{jt} = \rho y_{jt-1} + v^{*\prime}_{jt}\delta + \alpha^*_j + \eta_{jt},$$

where

$v^*_{jt} = v_{jt} - \rho v_{jt-1}$ and $\alpha^*_j = \alpha_j(1-\rho)$.

All coefficients in equation (2) have become more consistent and efficient. Nevertheless, estimating equation (2) using least squares is problematic because the lagged dependent variable is correlated with the disturbance, even if η_{jt} is not serially correlated. Hence, to overcome this issue, the most appropriate estimation method is to employ the instrumental variables techniques. Nevertheless, the necessary condition is that the instrumental variables (denotes as Z_{jt}) must display strict exogeneity, $E(\eta_{jt}/Z_{jt}) = 0$ for all t.

For this paper, a panel 3SLS model is considered. The advantage of using this model is that it takes account of both heteroscedasticity and contemporary correlation in the residuals when some of the right-hand side variables are correlated with the error terms. To put it differently, the 3SLS model is the two-stage least squares version of the seemingly unrelated (SUR) method (Ledesma-Rodriguez et al., 2001).

This paper includes a unit root test for dynamic panels, which is developed by Harris and Tzavalis (1999). It is asymptotic unit root tests where the residuals follow an AR(1) and the time dimension is fixed. The test derived is based on the normalised least squares estimators of the autoregressive coefficient and allow for fixed effects and individual deterministic trends. Harris and Tzavalis (1999) considered three data generating processes (DGP). One of them is written as follows:

$$log\, y_{it} = \omega_i + \rho\, log\, y_{i,t-1} + u_{it} \quad (3)$$

where y_{it} = some relevant variable, ω and ρ are parameters, and $u_{it} \approx Nitd(0, \sigma_u^2)$. The null hypothesis is the existence of a unit root in equation 3 (i.e. $\rho = 1$) and the alternative hypothesis is that the AR(1) process is stationary, i.e. $|\rho| < 1$. The model is a unit root process with heterogeneous drift parameters under the null hypothesis, and a stationary process with heterogeneous intercepts under the alternative hypothesis. The normalised distribution of the statistic is:

$$\sqrt{N}(\hat{\rho} - 1 - B) \xrightarrow{L} N(0, C)$$

where $B = -3(T+1)^{-1}$,

$C = 3(17T^2 - 20T + 17)(5(T-1)(T+1)^3)^{-1}$

Tourism Demand Model and Proxy Variables

According to consumer demand theory, domestic tourism demand can be written (in panel data format) as:

$$TD_{jt} = f(Y_{jt}, TP_{jt}, TC_{jt}, OC_{jt}, DUM_{jt})$$

where *TD* = Demand for domestic tourism at time *t* in state *j*, *Y* = domestic household income, *TP* = tourism prices, *TC* = transportation costs, *OC* = the price of overseas holidays and *DUM* = dummy variable for one-off events (such as Bali bombings in 2005 and Sydney Olympic Games in 2000) and seasonality. According to the theory, the expected signs of *TP* and *TC* are negative, whereas *OC* would anticipate having a positive sign. For *Y*, it can be either positive or negative. The dummy variables depend on the nature of one-off events. For instance, global unfavourable events such as the Bali bombings and the outbreak of SARS would encourage Australians to travel within their own country. Hence, the dummy variables for these negative events would have a positive sign. [Refer to Lim (2006) and Allen et al. (2009) for further information about the application of consumer demand theory in tourism demand analysis]

This paper uses numbers of visitor nights in Australia as the dependent variable for Australian domestic tourism demand. In the tourism literature, Faulkner (1988) highlighted that statistics based on visitor nights are significant from an economic viewpoint because they reflect the utilisation of tourism facilities and related tourism expenditure. Moreover, disaggregated data is employed rather than aggregated data because the former contains more information about the nature of the tourists. Furthermore, Kim and Moosa (2005) found that forecasting using disaggregated data generates more accurate forecasts than using aggregated data. Therefore, in this research, we use three main types of domestic tourism demand data, namely the numbers of visitor nights by holiday-makers (HOL), business visitor nights (BUS), and visitors of friends and relatives (VFR). The demand data is abstracted from *Travel by Australians*, which is published quarterly by Tourism Research Australia.

In the case of the independent variables, several variables are used as a proxy for household income. They are disposable income (DI), gross domestic product (GDP) and GDP per capita. In the case of tourism prices, a further break-down is made into two groups, namely the costs of living and transportation costs. In this paper, the CPI for domestic holidays and accommodation is used as a proxy variable for the costs of living; whilst for transportation costs, the proxy variables are the CPI for Australian domestic economy airfares and the CPI for automotive fuel. As the proxy for overseas holidays, this paper employs the CPI for overseas holidays and accommodation, which measures the average prices that Australian paid for travelling overseas. In terms of instrument variables, this paper uses two- and three-period lagged dependent variables. These data are freely available from the websites of the Australian Bureau of Statistics.

This paper employs pooled data which is based on seven Australian States from 1999 quarter 1 to 2007 quarter 4. This provides a total of 252 pooled observations.

RESULTS DISCUSSION

In this research, we employ first-differenced data for two reasons. First, by differencing the data and removing the problem of potentially non-stationary observations, panel data analysis will give us confidence in the reported coefficients and standard errors (Garin-Munoz, 2007). Second, after carrying out several panel unit root tests, we

found that the independent variables are non-stationary [Due to space limitation, the results of panel unit root test are omitted from this paper. However, they are available upon request].

All the significant estimates are shown in Table 3. Based on the figures, the proxy variables for income and tourism prices are all statistically significant and have the expected signs. In other words, domestic visitors are strongly influenced by changes in income and tourism prices.

The effects of income changes on domestic travel are distinct from one type of visitors to another. The income elasticities of domestic VFR tourism demand are -1.69, implying that an increase in household income will lead to Australian households preferring to travel overseas than domestically. Nevertheless, for business visitor night data, the coefficients for GDP and GDPP(-1) are 1.54 and 5.89, respectively, indicating that the demand for domestic business tourism is strongly responsive to the conditions of Australian economy.

With regard to the tourism prices, in Table 3, the estimates for one-period lagged domestic tourism prices [DT(-1)] are negative for all types of domestic visitors, implying that an increase in the current tourism prices will lead to a fall in domestic tourism demand in the following quarter. Furthermore, the price elasticity for domestic holiday demand is the highest (-1.26) compared to the domestic business visitor data. This shows that, when changes in prices of domestic travel occur, domestic holiday demand will be strongly affected.

Furthermore, the coefficients for two-period-lagged domestic tourism prices [DT(-2)] are statistically significant for holiday and VFR tourism demand. The elasticities for HOL and VFR are relatively high, ranging between -2.54 to -3.54. In other words, a rise in domestic tourism prices in the current period will cause domestic tourism demand to fall noticeably in the next two quarters. In fact, the estimates for DT(-2) are higher than the estimates for DT(-1), indicating that the effects of tourism prices for two-quarters ahead have stronger influences on domestic tourism demand than that of tourism prices for one-quarter ahead.

The incidents of the Bali bombings have strong influence on the demand for HOL tourism. From Table 3, the coefficient for Bali for HOL is 0.15, proving that Australian households are concerned about the safety risk of travelling to Bali. In other words, when the incidents occurred, they substituted from overseas travel (Bali) to domestic trips. However, as the elasticity is lower than one, this implies that the effect of Bali bombing incidences on domestic HOL trips is rather low.

Apart from that, the coefficients for $Y_{j,t-1}$ are negative and statistically significant at the 1% level for all data. In other words, the lagged dependent variables have negative effects on Australian domestic tourism demand. It may be that Australian domestic visitors make periodic interstate or intrastate trips for holidaying, business or visiting relatives and friends. On the face of it, this suggests a negative reaction to previous demand. We suspect there is probably a strong periodic demand element in this. If they have travelled in the recent past, they are unlikely to travel again in the near future. This is supported by the significance of two lagged seasonal variables in the 'VFR' column in Table 3. This issue requires further exploration. Moreover, one issue with our data is that it is drawn from a sample, undertaken at periodic intervals, which means our observations do not reflect the behavior of the same individual tourists.

Further support for this periodicity is suggested by the fact that seasonality is also evident for holiday and VFR visitor night data. In fact, the significance of S1indicates that Australians travel mostly during holiday

seasons which occur during the month of January and July.

In regard to the robustness of the models, the F-statistics reject the null hypothesis of $\delta_1= \delta_2=...= \delta_n=0$ (i.e. all coefficients are jointly zero) at a 1% significance level, indicating that all explanatory variables are important and independent in explaining domestic tourism demand. Moreover, based on the Harris and Tzavalis test of unit roots in dynamic panels, the student t-test rejects the hypothesis of $\rho=1$. This concludes that $Y_{j,t-1}$ follows a stationary stochastic process of AR(1).

CONCLUSSIONS

This paper studied whether household income and tourism prices have significant influences on domestic tourism demand in Australia using a panel data approach. Based on the results, it turned out that the panel data estimations produced reasonably convincing findings, in which the estimates have the expected signs and are consistent with the theory.

Hence, we confirmed that household income and tourism prices are the influential factors in determining the demand for Australian domestic tourism.

Table 3: Empirical Results of Modeling Australian Domestic Tourism Demand Using Panel 3SLS Model

Variable	HOL	BUS	VFR
DI			-1.630 (0.616)**
GDP		1.536 (0.679)**	
GDPP(-1)		5.885 (2.611)**	
DT(-1)	-1.261 (0.629)**	-1.394 (0.510)***	
DT(-2)	-3.535 (0.049)***		-2.541 (0.525)***
BALI	0.151 (0.049)***		0.128 (0.081)
$Y_{j,t-1}$	-0.413 (0.048)***	-0.544 (0.048)***	-0.535 (0.054)***
S1	0.527 (0.062)***		-0.011 (0.092)
S2	-0.028 (0.062)		-0.120 (0.055)**
S3			-0.134 (0.065)**
$F(\delta_1=\delta_2=\ldots=\delta_j=0)$	13.005***	11.260***	16.236***
$t(\rho=1)$	-29.734	-31.983	-28.345

Notes:

1. Dependent variables: The numbers of domestic holiday tourists (HOL), business visitors (BUS) and domestic travellers who visit friends and relatives (VFR).
2. Independent variables: Disposable income (DI), gross domestic products (GDP), one-quarter-lagged GDP per capita [GDPP(-1)], one-quarter-lagged CPI of domestic travel [LDT(-1)], two-quarters-lagged CPI of domestic travel [DT(-2)], the incidences of Bali bombings (BALI), lagged dependent variable ($Y_{j,t-1}$), S1 = seasonal dummy for January – March; S2 = seasonal dummy for April – June; S3 = seasonal dummy for July - September.
3. Figures in brackets are White cross-section standard errors. ***, ** and * denotes significance at the 1%, 5% and 10% levels. $F(\delta_1=\delta_2=\ldots=\delta_j=0)$ represents an F-test on the null hypothesis of jointly significance of the parameters. $t(\rho=1)$ is the t-values for testing $\rho=1$ to test the existence of unit roots in the dynamic panel model. The normalized coefficients for the Harris and Tzavalis test of $\rho=1$ are -13.795, -10.160, and -10.411. The CPI for overseas holidays and accommodation is found to be statistically insignificant and hence, we decided to omit this variable from this study.

However, the study discovered two issues. First, there is a negative response of VFR to lagged income changes. This might suggest that domestic holiday travel is an inferior substitute for preferred overseas travel. Second, we found a negative sign for the lagged dependent variables, indicating that Australians may travel on a periodic basis. The results are rather inconsistent with the majority of the tourism literature, where they found positive signs for the lagged dependent variables (for example, Ledesma-Rodriguez et al., 2001 and Lim, 2004). The issues above require further exploration.

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