Demand Elasticities for Air Travel to and from Australia

Working Paper

This Working Paper explains why sound demand elasticities are of key importance to any assessment of the impact on passenger demand of changes to air services or aviation infrastructure. Using quarterly data from 1986 to 1993, the study provides updated and disaggregated estimates for Australian international travel markets through the development of econometric demand models. Twelve markets are examined: Australia-Germany, Italy, United Kingdom, Japan, Korea, Taiwan, Indonesia, Malaysia, Singapore, Fiji, New Zealand and the United States of America. The demand characteristics of different nationalities and passengers travelling for different purposes are identified and incorporated into the analysis.

Bureau of Transport and Communications Economics

WORKING PAPER 20

DEMAND ELASTICITIES FOR
AIR TRAVEL TO AND FROM AUSTRALIA

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FOREWORD

Air travel demand elasticities are important inputs to transport and tourism research, and are used in the development and evaluation of transport policy. However, it has been some years since a comprehensive study has been undertaken to estimate demand elasticities for Australian international air travel, and researchers and policy makers alike have had to rely on increasingly dated or inappropriately aggregated studies.

This study was undertaken to address the need for better elasticity estimates. Air travel demand between Australia and those countries which constitute the bulk of our air travel markets are explained using econometric models. Models are disaggregated to a level where demand by nationality and by purpose of travel can be examined; a degree of disaggregation that is rare, but most informative in that it allows the unique features of individual markets to be exposed.

The research was undertaken by Scott Savage and Corey Dykstra under the supervision of David Smith.

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ABSTRACT

This working paper explains why sound demand elasticities are of key importance to any assessment of the impact on passenger demand of changes to air services or aviation infrastructure. Using quarterly data from 1986 to 1993, the study provides updated and dissaggregated estimates for Australian international travel markets through the development of econometric demand models. Twelve markets are examined: Australia–Germany, Italy, United Kingdom, Japan, Korea, Taiwan, Indonesia, Malaysia, Singapore, Fiji, New Zealand and the United States of America. The demand characteristics of different nationalities and passengers travelling for different purposes are identified and incorporated into the analysis.

The study should be useful to transport and tourism researchers, policy makers, aviation regulators and industry analysts.

CHAPTER 1 INTRODUCTION

International travel to and from Australia has experienced significant growth over the last 10 years. Tourism, in particular, is a major growth industry—the Australian Tourism Commission (ATC) estimated that foreign tourists spent some $10 billion in Australia in 1993. Growth has not been entirely driven by leisure travellers though. As the economies of our Asian neighbours continue to grow, so do trade opportunities, which generate strong demand for business travel.

The total number of foreign visitors to Australia increased more than threefold over the last 10 years, to almost 3.4 million in 1994. Over the same period the number of Australians travelling abroad rose by 66% to 2.4 million.

These rapid rates of growth raise interesting questions for transport researchers, such as: is Australia's aviation infrastructure adequate to meet future demand? How appropriate is the existing system of air service arrangements to facilitate future growth of Australian markets?

These questions are clearly complex, but may be addressed by empirical research. Therefore it is essential researchers have a sound understanding of what determines the demand for air travel, and how responsive demand is to changes in those determinants.

Elasticities measure how demand responds to changes. For example, a negative airfare elasticity indicates the proportional increase in demand that results from a decrease in the airfare.

The most recent comprehensive analysis of demand elasticities for air travel was undertaken seven years ago by the Bureau of Transport and Communication Economics (BTCE 1988). However, elasticities date, and the rapid growth in foreign visitor numbers since that work was undertaken, in particular from the North–east Asian region, suggests a strong need for re–estimation of these values.

In addition to updating existing elasticity estimates, this study disaggregates the travel market into traveller type (foreign and Australian) and the reason for travel (leisure and business). Travel is considered, between individual origin and destination countries, rather than by regional groups, an approach which enables the different characteristics of each market to be modelled.

Demand elasticities for air travel between Australia and 12 countries are estimated: Germany, Italy, the United Kingdom, Japan, Korea, Taiwan, Indonesia, Malaysia, Singapore, Fiji, New Zealand and the United States of America. Visitors from these countries made up almost 79% of all foreign arrivals to Australia in 1994. In the same year, 65% of Australian overseas travel was to these countries.

Chapter 2, provides a background description of travel between Australia and each country over the last 10 years. Chapter 3 develops the theoretical demand models for air travel. Chapter 4 reviews recent empirical studies which have estimated demand elasticities for air travel, focusing on Australian studies. Chapter 5 describes the general form leisure and business demand models which are used to estimate demand elasticities and outlines the data series used to represent the factors influencing demand. Chapter 6 concludes by reporting the results and outlining the main findings.

A series of technical appendices describes: the representative airfares for each origin–destination market; data sources; the diagnostic tests performed on the econometric models; the results from econometric models and the diagnostic tests; and elasticity estimates grouped by country of origin and destination.

CHAPTER 2   INTERNATIONAL AIR TRAVEL TO AND FROM AUSTRALIA

This chapter outlines changes in the volume and composition of passenger travel to and from Australia over the last 10 years. It looks briefly at the trend in total passengers before considering travel between Australia and individual countries in more detail. The different dynamics underlying passenger demand in each market become apparent through this process, and underlies the development of separate demand models for each country origin-destination (OD) market in this paper.

TOTAL TRAVEL TO AND FROM AUSTRALIA

The volume of international travel to and from Australia increased significantly over the past 10 years. Foreign visitor arrivals grew by more than 230% to almost 3.4 million in 1994, which represents an average annual growth rate of over 12.5%. As figure 2.1 shows, over the same period the number of Australians travelling abroad grew more slowly — around 5% annually. However, in absolute terms, this was an increase of almost one million travellers, to 2.4 million in 1994.

Figure 2.1   International travel to and from Australia, 1984 to 1994

Source   Australian Bureau of Statistics (ABS), *Overseas Arrivals and Departures Australia*, Cat. 3404.0 various issues

Since 1987, the number of foreign visitors to Australia has exceeded the number of Australians travelling abroad. Figure 2.1 illustrates that foreign visitor numbers peaked briefly in 1988 before falling the following year. The peak in 1988 may have been due partly to the Australian Bicentenary and the World Expo, which both took place that year. The domestic pilots' strike in 1989 may have contributed to the decline in visitor arrivals in that year.

While illustrative of the total market, the data presented in figure 2.1 are unable to provide such important details as the size of individual country OD markets and the mix of travellers on each route. Individual route characteristics are important in determining the responsiveness of travellers to changes in factors determining demand. For these reasons a disaggregated approach is desirable.

Air travel is undertaken primarily for one of two reasons: to facilitate business, or to reach a leisure destination (whether for pure holiday purposes or to visit friends and relatives). Therefore travel can be broadly disaggregated by purpose of journey into either leisure or business travel (further discussed in Chapter 3). When considering the pool of air travellers between Australia and overseas countries, four main types are identified. These are Australian business and Australian leisure travellers, and foreign business and foreign leisure travellers.

An identifiable and sometimes significantly sized subgroup of the leisure market is those people travelling to visit relatives (referred to as 'VR travellers')[1]. Where data permits the size of this subgroup in the discussion of individual markets which follows is identified.

Growth in, and the composition of, travel between Australia and 12 countries which make up a large proportion of Australia's total travel market is discussed in more detail in the following section. The twelve countries are Germany, Italy, United Kingdom, Indonesia, Malaysia, Singapore, Japan, Korea, Taiwan, Fiji, New Zealand and the United States of America.

EUROPE

Germany

Travel by German visitors to Australia rose from less than 35 000 in 1984 to 122 700 in 1994. As figure 2.2 shows, the rate at which numbers are increasing appears to have accelerated since 1991. Despite the steep increase, German visitors still account for approximately 3.5% of total visitors to Australia — the same proportion as in 1984.

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1   Traveller categories are obtained from ABS, *Overseas Arrivals and Departures*

Figure 2.2 ·Travel between Australia and Germany, 1984 to 1994

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

Although the number of Australian travellers to Germany grew by an average annual rate of 3% over the last 10 years, in total the increase was less than 10 000, to 32 300 in 1994.

Figure 2.3 shows that total traffic between Australia and Germany in 1994 was dominated by German leisure visitors. Most of these were travelling for holiday reasons, although just under 15% were visiting relatives in Australia. However, of Australian leisure travellers, almost 50% were VR travellers.

Figure 2.3   **Composition of travel between Australia and Germany, 1994**

Source   ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

Italy

The number of Italian visitors to Australia rose from around 13 400 in 1984 to over 36 000 in 1994. Figure 2.4 appears to suggest that the World Expo and Australian Bicentenary in 1988 and domestic pilots' strike in 1989 may have

influenced visitor numbers in those years. However, the overall trend has been for consistent growth of around 10.6% annually.

Figure 2.4   Travel between Australia and Italy, 1984 to 1994

Travel by Australians to Italy fell in 1991; however, the overall trend remained relatively flat. Their number increased from 39 500 in 1984 to 45 000 in 1994, an increase of only 12% over 10 years.

Figure 2.5   Composition of travel between Australia and Italy, 1994

Although traffic between the two countries is dominated by Australian travellers, figure 2.4 shows this is decreasing. In 1994 Australian leisure travellers accounted for almost half of all travel between Australia and Italy. Almost 40% of these were VR travellers. Just under 30% of Italian leisure visitors were visiting family in Australia. These figures indicate that VR travellers made up around 30% of all travel between Australia and Italy.

United Kingdom

The large volume of traffic between Australia and the United Kingdom (UK) each year reflects, in part, the historical ties between these two countries. In 1994 more than 335 000 Britons visited Australia, an increase of almost 190 000 since 1984. Although there was a decline in 1991, on average, visitor numbers increased by 8.7% annually.

While the number of British visitors increased, as a percentage of all visitors to Australia, it fell from 14.3% in 1984 to less than 10% in 1994.

Figure 2.6   Travel between Australia and the United Kingdom, 1984 to 1994

Source   ABS, *Overseas Arrivals and Departures Australia,* various issues

The number of Australians travelling to the United Kingdom rose to just over 250 000 in 1990, before a sharp fall the following year. Since then it has recovered to 254 600 in 1994. However, the percentage of Australians who choose to travel to the UK also fell, to just over 10% in 1994, from almost 14% previously.

Figure 2.7 shows that in 1994 just over half of all travel between Australia and the UK was by British leisure travellers. Almost 50% of these, or 147 000, were VR travellers. Although, the majority of Australian leisure travellers were on holiday, a large proportion, almost 38% in 1994, were VR travellers.

It is interesting to note that the mix of travellers has changed a lot over the years. In 1984, more than 60% of Britons travelling to Australia were VR travellers. However, Australian VR travellers have actually increased since 1984, when they made up only 33% of all travellers.

Figure 2.7   Composition of travel between Australia and the United Kingdom, 1994

UK leisure arrivals 51%

Australian business departures 6%

Australian leisure departures 37%

UK business arrivals 6%

Total travellers 589 800

Source   ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

NORTH–EAST ASIA

Japan

The number of Japanese visitors to Australia grew at an average rate of 23% each year since 1984. In 1994, over 720 000 Japanese travelled to Australia, more than an eightfold increase over the last 10 years. Japan is now Australia's largest single source of visitors, and in 1994 more than 21% of all visitors to Australian were Japanese citizens.

Figure 2.8 shows that, prior to 1989, the year of the domestic pilots' strike, travel by Japanese visitors to Australia was growing at an increasing rate. Although since then the number of visitors from Japan has continued to increase, the rate of growth appears to be slowing.

Figure 2.8   Travel between Australia and Japan, 1984 to 1994

Passenger numbers

800000
700000
600000
500000
400000
300000
200000
100000
0

------ Resident departures
——— Foreign arrivals

1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994

Year

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

The number of Australians travelling to Japan remains small, compared to the number of Japanese visitors to Australia. But in absolute terms more than 42 000 Australians travelled to Japan in 1994, up from 26 300 in 1984. This represents an average annual growth rate of around 5%.

Figure 2.9   Composition of travel between Australia and Japan, 1994

Australian
business
departures
2%

Australian leisure
departures
3%

Japanese
business arrivals
4%

Japanese leisure
arrivals
91%

Total travellers 763 700

Source   ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

Travel between Australia and Japan was dominated by Japanese leisure visitors, who make up just over 20% of *all* visitors to Australia. The majority of these are holiday makers, with VR travellers accounting for only 1.5%. By comparison, about 20% of Australian leisure travellers to Japan are visiting relatives.

Korea

Korea is emerging as an important source of visitors to Australia. Since 1991 their number has increased by more than 65% each year. Koreans now make up almost 3.3% of all foreign visitors to Australia, up from less than a half per cent in 1985.

Figure 2.10   Travel between Australia and Korea, 1984 to 1994

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

Growth in the number of Australians travelling to Korea has been more subdued. While it has increased more than threefold since 1985, in absolute terms this is an increase of less than 10 000.

Figure 2.11   Composition of travel between Australia and Korea, 1994

Korean leisure arrivals 83%

Australian business departures 4%

Australian leisure departures 6%

Korean business arrivals 7%

Total travellers 122 800

Source   ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

As shown in figure 2.11, in 1994 travel between Australia and Korea was dominated by Korean leisure visitors. The majority of these visited Australia on holidays. VR travellers accounted for only 8% of leisure travel. On the other hand, VR travellers made up almost 60% of Australian leisure travellers to Korea.

Taiwan

Similarly to Korea, travel by Taiwan's residents to Australia has increased significantly since 1991. In 1994, more than 142 000 Taiwanese visitors arrived in Australia. As a proportion of all foreign visitors to Australia, Taiwanese have increased from less than 1% in 1985 to just over 4%.

Figure 2.12   Travel between Australia and Taiwan, 1984 to 1994

·······Resident departures
———Foreign arrivals

Passenger numbers

160000
140000
120000
100000
80000
60000
40000
20000
0

1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
Year

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

Again, similar to Korean statistics, the number of Australians travelling to Taiwan has not increased to the same degree. More than 28 000 Australians travelled to Taiwan last year, up from 3 500 in 1985.

Figure 2.13 Composition of travel between Australia and Taiwan, 1994

Taiwanese leisure arrivals 79%

Australian business departures 5%

Australian leisure departures 11%

Taiwanese business arrivals 5%

Total travellers 170 600

Source ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

Figure 2.13 shows that travel between Australia and Taiwan was dominated by Taiwanese leisure visitors. VR visitors made up around 10% of this group. For Australians travelling to Taiwan, the majority, 61% of travellers, visited family.

It is interesting to observe that each of the three North-east Asian countries discussed share common characteristics in their travel patterns with Australia. All three, Japan, Korea and Taiwan, have experienced significant growth in the number of residents travelling to Australia. In each case, leisure visitors from the North-east Asian country dominate the total amount of travel between Australia and that country. Finally, the number of Australians travelling to Japan, Korea and Taiwan, has not increased to the same extent as foreign arrivals in Australia.

SOUTH–EAST ASIA

Indonesia

Indonesia traditionally has been an important destination for Australian travellers. In 1994, more than 200 000 Australians travelled there. As shown below, the number of Australian travellers to Indonesia increased by around 9% each year since 1984.

Importantly, the proportion of Australians travelling to Indonesia continues to increase. Last year, just over 9% of *all* Australians travelling overseas travelled to Indonesia, up from 6.2% in 1984.

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Figure 2.14 Travel between Australia and Indonesia, 1984 to 1994

Source ABS, *Overseas Arrivals and Departures Australia*, various issues

Travel by Indonesians to Australia started to increase noticeably after 1991. In 1994 more than 105 000 Indonesians travelled to Australia, an increase of more than 40% each year since 1991 (see Figure 2.14).

Figure 2.15 Composition of travel between Australia and Indonesia, 1994

Source ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

In 1994, more than two–thirds of all travel between the two countries was by Australians to Indonesia. The majority of these were Australian leisure travellers. Only 5% of Australian travellers and 10% of Indonesian visitors to Australia were visiting family.

Malaysia

As shown in figure 2.16, the number of Malaysian visitors to Australia has increased more than threefold from 29 300 to just over 95 000 in 1994. Growth has been particularly strong since 1991.

Figure 2.16 Travel between Australia and Malaysia, 1984 to 1994

Source ABS, *Overseas Arrivals and Departures Australia*, various issues

The number of Australians travelling to Malaysia increased to 84 500 in 1994 from just under 39 000 in 1984. While 3.6% of *all* Australians travelling overseas travelled to Malaysia in 1994, up from 2.7% in 1984, figure 2.16 indicates that the rate of growth in this market has slowed since 1991.

Figure 2.17 Composition of travel between Australia and Malaysia, 1994

Source ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

Travel between Malaysia and Australia is dominated by Malaysian leisure visitors to Australia. VR visitors form an important part of this market, contributing 20% of visitors. While the majority of Australians are holiday travellers, almost 32% travelled to Malaysia to visit family.

Singapore

There have been significant changes in the composition and amount of travel between Australia and Singapore over the last 10 years. As shown in figure 2.18, initially Australian departures to Singapore were almost twice as high as

travel by Singaporean residents to Australia. This position was reversed in 1994.

The number of Singaporeans visiting Australia increased significantly after 1984. More than 187 000 visitors came to Australia in 1994, up from just 33 000 in 1984. Figure 2.18 shows that the rate of growth seems to have increased since 1991. Foreign visitors from Singapore now make up 5.6% of all foreign visitors to Australia, an increase from 4.3%.

Figure 2.18 Travel between Australia and Singapore, 1984 to 1994

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

The number of Australian travellers to Singapore increased up until the end of the 1980s. Since then it has steadily declined to just over 91 000 from a peak of just under 118 000. Overall, the number of Australian travellers to Singapore was approximately 30 000 higher than a decade ago. However, as a percentage of *all* Australian travellers, the number of those travelling to Singapore has decreased marginally from 4.3 to 3.9%.

Figure 2.19   Composition of travel between Australia and Singapore, 1994

Source   ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

As figure 2.19 shows, travel between Australia and Singapore was dominated by Singaporean leisure visitors, of which about 10% are VR. About 20% of Australian leisure travellers to Singapore were visiting family.

OCEANIA

Fiji

Travel by Australians to Fiji fluctuated over the last decade, but remained almost constant in trend terms. However, the percentage of *all* Australians choosing to travel to Fiji decreased from 6.3% in 1984 to just over 3.5% in 1994.

As figure 2.20 shows, the number of Fijian visitors to Australia increased from 1984 to 1988, remaining relatively constant since then. In absolute terms, the number of visitors from Fiji increased by around 10 000, to 19 500 over the period analysed.

Figure 2.20 Travel between Australia and Fiji, 1984 to 1994

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

Travel between Australia and Fiji is dominated by Australian leisure travellers. The majority of these are on holidays, with only 13.4% being VR travellers.

Figure 2.21 Composition of travel between Australia and Fiji, 1994

Australian
business
departures
9%

Fijian leisure
arrivals
16%

Fijian business
arrivals
3%

Australian leisure
departures
72%

Total travellers 102 500

Source   ABS 1994, Overseas Arrivals and Departures Australia, Cat. 3402.0

Fijian leisure visitors make up only a small amount of total traffic between Australia and Fiji. However, of these, VR visitors make up almost 44%.

New Zealand

As New Zealand is Australia's closest neighbour, travel between Australia and New Zealand has traditionally accounted for a large part of total foreign visitors and Australian travellers. Almost half a million New Zealanders travelled to Australia in 1994, more than double the number of 10 years ago.

However, as figure 2.22 shows, since 1988 the number of visitors has fluctuated, while remaining relatively constant in trend terms. In 1984, visitors from New Zealand made up almost one-quarter of *all* travel to Australia. This fell to only 15% in 1994.

Figure 2.22 Travel between Australia and New Zealand, 1984 to 1994

Passenger numbers

····· Resident departures
——— Foreign arrivals

Year

Source   ABS, Overseas Arrivals and Departures Australia, various issues

Travel by Australians to New Zealand has grown slowly, although fairly consistently since 1984. The 50% increase in numbers between 1984 and 1994 represents an average growth of about 4% each year.

The percentage of *all* Australians travelling to New Zealand has decreased marginally from 16.7% in 1984 to 15% in 1994.

Figure 2.23   Composition of travel between Australia and New Zealand, 1994

NZ leisure
arrivals
46%

Australian
business
departures
10%

Australian leisure
departures
32%

NZ business
arrivals
12%

Total travellers 833 600

Source   ABS 1994, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

In 1984, travel between Australia and New Zealand was relatively evenly divided between foreign visitors and Australian travellers. However, faster growth in the number of New Zealander visitors means they now account for the majority of travel between the two countries.

VR travellers make up a significant proportion of travel in this market. Thirty–seven per cent of New Zealander, and 42% of Australian leisure travellers are visiting family.

UNITED STATES OF AMERICA

The United States of America (USA) has historically been a large source of foreign visitors to Australia. As shown in figure 2.24, USA visitor numbers increased from around 160 000 in 1984 to almost 290 000 in 1994. However, the rate of growth has been anything but uniform. A large drop in the number of Americans visiting Australia occurred in 1989, after four years of sustained growth. Since then numbers of travellers have recovered slightly, but still remain below 1988 levels.

Figure 2.24   Travel between Australia and the United States of America, 1984 to 1994

Source   ABS, *Overseas Arrivals and Departures Australia*, various issues

In 1984, visitors from the USA were Australia's second-largest source of foreign arrivals, making up 15.8% of the total. By 1994 this had decreased to 8.6%.

The USA is still a significant destination for Australians travelling overseas. In 1984, just under 10% of Australian international travel was to the USA. By 1994, this had increased to a little over 12%.

Figure 2.25 shows the composition of travel between Australia and the USA by passenger type in 1994. Total travel between the two countries was evenly split between Americans and Australians. The relative shares of business and leisure travel for each nationality were also relatively even.

Figure 2.25   Composition of travel between Australia and the United States of America, 1994

Source   ABS, *Overseas Arrivals and Departures Australia*, Cat. 3402.0

ABS data indicate that the majority of American leisure visitors travelled for holiday purposes. However, a significant proportion, around 20%, were visiting relatives. This is also true of Australians travelling to the USA, with VR travellers accounting for almost 16% of all leisure travel.

CHAPTER 3   DEMAND FOR AIR TRAVEL

This chapter consists of two major sections. The first applies standard economic optimisation theory to derive demand functions for leisure and business travellers. This simply provides background material, and readers may choose to turn directly to the second section, which discusses the real world variables used in modelling demand for international air travel.

THEORETICAL DEMAND MODELS

As indicated in Chapter 2, air travel is generally undertaken for two broad reasons: leisure and business. Leisure travellers, as consumers, aim to maximise the utility, or satisfaction, derived from air travel and the associated consumption of holiday experiences. Business travellers, who use travel as an input to final production, are interested in minimising costs for a given level of output. Therefore leisure and business travellers are likely to respond differently to changes in certain socioeconomic factors influencing demand, and should be modelled separately.

The leisure and business travellers' economic optimisation problems are separately discussed below, showing how the standard demand function, which says demand is a function of the price of a good, the prices of complementary and substitute goods, and certain socioeconomic characteristics inherent to the individual, is derived.

International leisure travel

Like all goods[1], an individual's demand for international leisure travel can be obtained by applying utility maximisation theory to the consumer's decision problem. When making consumption decisions, the individual's economic problem is to choose a utility–maximising bundle of goods, x, subject to a given income or budget constraint, y. If p is the price of each good in the consumption bundle, and s is a vector of socioeconomic characteristics inherent to the consumer, the utility maximisation problem can be expressed

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[1]   The term 'goods' refers to both goods and services.

as:

$$\text{Max } u(x, s) \text{ subject to } p'x = y \tag{3.1}$$

Solving for the optimal value of x, we can derive a separate demand equation for each good in the consumption bundle as:

$$x_i = x_i(p_i, p_j, \dots, p_n, y, s), \text{ for } i \dots n. \tag{3.2}$$

If good i is international leisure travel, then the representative individual's demand for leisure travel can be expressed as a function of the price of travel (p_i), the price of all other goods in the consumption bundle (p_j through to p_n), income and socioeconomic characteristics of the consumer.

By aggregating individual demands across all consumers, aggregate demand for leisure travel is derived. Aggregate demand is expressed as a function of the airfare, the prices of all goods consumed on the trip, the price of 'all other goods', income and other socioeconomic characteristics which may influence the propensity to consume leisure travel. Using a foreign price index to represent the prices of goods consumed at the foreign destination, and a domestic price index to represent the price of 'all other goods', the aggregate demand for leisure travel can be written as a function of the airfare, the foreign price index, the domestic price index, income, and other socioeconomic attributes.

Assuming the demand function is homogeneous of degree zero, the expression can be normalised by dividing through by domestic prices so that the aggregate demand function for leisure travel becomes:

$$d_t^e = f(p_t, r_t, y_t, s_t) \tag{3.3}$$

where: d_t^e is leisure demand in period t; p_t is the real airfare; r_t is relative prices; y_t is real income; and s_t is a vector of other socioeconomic characteristics such as available leisure time, population and quality of service.

International business travel

Demand for business air travel is derived from the production activities of the firm. Consider the production function of a representative firm as a function of all its inputs,

$$q = q(z) \tag{3.4}$$

where: q is the firm's output, and z is a vector of the firm's inputs.

The firm's decision problem is to minimise the total cost of production, c, conditional on a given output level (q^*). If w is the price of each factor input, then the firm's minimisation problem is

$$\text{Min } c(w, z) \text{ subject to } q(x) \geq q^* \tag{3.5}$$

By solving for the optimal value of z, the conditional input demand function for each input i is:

$$z_i = z_i(w_i, w_j, \ldots, w_n, q) \tag{3.6}$$

If the factor i is assumed to be the production input 'business travel', then the demand for business air travel is a function of the airfare, the price of any inputs complementary to air travel, the price of all other inputs in the production process, and the firm's level of output.

By aggregating individual factor demands across all firms, we can derive aggregate demand for business air travel. Again, using a foreign price index to represent the prices of foreign inputs complementary to air travel, and a domestic price index to represent the price of all other inputs, aggregate demand for business travel can be expressed as a function of the airfare, the foreign price index, the domestic price index, and output.

When normalising this expression by dividing through by domestic prices, the aggregate demand function for business air travel becomes:

$$d_t^b = g(p_t, r_t, q_t) \tag{3.7}$$

where: d_t^b is the demand for business air travel in period t; p_t is the real airfare; r_t is relative prices; and q_t is real output.

Econometric models to estimate leisure and business demand for air travel can be specified from these general expressions for demand.

SUPPLY ISSUES

Many studies of demand for international air services (see for example Saad et al. 1983, BTCE 1988, and the Industries Assistance Commission (IAC) 1989) assume supply is completely elastic, and then estimate a single demand equation for each submarket. However, the regulated nature of international aviation suggests that the supply of air travel, at least in some markets, may not be perfectly elastic, especially in the short run. In these cases, economic theory suggests that increased demand, when supply is constrained, will result in higher prices. Higher prices will in turn lead to a decline in demand,

indicating demand for air passenger services may be jointly determined with airfares[2].

Several studies of aviation markets examined this possibility (see Bailey, Graham and Kaplan 1984, Dresner and Tretheway 1990, and Savage, Smith and Street 1994). When studying the effect of competition on airfares, these studies specified a multi-equation model consisting of a passenger demand equation (3.8) and a price equation (3.9). The models were then estimated using two stage least squares (2SLS).

$$\text{Passengers} = f(\textit{Airfare, Income, Distance, Population}) \qquad (3.8)$$

$$\text{Airfare} = g(\textit{Competition, Passengers, Distance, Service Quality}) \qquad (3.9)$$

However, this BTCE study performed diagnostic tests to examine the endogeneity of passenger demand and airfares, and failed to find conclusive evidence of joint determination of these data series[3]. This suggests that for this BTCE data series, the supply of air travel can be treated as being perfectly elastic with respect to price in the long run. Therefore single equation demand models for international travel are specified. These models are discussed in Chapter 5.

'REAL WORLD' DETERMINANTS OF DEMAND FOR AIR TRAVEL

Equations 3.3 and 3.7 describe general form demand models for international leisure and business travellers, respectively. This section discusses in more detail how each of the determinants of demand identified in the theoretical demand models have been modelled in empirical studies.

Total cost of travel

The total cost of travel consists of two components: the cost of transport to the destination, in this case, the airfare; and the cost of living at the destination (Witt and Martin 1987). The cost-of-living component includes such expenses as food, accommodation and entertainment, consumed at the travel destination. Morley (1993) noted that total travel costs cannot simply be derived by combining these two components. This is because the airfare is a price per trip while the other relates to the length of the trip, and is incurred as a price per day.

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[2] One of the basic assumptions under Ordinary Least Squares (OLS) estimation is the independence of the independent explanatory variable (i.e. airfare) and the error term. This assumption is obviously violated here.

[3] Endogeneity means that airfares and passenger demand both affect and are affected by the relationship depicted in a model such as equations 3.8 and 3.9.

Airfare

Airfares form a large proportion of total travel costs for leisure travellers, and are one of the most important determinants of leisure travel demand. Tretheway and Oum (1992) explain that two of the greatest lessons learned from airline deregulation in North America were that discounted airfares induce consumers to travel more often, and that they opened a whole new market segment for air travel. In studies of domestic aviation in Canada, Oum and Gillen (1983) and Oum, Gillen and Noble (1986) found that a decrease in the cost of air transport would lead to a more than proportionate increase in the demand for air travel. More recently, in Australia, the BTCE (1993) reported that deregulation of domestic aviation in 1990 resulted in lower fares and an increase in consumer propensity to travel.

Leisure travel is generally regarded as discretionary expenditure. Many goods and services compete with leisure travel for a share of the consumer's discretionary budget. These might include such items as home entertainment systems, swimming pools and entertainment, such as dining out. Because leisure travel has many substitutes, individuals travelling for leisure purposes tend to be sensitive to changes in airfares.

On the other hand, the elasticity of business demand with respect to airfares is likely to be lower than that for leisure travellers. Two factors suggest that business travellers will be less responsive to changes in the airfare. First, the total cost of travel includes a value of time component. Since business travellers generally value time more than leisure travellers, airfares form a smaller part of their total travel costs. This means an increase in airfares leads to a smaller rise in total travel costs for business travellers, compared to leisure travellers.

Second, business travellers are more likely to be concerned with maximising their productivity while travelling. Therefore they may be willing to pay for a 'higher quality' service that allows last-minute bookings and changes to travel plans, and provides better check-in and on-board facilities. Additionally, any rises in airfares tend to be absorbed by the firm, rather than the individual traveller.

Cost of living at the travel destination

When contemplating an international holiday, consumers may compare the prices of accommodation, food and tours in the resident country to prices of the same goods in potential holiday destinations. Leisure travellers may choose to holiday at home (or consume alternative discretionary goods and services at home) if tourism prices in a destination country are higher than tourism prices in the home country.

Morley (1993) explained that 'measuring the cost (or price) of tourism is difficult', and researchers will often choose the consumer and retail price

indexes as broad measures of the cost of tourism[4]. There are 'theoretical' problems in using broad measures such as the consumer price index (CPI). Most importantly, the CPI may not adequately represent the basket of goods purchased by tourists. Although there may be a number of technical problems in using the CPI, there is considerable evidence to suggest that these indexes can be significant in explaining of travel demand[5].

The nominal exchange rate, which is the relative price of two countries' currencies, is also used to represent the cost of living for tourists. Crouch (1993) explained that the nominal exchange rate fluctuates more than relative international prices, and with more publicity, so that potential tourists may be better informed about exchange rates than actual prices. Further, Crouch suggested that in the Australian tourism industry exchange rates are the most important factor in the costing of tours and accommodation, and hence are the main component of price fluctuations. If so, the nominal exchange rate may be an important proxy for the relative price of tourism.

Changes in both the nominal exchange rate and relative price levels can be conveniently represented by the real exchange rate. The real exchange rate measures prices of goods and services in one country relative to another country, and is a function of the nominal exchange rate and the costs of living in the home and destination countries. Because the real exchange rate measures relative purchasing power it can also, to some extent, explain how consumers substitute between foreign and domestic holidays, and how they switch between different potential foreign destinations.

Economic activity in the traveller's country of residence and/or destination

The level of economic activity in the traveller's country of residence has been found to be an important determinant of leisure demand (see for example BTCE 1988, Mitchell 1993, and Hooper 1993), and is usually measured by gross domestic product (GDP). Although GDP does not specifically measure income distribution, high levels of GDP are generally associated with high levels of disposable income.

Because expenditure on leisure travel tends to be regarded as discretionary, demand is likely to be elastic with respect to income. Tretheway and Oum (1992) note that air travel exhibits procyclical behaviour and that very few goods are as responsive to income as air transport. Demand for air travel, therefore, is likely to be sensitive to changes in economic conditions which might affect income.

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[4] Morley has done some work on constructing tourism price indexes for Australia.

[5] Witt and Martin (1987) have a comprehensive review of the use of price indexes and exchange rates in travel demand models.

Additionally, increases in disposable income increase the quantity of goods and services an individual is able to consume. Therefore imports may rise as disposable income increases. Since increased trade opportunities may generate business travel demand, GDP growth in both Australia and the foreign country are likely to influence demand for business travel.

The way income is represented in demand studies may be important. Most demand studies use current income measures, such as private final consumption expenditure, gross national product or average weekly earnings as proxies for personal disposable income. Alperovich and Machnes (1994) argue that the use of current income is at odds with economic theory which suggests that permanent rather than current income is the relevant explanatory variable that determines demand. They suggest there may be a role for wealth in models of leisure travel demand studies. While leisure travel by employed persons is likely to be related to changes in disposable income, travel by retirees may depend upon wealth and retirement income.

In many developing countries, income distribution is very uneven compared to that in more developed economies. As a consequence, an increase in average disposable incomes may not lead to an increase in travel demand to the same extent that would a similar increase in disposable income in developed countries. Secondly, increasing disposable incomes of the population as a whole is initially more likely to be translated into the purchase of consumer goods than of travel. In this latter respect, many of the emerging Asian markets will be similar to the Eastern European markets (Bureau of Tourism Research (BTR) 1990).

Relative prices between countries

The link between leisure travel demand and the real exchange rate has been discussed under the 'cost of living at the travel destination' heading (page 25).

The real exchange rate can also be used as a measure for international competitiveness. For firms, a decline in the real exchange rate may indicate an increase in Australia's international competitiveness, as production costs fall relative to other nations. This might lead to an increase in foreign investment in Australia, and an increase in associated business travel.

Changes in the real exchange rate may also influence the flow of imports and exports. An increase in the real exchange rate reduces the relative price of goods imported into Australia, but results in an increase in the price of its exports relative to other countries. For example, an increase in the real exchange rate between Australia and Japan might result in a fall in the price of imported Japanese cars. One outcome of this might be an increase in business travel by Japanese exporters to Australia.

Quality of service

Generally, leisure travellers prefer to travel on 'low price, low service' discount airfares. Service quality attributes are not significant determinants of leisure demand, although an airline's safety and security record may be important in determining *airline* choice (see Morrison and Winston 1989). However, quality of service, particularly flight frequency, has been found to be of some importance to business travellers (see Ippolito 1981, Morrison and Winston 1985, 1989).

In practice, it is difficult to obtain measures of 'service quality' because of lack of data. Often quality of service is proxied by flight frequency. Ippolito (1981) explained that this tendency is based on the presumption that consumers attach a benefit to having a wider choice of flight times. Given an initial demand and plane size, an increase in flights will generate lower load factors. This increases the probability that consumers will obtain tickets for first choice flights at, or near, desired departure times. If an increase in flight frequency and/or total available seats can reduce time delays for consumers, then demand for air travel on a particular route may increase. In their comprehensive study of airline economics in 1992, Tretheway and Oum argued that the most important qualities of service elements in air travel demand are service frequency and convenience.

Substitute destinations

Consumers planning overseas holidays may choose among a range of competing, or substitute, destinations. Therefore models of international leisure travel demand should probably consider potential substitute destinations by including the price of travel between the home country and all possible destinations.

Although this type of analysis has some theoretical appeal, it is often unattractive in practice because of the difficulty of identifying alternative destinations. Since not all potential destinations will be substitutes, identifying alternative destinations is very subjective. Further, such an exercise would require the collection of vast amounts of data. For these reasons, many studies exclude price variables for substitute destinations.

Intermodal competition

Generally, the best mode of transport for international passenger travel is air, although there are exceptions in Europe, where high-speed rail may be a close substitute (BTCE 1994). For Australia, there is effectively no intermodal

competition to international air travel[6]. The cost and quality of alternative transport modes will therefore have negligible impact on air travel demand to and from Australia, and are not considered.

Population and distance

The populations of origin and destination cities (or countries) and the distances between the cities are determinants often considered in gravity specifications of transport demand.

In economic terms, population can be thought of as a proxy for the size of the market between two cities. Any increase in the size of the market has the potential to increase demand for travel between the two cities. Distance can affect a traveller's choice of destination in terms of the cost of travel and the time taken to reach the destination. Thus an inverse relationship between distance and demand for travel would be expected.

Marketing

Marketing expenditure by the ATC, or advertising expenditure by major airlines such as Qantas, which promotes holiday destinations and customised holiday packages, is a potential determinant of international leisure demand.

Crouch, Schultz and Valerio (1992) reported a regression analysis of demand for international tourism to Australia which employs traditional variables such as price and income, but also includes the level of marketing activity by the ATC. They found that the ATC's marketing activity was statistically significant in explaining the variation in travel demand to Australia from Japan, USA, New Zealand, UK and Germany.

Migration

Past migration patterns may have an impact on demand for international travel, particularly for Australians. Visiting family and friends is an important part of leisure travel. Australians born overseas may generate travel by visiting their country of birth, and by encouraging overseas relatives and friends to visit Australia. Travel demand is expected to be positively related to the number of Australian residents born overseas.

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[6] In 1993, only 0.3% of arrivals and departures were by ship (ABS, *Overseas Arrivals and Departures Australia*, 3404.0)

Other factors

An increase in the amount of leisure time available to consumers may increase the demand for overseas holidays. Duffey (1992), reporting on structural change in the USA domestic airline industry, suggested the possibility that such forces as the trend toward a shorter working week and the shifting age composition of the population may significantly accelerate the rate of growth of leisure travel.

Demand for both leisure and business air travel is influenced by seasonal factors such as the northern and southern summers, Christmas holiday periods, and special events like the 1987 America's Cup, Australia's 1988 Bicentenary and World Expo and the 1990 Gulf War. Qualitative factors such as individual tastes and preferences for particular holiday destinations, the level of service at the destination, the threat of terrorism, political unrest and natural disasters may all influence demand for leisure travel to various destinations.

CHAPTER 4   REVIEW OF EMPIRICAL STUDIES

This chapter reviews the findings of major studies undertaken over the last 20 years which estimated demand elasticities for travel between Australia and overseas countries and regions. A summary table of elasticity estimates is included at the end of the chapter. The aim of this literature review is not to illustrate the historical development, but rather provide an exposition, of the nature of work undertaken in this field.

A selection of international studies which have investigated specific issues important in modelling air travel demand is also discussed.

AUSTRALIAN STUDIES

Bureau of Transport Economics

In 1978, the Bureau of Transport Economics (BTE) examined factors affecting the demand for international air travel. Using quarterly data from March 1964 to March 1977, the BTE developed a model of air travel demand between Australia and eight countries: Germany, Italy, Japan, Malaysia, Singapore, New Zealand, UK and the USA. The approach adopted by the BTE involved pooling time-series and cross-sectional data and using dummy variables to account for variations between country pairs due to unrepresented factors. Separate equations were formulated to model leisure and business traffic by foreign arrivals and resident departures.

The BTE expressed demand for leisure travel as a function of real income (measured by personal disposable income and gross domestic product), the real airfare, the exchange rate between Australia and the overseas country, and migration. Migration was proxied by two variables: the proportion of the Australian population born in the overseas country, and the number of Australian-born permanent residents in the overseas country. Demand for business travel was represented by the real airfare, the volume of trade between Australia and the overseas country, and a time trend. The volume of trade was derived by summing real exports and imports. To account for a lag in the response of actual demand to a change in the determinants, the business equation was formulated as a partial adjustment model.

Overall, the BTE found that price and income were significant determinants of leisure travel and that demand was relatively elastic with respect to both these factors. The BTE calculated an average airfare elasticity of demand of -1.8 for leisure travellers from Australia and an income elasticity of 2.4. For foreign visitors to Australia, the airfare elasticity was -1.85 and the income elasticity, 2.1. Past migration was found to be a statistically significant explanator of leisure demand, but its impact was relatively less important.

The coefficients for the airfare and trade variables in the analysis of business demand were significant for both foreign visitors and Australian travellers. An airfare elasticity of -1.2 was estimated for Australian business travellers and -1.0 for business visitors to Australia. The elasticity of demand with respect to trade was significant for foreign business visitors and Australian business travellers at 0.8.

Hollander

Hollander (1982) followed a similar approach to the BTE (1978) in his study of international air travel, developing separate models for leisure and business travel. All demand equations were specified in double-log form and estimated using quarterly data from March 1970 to March 1980.

For leisure travel, Hollander used the same model as the BTE, except that personal income was proxied by real per capita consumption expenditure. Demand equations were estimated for travel to and from New Zealand, UK, USA, Japan, Italy, Germany and Canada. For foreign visitors, demand was generally elastic with respect to income, with values ranging from 1.21 for USA to 6.82 for Germany. Only the income elasticity of 0.63 for New Zealand was inelastic and not statistically significant. The significant airfare elasticities were -0.47 for the USA, -0.95 for New Zealand and -1.04 for UK.

For Australian resident departures, Hollander estimated a pooled time series and cross-sectional model with data from New Zealand, UK, USA, Japan, Italy, Germany, Canada, Ireland, Malaysia and Singapore. Income was found to be the most important determinant of leisure demand, with a elasticity of 1.28. The fare elasticity was relatively low, but statistically significant at -0.6.

In the business demand model, Hollander used GDP as an income measure, and included a time trend as an explanatory variable. All variables in the model, except the time trend, were lagged by one quarter to allow for adjustment in demand. The countries analysed were New Zealand, UK, USA, Japan and Germany. Regression results indicated that the time trend was the only significant explanator of demand to and from Australia.

However, it is unlikely, given the results of the BTE (1978) and other studies, that price and income are not significant determinants of business demand. The time trend may have captured factors, not defined in the model, which explain

business demand. This suggests that the adjustment process may have been mis-specified and/or that other explanatory variables such as the exchange rate or different price and income variables should have been included.

Poole

Poole (1988) developed a model to explain changes in the number of visitors arriving in Australia. Separate demand equations for visitors on business, holidaying or visiting friends and relatives (VFR) were estimated for the markets of North America, New Zealand, Japan, other Asia, UK and other Europe. In the case of Europe and Asia, it was assumed that visitors from countries within each region react in the same way to changes in the independent determinants of demand.

The model used for all three travel purposes was a typical 'Marshallian' demand equation with demand expressed as a function of the real airfare, real foreign income (proxied by gross domestic product) and the real exchange rate (adjusted by the CPI). In the holiday and VFR equations, income and exchange rates were lagged by three quarters to allow for the time delay between changes in these variables and their effects on arrivals. These lags were consistent with the time lag for exchange rate effects found in the BTE 1988 study of international air transport. In the business demand equation, variables representing Australian and overseas income were included in the model, depending on whether Australia's trade with a country was import or export dominated.

Poole estimated airfare, income and exchange rate elasticities of demand by fitting quarterly data from 1976 to the three demand equations. The models were specified in double-log form, where both independent and dependent variables were converted to natural logs. The estimated airfare elasticities were between -0.4 and -1.5 for holiday travellers, and -0.3 and -1.3 for VFR travellers. For business travel, only the airfare elasticity for New Zealand was significant at -0.7. Income was an important determinant for all three travel purposes, but relatively more important for holiday and business travellers. For leisure travel, demand was highly elastic with respect to income, ranging from 1.5 for New Zealand to 5.1 for Europe and 5.2 for Japan. Income elasticities for business travel were also elastic, ranging from 1.4 to 5.2. Exchange rates were particularly important for holiday travellers from the USA and New Zealand, with elasticities of -1.8 and -1.1 respectively.

Bureau of Transport and Communications Economics

In 1988, the Bureau of Transport and Communications Economics (BTCE) produced a study of international aviation. The report Trends and prospects for Australian international air transport analysed factors which affect demand for international air services. Demand analysis was conducted for five regions: Europe, New Zealand, North America, Japan, and Asia (excluding Japan).

Separate demand equations for leisure and business travel (foreign visitors and Australian travellers) were specified, using quarterly data from 1976 to 1986.

The models used in this study were based on a single equation double-log relationship, with demand expressed as a function of real income, real airfares and relative prices. For the analysis of Australian outward leisure travel to each region, a model based on the 'almost ideal demand system' was developed to account for Australians substituting between alternative holiday destinations[1].

The BTCE estimated aggregate demand elasticities for business and leisure travel to and from Australia. For leisure travel, the price elasticity was -0.62 for Australian travellers and -0.57 for foreign visitors to Australia. The income elasticity for foreign visitors of 2.92 was much higher than the estimate of 1.3 for Australian travellers. A possible reason for this is that the BTCE used income data from the Organisation for Economic Co-operation and Development (OECD) as a proxy for aggregate income. This may not adequately reflect the growth in incomes from individual countries which have been major sources of visitors to Australia.

Airfare elasticities for Australian leisure travellers were all significant, with the demand for travel to North America (-1.86) displaying a high degree of responsiveness to price. For foreign visitors, income was the most important factor and elasticities ranged from 1.94 for New Zealand to 5.57 for Japan. Airfares were also important for foreign leisure visitors and statistically significant elasticities were estimated for Europe (-0.61), North America (-1.23) and New Zealand (-1.33). Most of the relative price measures were insignificant.

For business travel, Australian income was an important determinant of demand. All income elasticities for Australian business travellers were significant, except Asia, with estimates varying from 1.09 for Europe to 3.82 for North America. Income was also an important determinant of foreign leisure visitors with statistically significant estimates for North America, Asia, and New Zealand. Airfares were less important in determining business demand with only the elasticities for New Zealand inbound (-0.56) and Europe outbound (-0.23) and North America outbound (-0.34) being statistically significant.

Crouch

Crouch (1991) examined a number of factors that might influence tourism to Australia from five countries (Japan, New Zealand, UK, USA and West

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1 The basis of this technique is to analyse the share of total expenditure on international air travel that Australians spend on fares in travel to each region. These shares are estimated simultaneously using as explanatory variables the fare to each region, the relative prices of each region and the average expenditure on fares for overseas travel.

Germany) using multivariable regression analysis. Factors considered were income, relative price, airfares, expenditure by ATC on advertising and marketing, special events (for example, the global economic recession in 1982 and 1983, the effects of terrorism in 1986, and Expo and the Bicentenary in 1988) and a time trend.

Airfares appeared to be a significant determinant of demand in only two of the five countries included in the analysis. Elasticities ranged between -1.4 to -1.9 for New Zealand and -1.0 to -1.3 for the UK, but were found to be insignificant for USA, Japan and West Germany.

Bureau of Tourism Research

The Bureau of Tourism Research (BTR) (1992) used a dynamic model of travel behaviour, which includes lagged variables, to forecast the number of visitors to Australia between 1992 and 2001. A double-log equation was specified with the number of travellers assumed to be a function of income (represented by GDP of the source country) and relative prices (the real exchange rate)[2]. The BTR hypothesised that travellers do not react instantaneously to changes in income and the real exchange rate, and included lagged explanatory variables in its model to capture this partial adjustment process. This dynamic specification allowed BTR to estimate both short-run and long-run elasticities of demand with respect to income and relative prices.

Using quarterly data from March 1976 to December 1991 the BTR estimated separate demand equations for visitors to Australia from 13 countries. In each equation, only the lagged values for income and exchange rates were found to be significant determinants of demand. Consequently, the short-run income and relative price elasticities of demand were all zero.

Overall, BTR found that, in the long run, demand for travel to Australia is generally elastic with respect to income and relative prices. Income elasticities for the 13 countries ranged from 1.35 for New Zealand to 6.73 for Switzerland and 7.58 for Japan. Income growth was the most important determinant for visitors from Japan, Switzerland, Germany, France and Indonesia. Relative prices were elastic for nine of the 13 countries examined and were particularly important for visitors from the USA (-2.54), Malaysia (-3.09), and Japan (-3.01).

As there is a direct link between the number of foreign visitors travelling to Australia and demand for air transport, it appears that income growth is a major determinant of the total demand for air passenger services. Relative prices are

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2 Airfares were not included as a determinant in this demand model. However, forecasts of visitor numbers were adjusted for the anticipated impact of the deregulation of the international aviation industry on international airfares.

generally a less significant determinant of demand than income, but are still an important explanator of how people substitute travel to other countries for travel to Australia. The weakness of this model is that airfares were excluded as an explanatory variable, since BTR was interested only in modelling the *potential* growth in foreign arrivals, and not the responsiveness of demand to changes in airfares.

Conclusion of Australian studies

The wide range of elasticity estimates reported above suggests that the functional form of the model and the nature of the variables chosen to explain demand are extremely important. The following section reviews a number of these aspects that have been identified by international studies.

SELECTED INTERNATIONAL STUDIES

Many international studies have estimated demand elasticities for air travel. However, the following studies examined the importance of specific aspects of demand modelling in estimating elasticities.

Lagged dependent variable: Witt and Martin

Witt and Martin (1987) developed a set of econometric models for forecasting international tourism demand from West Germany and the UK. Their models were 'typical' tourism demand models with demand expressed as a function of real income, relative prices, and the cost of travel (this includes air travel and surface travel). However, Witt and Martin also considered using lagged values of demand to explain habit persistence and the possible rigidity in the supply of tourist facilities and services. They argued that once people have visited a country and liked it, there is a tendency to reduce travel risk by returning. Furthermore, news about the destination spreads as people disseminate information about their holidays. Capacity constraints may result as demand increases more rapidly than the supply of tourist facilities.

To account for habit persistence and general supply rigidities Witt and Martin included a lagged dependent variable in each tourism demand equation for the UK and West Germany. They found that this lagged dependent variable was significant in the majority of regressions for the UK, but in only one regression for Germany. This implies that, in some markets, habit persistence and possibly supply constraints may have a role alongside traditional income and price variables in the determination of tourist demand.

To take into account the findings of Witt and Martin, dynamic demand models, which included the lagged dependent variable, were specified to estimate demand elasticities for travel between Australia and overseas countries.

Importance of individual market characteristics: Crouch

When modelling tourism demand between origin–destination countries, researchers need to consider the individual characteristics of each market and develop a model appropriate for that market. The importance of these individual market characteristics was explored further by Crouch (1991). Crouch collected and examined data from 44 previous studies of international tourism demand in an effort to identify some of the causes of variability in the estimates of price and income elasticities of demand.

Crouch found that there was a great deal of variability in the estimates of income elasticities of demand, and identified a number of reasons for this. Lagged demand, transportation costs, marketing expenditure and income definition were found to have a statistically significant effect on the variability of the income elasticity estimate. Even the measurement of income in total terms may result in an income elasticity which differs significantly from that of a per capita estimate. For relative prices, Crouch identified 'price definition' as the main reason for variability in estimated relative price elasticities.

The important point from the work of Witt and Martin and then Crouch is the need for researchers carefully to examine the characteristics of individual markets and the nature of the relationships between particular origin countries, destination countries, and competing or complementary alternative destinations. The resultant elasticity estimates may vary markedly depending on the modeling techniques used.

The different characteristics of individual OD country–to–country markets have been allowed for by modelling them independently. By selecting a statically robust functional form, the models in this paper provide a close estimate of the true elasticity of travel between countries.

Role of wealth: Alperovich and Machnes

Alperovich and Machnes (1994) argued that an aggregate income measure, such as GDP, may be an inadequate measure of income. To test their hypothesis, they used three distinct variables to depict income in their demand model. Employee wages were used to represent current income, and stocks of financial and non-financial assets were used to represent permanent income (or wealth). Through representing consumer income by three distinct components, the elasticities of wage income, income from financial assets and income from non-financial assets were allowed to differ.

In agreement with previous studies, Alperovich and Machnes found that international air travel from Israel was a luxury good with a wage income elasticity greater than one and an inelastic price elasticity. The price elasticities were -0.26 for the model without a trend and -0.34 with a trend. Wage income elasticities were 1.55 and 2.06, respectively. Demand elasticities with respect to

non-financial assets were found to be significant, and were estimated to be 0.56 and 0.72 with respect to financial assets and 0.24 and 0.36 for non-financial assets.

The most important factor to arise from their study is the significant role permanent income or wealth might play in demand analysis. Alperovich and Machnes compared their general results with those from a 'simple' model, which used only wages as the income variable. They found significant serial correlation in the simple model, perhaps caused by mis-specification due to the exclusion of variables representing consumer assets. Alperovich and Machnes concluded that the role of wealth in affecting demand is important, and the inclusion of wealth variables eliminates serial correlation and improves the precision of elasticity estimates.

Unfortunately resource constraints meant the BTCE was unable to include measures of wealth alongside the more standard income measures such as GDP and private consumption expenditure, in this study. It would be interesting to investigate in future whether the findings of Alperovich and Machnes also hold for travel between Australia and other countries.

Different fare classes: Oum, Waters and Yong

Oum, Waters and Yong (1992) reviewed empirical estimates of price elasticities for international and domestic air travel. They identified a range of price elasticities for international and domestic air travel between -0.4 and -4.51, with the majority of these estimates falling between -0.8 and -2.0. Oum points out that elasticities differ significantly among different fare classes (for example, first-class, standard economy and discount fares) and distance.

Generally, demand for business travel is less elastic than that for leisure travel. Oum concluded that while the estimates are ambiguous, demand elasticity of business travel is likely to be less than unity and the elasticity of leisure travel is likely to be greater than unity.

SUMMARY OF IMPORTANT DETERMINANTS FROM STUDIES

The demand elasticities estimated by the six Australian studies varied widely, even between Australia and the same overseas destination. Generally, the results of empirical studies of demand for airline services indicate that the most important determinants of travel demand are airfares, incomes and relative prices. However, the degree of sensitivity depends largely on whether the journey is for leisure or business purposes. Leisure travellers tend to be more sensitive to changes in airfares than business travellers.

Other factors such as marketing activity and migration were also found to be important explanators in specific markets. The importance of considering the

individual characteristics of the market being analysed was highlighted by the literature. The wide range of elasticity estimates, even for the same routes, indicates the importance of using desegregated and statistically robust demand models for estimating demand elasticities.

TABLE 4.1 SUMMARY OF ESTIMATED ELASTICITIES FOR AIR TRAVEL TO AND FROM AUSTRALIA

		Elasticity				
Study	Market analysed	Airfare	Relative price	Australian income	Foreign income	Country/region analysed
BTR (1992)	Foreign visitors	–	-2.54	–	2.12	USA
	Foreign visitors	–	-1.06	–	2.74	UK
	Foreign visitors	–	-1.22	–	4.74	Germany
	Foreign visitors	–	-0.894	–	1.54	Netherlands
	Foreign visitors	–	-0.714	–	4.59	France
	Foreign visitors	–	-2.16	–	2.48	Italy
	Foreign visitors	–	-1.24	–	6.73	Switzerland
	Foreign visitors	–	-3.01	–	7.58	Japan
	Foreign visitors	–	-2.16	–	2.48	Singapore
	Foreign visitors	–	-3.09	–	2.99	Malaysia
	Foreign visitors	–	-0.75	–	4.43	Indonesia
	Foreign visitors	–	-0.30	–	2.13	Hong Kong
	Foreign visitors	–	-1.93	–	1.35	New Zealand
BTCE (1988)	Foreign leisure visitors	-0.57	-0.65	–	2.92	Aggregate[a]
	Foreign leisure visitors	-0.61	-0.16	–	4.09	Europe
	Foreign leisure visitors	-1.23	-0.33	–	1.24	North America
	Foreign leisure visitors	-1.33	-1.47	–	1.94	New Zealand
	Foreign leisure visitors	0.43	-0.11	–	5.57	Japan
	Foreign leisure visitors	0.02	-0.18	–	1.51	Asia
	Australian leisure travellers	-0.62	0.21	1.30	–	Aggregate[a]
	Foreign business visitors	–	-0.13	1.21	1.60	Aggregate[a]
	Foreign business visitors	–	0.03	1.67	1.91	Europe
	Foreign business visitors	–	0.48	3.33	–	North America
	Foreign business visitors	–	–	1.41	1.30	Asia
	Foreign business visitors	–	-0.26	1.60	1.25	Japan
	Foreign business visitors	-0.56	-0.86	1.78	–	New Zealand
	Australian business travellers	–	0.16	0.03	3.12	Aggregate[a]
	Australian business travellers	-0.23	–	1.09	1.38	Europe

TABLE 4.1 (CONTINUED)

Study	Market analysed	Airfare	Relative price	Australian income	Foreign income	Country/region analysed
				Elasticity		
	Australian business travellers	-0.34	0.71	3.82	0.32	North America
	Australian business travellers	–	0.48	2.01	1.03	Japan
	Australian business travellers	–	–	–	1.54	Asia
	Australian business travellers	–	-0.34	2.43	–	New Zealand
Poole(1988)	Foreign holiday visitors	-0.40	-1.80	–	2.90	USA
	Foreign holiday visitors	–	-0.50	–	5.20	Japan
	Foreign holiday visitors	–	-0.90	–	2.90	Asia (excluding Japan)
	Foreign holiday visitors	-1.50	-1.10	–	1.50	New Zealand
	Foreign holiday visitors	-0.70	-0.70	–	2.80	UK
	Foreign holiday visitors	-0.40	-0.10	–	5.10	Other Europe
	Foreign VFR visitors	-1.10	-0.50	–	1.10	USA
	Foreign VFR visitors	–	-0.30	–	2.20	Asia (excluding Japan)
	Foreign VFR visitors	-1.20	-0.20	–	1.60	New Zealand
	Foreign VFR visitors	-1.30	-0.60	–	–	UK
	Foreign VFR visitors	-0.30	–	–	0.80	Other Europe
	Foreign business visitors	–	-0.30	–	–	USA
	Foreign business visitors	–	-0.70	–	1.00	Japan
	Foreign business visitors	–	–	–	1.70	Asia (excluding Japan)
	Foreign business visitors	-0.70	-0.10	1.60	–	New Zealand
	Foreign business visitors	–	-0.20	2.00	–	UK
	Foreign business visitors	–	0.30	–	5.20	Other Europe
Hollander(1982)	Foreign leisure visitors	-0.95	-0.79	–	0.63	New Zealand
	Foreign leisure visitors	-1.04	-0.37	–	4.64	UK
	Foreign leisure visitors	-0.47	-0.25	–	-1.21	USA
	Foreign leisure visitors	–	-0.06	–	4.64	Japan
	Foreign leisure visitors	-0.32	0.06	–	1.40	Canada
	Foreign leisure visitors	-0.19	-0.63	–	6.82	Germany
	Foreign leisure visitors	0.28	0.27	–	3.17	Italy
	Australian leisure travellers	-0.55	-0.38	1.28	–	Aggregate[b]

TABLE 4.1 (CONTINUED)

| Study | Market analysed | Airfare | Elasticity | | | Country/region analysed |
			Relative price	Australian income	Foreign Income	
BTE (1978)	Foreign leisure visitors	-1.85	–	–	2.51	Aggregate[c]
	Foreign leisure visitors	-0.58	–	–	4.99	Germany
	Foreign leisure visitors	-1.94	–	–	3.81	Italy
	Foreign leisure visitors	-0.96	–	–	2.28	Malaysia/Singapore
	Foreign leisure visitors	-1.20	–	–	1.54	New Zealand
	Foreign leisure visitors	-1.00	–	–	1.13	UK
	Foreign leisure visitors	-1.38	–	–	3.37	USA
	Australian leisure travellers	-1.78	0.55	2.36	–	Aggregate[b]
	Australian leisure travellers	-1.15	0.56	–	1.24	Germany
	Australian leisure travellers	-1.13	–	–	2.84	Italy
	Australian leisure travellers	-4.57	–	1.53	–	Japan
	Australian leisure travellers	-1.54	–	0.68	–	Malaysia/Singapore
	Australian leisure travellers	-1.01	–	1.13	–	New Zealand
	Australian leisure travellers	-1.16	–	–	3.49	UK
	Australian leisure travellers	-1.67	–	–	3.32	USA
	Foreign business visitors	-1.00	–	–	–	Aggregate[b]
	Australian business travellers	-1.23	–	–	–	Aggregate[b]

a. includes Asia (excluding Japan), Europe, Japan, New Zealand and North America

b. includes Germany, Italy, Japan, Malaysia/Singapore, NZ, UK, and USA

c. includes UK, Japan, Germany, Italy, New Zealand, Singapore/Malaysia

– omitted or not estimated in model

CHAPTER 5   MODEL SPECIFICATION AND DATA

DYNAMIC DEMAND MODEL

In aviation markets, supply rigidities, imperfect information and the tendency, particularly of leisure travellers, to plan and book an international trip a long time in advance, suggest that market adjustment may not be instantaneous. Therefore, when analysing demand for international air travel, it becomes important to develop a dynamic demand model that includes lagged values of the explanatory variables.

A dynamic model is valuable as it can be used to distinguish between short-run and long–run effects of changes in the explanatory variables. Long–run elasticities are generally higher in absolute value than short–run elasticities. Goodwin (1992) suggests that past transport demand studies show that in the long run elasticities are between 50 and 150% higher than the short run.

Our analysis focuses on estimating long-run elasticities of demand with respect to prices, particularly airfares. Government and industry analysts are interested in the *full* effect policy instruments may have on air travel demand. Long–run elasticities are therefore more meaningful since they capture the lagged adjustment process and the time it takes consumers and producers to adjust their consumption and production habits in response to changes in prices and income.

Leisure travel

A general expression for the dynamic model of leisure travel demand is:

$$LD_{it} = \alpha + \sum_{j=0}^{4} \rho_j LF_{i(t-j)} + \sum_{j=0}^{4} \beta_j REX_{i(t-j)} + \sum_{j=0}^{4} \lambda_j Y_{i(t-j)} + \sum_{j=1}^{4} \phi_j LD_{i(t-j)} \qquad (5.1)$$

for $i = 1, 2, \dots, 24$ and $t = 1, 2, \dots, 32$

where i is the leisure travel market analysed for foreign visitors and Australian travellers between Australia and each of the 12 countries, t is the quarterly time period and j is the number of quarterly lags.

The variable *LD* is leisure demand for air travel, *LF* is the real leisure airfare, *REX* is the real exchange rate, and *Y* is real income. A full description of variables modelled in the leisure demand model follows later in this chapter.

The coefficients ρ_o, β_o and λ_0 represent the short–run effect on demand of a change in the airfare, the real exchange rate and income. The sum of the coefficients $\sum_{j=0}^{4} \rho_j$, $\sum_{j=0}^{4} \beta_j$ and $\sum_{j=0}^{4} \lambda_j$ represents the long–run effect on demand of a change in the airfare, the real exchange rate and income. These coefficients can be used to derive long–run *elasticities* of demand[1].

Business travel

A general expression for the dynamic model of business travel demand is:

$$BD_{it} = \alpha + \sum_{j=0}^{4} \rho_j BF_{i(t-j)} + \sum_{j=0}^{4} \beta_j REX_{i(t-j)} + \sum_{j=0}^{4} \lambda_j AGDP_{i(t-j)} + \sum_{j=0}^{4} \delta_j FGDP_{i(t-j)}$$

$$+ \sum_{j=1}^{4} \phi_j BD_{i(t-j)}$$

$$(5.2)$$

for $i = 1, 2, \dots, 24$ and $t = 1, 2, \dots, 32$

where *i* is the business market analysed for foreign visitors and Australian travellers between Australia and each of the 12 countries, *t* is the quarterly time period and *j* is the number of quarterly lags.

The variable *BD* is business demand for air travel, *BF* is the real business airfare, *REX* is the real exchange rate, *AGDP* is real Australian gross domestic product and *FGDP* is real foreign gross domestic product. A full description of variables modelled follows later in this chapter.

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[1] For example, in the double-log specification of leisure air travel, the long-run elasticity of demand with respect to the airfare ($\varepsilon_{Airfare}$) is:

$$\varepsilon_{Airfare} = \sum_{t=t_0}^{\infty} \frac{d\text{NBD}_t}{d\text{NBF}_t} = \frac{\sum_{j=0}^{4} \rho_j}{1 - \sum_{j=1}^{4} \phi_j}$$

where *d* is the difference operator. For the linear model of leisure demand this would be multiplied by the sample mean of the independent variable divided by the sample mean of the dependent variable, i.e. $\dfrac{\overline{\text{NBF}}}{\overline{\text{NBD}}}$.

These general form models of leisure and business air travel demand can be used to estimate demand elasticities for:

- leisure travel by foreign visitors to Australia;
- leisure travel by Australian residents to overseas destinations;
- business travel by foreign visitors to Australia; and
- business travel by Australian residents to overseas destinations.

MODEL SELECTION

All demand equations were specified in either linear or double-log form. The selection of the most appropriate functional form was based on an inspection of the data and the results of statistical tests for mis–specification and functional form.

The selection of the appropriate dynamic equation is based on an approach suggested by Hendry (1979) and explained by Madalla (1988). This is a 'general to specific' approach that starts with a very general dynamic model which is overparameterised (that is, has more lags than might be considered necessary). This general model is then sequentially simplified to a more specific form on the basis of F-tests for the significance of each lag and the overall explanatory power of the model. The aim ultimately is to find a dynamic structure for each equation which best fits the underlying data.

MODEL TESTING

The airfare variable was tested for endogeneity using Hausman's test and a version of the multi-equation model similar to that specified in Chapter 3 (see equations 3.7 and 3.8). Generally, Hausman's test revealed that airfares and the residuals were not correlated. Therefore airfares were treated as exogenous, and a single demand equation was estimated for each of the leisure and business travel demand models.

During the model specification process, diagnostic tests were performed on each model. These were the:

- F-test for the significance of the equation;
- Lagrange Multiplier test (LM) for serial correlation of the residuals;
- Bruesch-Pagan (BP) test for heteroskedasticity in the residuals;
- Ramsey Reset test (RESET) for general misspecification of the model;
- Lagrange Multiplier test for autoregressive conditionally heteroskedastic (ARCH) effects in the residuals; and,
- Jarque-Bera (JB) test for normality of the residuals.

For further explanation of these tests, see appendix I.

Diagnostic testing generally indicated minimal problems with serial correlation and non-normality of the residuals, and no ARCH effects. There is also little evidence of any major misspecification of the demand models. In some of the demand equations, however, the BP test indicated the presence of heteroskedasticity in the residuals. In these equations, corrections to the estimated standard errors of the coefficients were made using White's (1980) variance-covariance matrix.

DATA

Leisure travel demand model

Leisure demand (LD)

Two separate time series were used to model leisure demand in each OD market, one for foreign visitors to Australia and one for Australian travellers overseas. These series were drawn from ABS estimates of total short-term OD passengers less those passengers travelling for business or attending a convention.

Source ABS, *Overseas Arrivals and Departures Australia*, Cat. 3402.0.

Real leisure airfare (LF)

Ideally, for each OD country market, an average airfare would be calculated by weighting the airfare for each possible city-pair route between two countries by the amount of traffic travelling on that route. However, it was not possible to obtain city-pair specific OD data.

It is proposed that the airfare for an OD country market can be proxied by the airfare for the city–pair (route) which holds the dominant share of traffic in that market. Preliminary analysis indicates that city-pair (published) airfares in a given market tend to move together on a fairly consistent basis. Since it is changes in airfares that are of interest, it is fair to assume that the airfare on the route which carries the majority of travellers will be a reasonable proxy for all airfares in that market.

Therefore, airfares are for travel between Sydney and the major gateway airport linking Australia and the foreign country. For example, the Sydney to Los Angeles airfare is used to represent air travel from Australia to the USA. Appendix II lists the Sydney–foreign-city-pair airfare used as a proxy for all airfares between Australia and each foreign country.

Leisure travellers can select from a range of airfares. However, it is assumed on average that these travellers will purchase the cheapest airfare available for the period in which they choose to travel.

However, the cheapest airfare varies. For example, a peak period discount fare may apply for two months of the September quarter and a shoulder period fare for the other month. BTCE derived a 'weighted average discount' economy (book) airfare, based on the period of availability of each main type of discount airfare (e.g. high, shoulder and low season)[2]. Airfares were converted to real airfares by dividing them by the CPI of the respective origin country.

For foreign visitors, the airfare is the 'weighted average discount' economy return airfare (divided by two) available for purchase in the foreign country and expressed in the foreign currency. For Australian travellers, it is the 'weighted average discount' economy return airfare (divided by two) expressed in Australian dollars.

Source Book 1 Worldwide Fares, Air Tariff Publications, Middlessex, various issues.

Real exchange rate (REX)

The real exchange rate is defined as:

$$RP = NX \times \left(\frac{ACPI}{FCPI} \right)$$

where: NX is the nominal exchange rate (the amount of foreign currency that equals \$A1);

   $ACPI$ is the Australian consumer price index; and

   $FCPI$ is the foreign country consumer price index.

For Australian travellers a positive relationship between the real exchange rate and demand would be expected and in the model of foreign visitors a negative relationship between the real exchange rate and demand.

Source variety of publications, see Appendix III.

Real income (Y)

For Australian travellers, private consumption expenditure was used as a measure of personal disposable income. For foreign visitors, private consumption expenditure or GDP was used, depending on data availability. All income was expressed in real terms by dividing by the appropriate CPI. From the literature review, real income level in the country of origin

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[2]   A 'book' airfare is the fare published in air tariff guides and on computerised reservation systems. Some travellers will be able to negotiate a discount on these 'book' airfares.

(residence) is expected to be positively related to the demand for leisure air travel.

Source variety of publications, see Appendix III.

Business travel demand model

Business demand (BD)

Separate time series were used to model business demand in each OD market: one for foreign visitors and one for Australian travellers overseas. Business demand is given by ABS estimates of total short-term OD passengers travelling for business purposes and those attending conventions.

Source ABS, *Overseas Arrivals and Departures Australia,* Cat. 3402.0, various issues.

Real business airfare (BF)

As for leisure airfares, business airfares are for travel between Sydney and the major gateway airport linking Australia and the foreign country. For foreign visitors, this is the published one-way business class airfare available for purchase in the foreign country and expressed in the foreign currency. For Australian travellers, it is the published one-way business class airfare expressed in Australian dollars.

Airfares were converted to real airfares by dividing the airfare by the CPI of the respective origin country. Airfares are expected to be inversely related to demand.

Source Book 1 Worldwide Fares, Air Tariff Publications, Middlessex, various issues.

Real exchange rate (REX)

The real exchange rate was defined earlier. In the business model, the real exchange rate is used as measure of international competitiveness and reflects Australia's potential to export and import. However, the relationship between the real exchange rate and business demand is difficult to determine a priori, as business travellers to and from Australia can be both exporters and/or importers.

Source variety of publications, see Appendix III.

Real Gross Domestic Product (AGDP and FGDP)

The relationship which is likely to exist between business demand and Australian and foreign GDP has been described in Chapter 3. Gross domestic

product was expressed in real terms by dividing through by the appropriate CPI.

Source variety of publications, see Appendix III.

Dummy variables (seasonality and one–off events)

Although not included explicitly in equations 5.1 and 5.2, dummy variables were included in each equation to take into account the strong seasonal nature of air travel. Also, where appropriate, dummy variables have been specified to take into account the effect 'special' events such as the Australian Bicentenary in 1988 and the Gulf War in 1990 might have had on travel demand.

CHAPTER 6 EMPIRICAL RESULTS AND CONCLUSIONS

RESULTS OF ESTIMATED EQUATIONS

Travel demand equations were estimated using quarterly data from March 1986 to June 1994. All equations explain at least 65% of the variation in demand, except for the model of foreign business visitors from Italy (24%) and the model for Australian leisure travellers to Singapore (51%). It was not possible to specify statistically robust models of Australian business travel to Fiji and Fijian business visitors to Australia. The F-statistic also indicated that all models except the model for foreign business visitors from Italy provide significant explanation (at the 5% level) of the variation in demand. Full details of the estimated demand equations and relevant diagnostic tests are included in appendix VI.

Although most of these models explain a statistically significant proportion of the variation in travel demand, as for all models, users should be aware of their limitations and apply and interpret findings appropriately. **Elasticity estimates should be used only to forecast how demand may react to small changes in the independent variables.**

Broad findings

The signs of the demand elasticities generally conform with economic theory and expectations from the literature review. It was found that airfares, income and relative prices were all important determinants of leisure travel, while income and relative prices were the most important determinants of business travel demand.

Not only were airfares less statistically significant determinants, but business travellers were also less *responsive* to changes in airfares than leisure travellers. That is, their estimated airfare elasticities were lower than those for leisure travellers.

Airfare elasticities for Australian leisure travellers ranged from -0.14 to -1.19, and for foreign leisure visitors, from -0.5 to -1.86. The size of these ranges indicates the importance of using market-specific rather than aggregate demand modelling techniques in estimating accurate demand elasticities.

The estimated long–run elasticities of travel demand for each of the four traveller types are presented in tables 6.1 to 6.4.

Foreign leisure arrivals

As expected, the results indicated that a negative relationship existed between airfares and leisure travel demand. That is, an increase in airfares would result in a decline in the number of foreign leisure visitors to Australia.

TABLE 6.1   DEMAND ELASTICITIES FOR LEISURE TRAVEL BY OVERSEAS RESIDENTS TO AUSTRALIA

Country	Airfare Elasticity	Income Elasticity	Real Exchange Rate Elasticity
Germany	-1.23[a]	4.60[a]	-0.52[a]
Italy	-0.56[a]	3.05[a]	-0.12
UK	-1.79[a]	2.37[a]	-0.88[a]
Japan	-0.79[b]	2.15[a]	-0.85[a]
Korea	-0.50	2.02[a]	-9.45[a]
Taiwan	-0.83[b]	2.22[a]	-2.42[a]
Indonesia	-1.46[a]	2.37[a]	-0.42[a]
Malaysia	-0.78	5.51[a]	-4.01[a]
Singapore	-1.86[b]	2.83[a]	-2.01[a]
Fiji	-0.80[b]	0.84[b]	0.16
New Zealand	-0.68[b]	1.11[a]	0.69[b]
USA	-1.85[b]	1.88[a]	-0.43

a. Statistically significant at the 5% level

b. Statistically significant at the 10% level

Source   BTCE estimates

Generally, airfare elasticities tended to be lower on shorter distance routes, such as those between Australia and the Asia–Pacific region, compared to longer routes such as to Europe and the USA. This makes intuitive sense, since airfares tend to be higher for longer flight distances. Therefore, a given percentage increase in airfares would result in a smaller increase in the total journey cost on short routes compared to the longer routes.

For example, the average expenditure on return airfares to Australia from the Asian region is about $1 100. Therefore, a 10% increase in airfares (that is $110) represents a relatively smaller increase in total travel costs compared to a 10% increase in fares from the USA, which would increase travel costs by about $250.

All of the estimated income elasticities were positive, and many around two in value. This suggests that a one per cent rise in foreign income will increase the number of leisure visitors from that country to Australia by around two per cent.

All the real exchange rate elasticities, which were statistically significant at the five per cent level, were negative. This confirms the expectation that a rise in

the real exchange rate would result in a decline in the number of travellers to Australia. The reverse will also hold.

The estimated real exchange rate elasticities for Malaysia and Korea, and the income elasticity for Malaysia, while all of the right sign and statistically significant at the five per cent level, appear to be quite high. The reason for this is related to the fact that both markets are relatively immature, and in the last few years have been growing at phenomenal rates (between 1991 and 1993, the number of Malaysians visiting Australia swelled from 42 000 to 73 000, and for Korean arrivals, from 19 000 to 56 000). The models attempt to explain this rapid escalation in demand in terms of consumer responses to changes in airfare, income and relative price. This approach, while appropriate for a mature market, does not specifically account for other factors which may be influencing demand, such as major shifts in consumption patterns or the effects of concerted destination marketing to an emerging middle class. Readers are urged to interpret the elasticity estimates from these models with caution.

Australian leisure departures

The estimated airfare elasticities for Australians travelling overseas for leisure are all of the expected negative sign.

TABLE 6.2   DEMAND ELASTICITIES FOR LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS DESTINATIONS

Country	Airfare Elasticity	Income Elasticity	Real Exchange Rate Elasticity
Germany	-0.50[b]	1.09[b]	0.51[a]
Italy	-0.29[a]	0.21[b]	0.20[b]
UK	-0.14[b]	1.03[a]	0.57[a]
Japan	-1.16[b]	0.44	0.28[a]
Korea	-1.14[b]	5.90[a]	1.41[b]
Taiwan	-1.19	11.58[a]	4.46[a]
Indonesia	-0.48	3.41[a]	0.25[b]
Malaysia	-0.95[a]	1.36[b]	1.01[a]
Singapore	-0.54[b]	0.44	0.59[b]
Fiji	-0.53[b]	0.84	0.36
New Zealand	-0.23	0.86[a]	0.26[a]
USA	-0.64[b]	1.52[b]	1.35[a]

a. Statistically significant at the 5% level

b. Statistically significant at the 10% level

Source   BTCE estimates

However, table 6.2 indicates that only travel to Japan, Korea and Taiwan was estimated to be airfare elastic (that is, greater than one). None of these countries are 'traditional' holiday destinations for Australian travellers, and therefore the cost of airfares might be expected to have a greater effect on travel than in traditional markets. The remaining markets are all established,

generally package and 'budget' holiday destinations, and each attracts more than 50 000 Australians visitors each year.

The low cost of travel between Australia and New Zealand, due to the close proximity of the countries, may explain the estimated low airfare elasticity of only -0.23.

All the estimated income elasticities for Australian travellers were positive, although they ranged from inelastic to highly elastic. The estimates of income elasticities for travel to Korea and Taiwan were particularly high. However, travel by Australians to both countries experienced slow growth over the past decade, and between them the two markets accounted for less than 40 000 Australian leisure travellers in 1993. It is suspected that the models may be picking up changes in social factors influencing demand which are highly correlated with income. Again, these particular results should be interpreted with caution.

The estimated real exchange rate elasticities for Australian leisure travellers were all positive. This indicates that if the real exchange rate between Australia and a foreign country increases (for example, through an appreciation of the Australian currency), travel by Australians to that country is likely to increase.

Foreign business arrivals

The estimated airfare elasticities for foreign business visitors to Australia were all negative. All are less than one, indicating that an increase in airfares to Australia will result in a less than proportionate decline in business demand for air travel. As expected, the estimated elasticities were lower than those for foreign leisure visitors. However, only three of the estimated airfare elasticities for foreign business visitors were statistically significant, and then only at the 10% level. This indicates that, generally, airfares were not a significant determinant of business travel demand.

The results indicate that a positive relationship exists between both Australian and foreign GDP and foreign business travel to Australia. Foreign and Australian GDP may be acting respectively as push or pull factors in attracting foreign business travellers to Australia. For example, growth in foreign GDP is likely to be accompanied by growing consumption expenditure in that country, leading to increased demand for imported goods. This in turn may lead to more business travel by foreign residents to 'exporting' countries. Additionally, discretionary business travel is expected to increase as economic activity and income rise.

TABLE 6.3   DEMAND ELASTICITIES FOR BUSINESS TRAVEL BY OVERSEAS
RESIDENTS TO AUSTRALIA

Country	Airfare Elasticity	Australian GDP Elasticity	Foreign GDP Elasticity	Real Exchange Rate Elasticity
Germany	-0.55	1.61[a]	–	-0.04[a]
UK	-0.21	0.53[a]	0.72	0.41[b]
Japan	-0.24[b]	0.47[a]	–	0.18[b]
Korea	-0.20	3.53[b]	0.77[b]	-5.13[a]
Taiwan	–	4.36[a]	–	-3.01[a]
Indonesia	-0.62[b]	0.97	1.65[a]	0.06[a]
Malaysia	–	1.80[a]	0.52	-0.42[b]
Singapore	-0.22	1.08	1.42[a]	-0.43[a]
New Zealand	-0.16	1.06[b]	1.33[a]	-0.79[a]
USA	-0.45[a]	1.22[b]	2.51[a]	-0.56[a]

It was not possible to estimate statistically robust models for Italy and Fiji

a. Statistically significant at the five% level

b. Statistically significant at the ten% level

–   Variable was omitted from the model as it added no further explanatory power

Source   BTCE estimates

The positive relationship between Australian GDP and foreign business visitors may indicate a similar relationship, although here the increase in foreign business travel is more likely to be associated with foreign companies which export to Australia responding to growth in Australian demand for their exports.

The BTCE models describe the relationship between foreign business visitors and the real exchange rate at the aggregate level. As indicated in chapter 3, at the industry level, the real exchange rate may influence foreign business travel through a number of linkages and in different directions. Therefore there is no prior expectation of the sign of these estimates.

However, results indicate that for travel between Australia and each of the 12 countries studied, the real exchange rate is a statistically significant determinant of business demand at the aggregate level. For Germany, Korea, Taiwan, Malaysia, Singapore, New Zealand and the USA, foreign business arrivals will decline in response to an increase in the real exchange rate, whereas foreign business arrivals to Australia from the UK, Japan and Indonesia are expected to increase (slightly) after a rise in the real exchange rate.

Australian business departures

All the estimated airfare elasticities for Australian business travellers were negative, meaning that departures are expected to fall in response to increases in airfares. However, only one of the estimated elasticities was statistically significant, and then only at the 10% level. The remaining elasticities were not significant at this level, or were omitted from the model as they added no additional explanatory power. This suggests that, for most markets, airfares

were not a statistically significant determinant of Australian business demand for air travel.

TABLE 6.4   DEMAND ELASTICITIES FOR BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS DESTINATIONS

Country	Airfare Elasticity	Australian GDP Elasticity	Foreign GDP Elasticity	Real Exchange Rate Elasticity
Germany	—	1.84[b]	1.57[b]	0.28[b]
Italy	-0.19	0.54	1.06	0.55[a]
UK	-0.20	0.79	0.91[b]	-0.26[b]
Japan	—	—	2.19[a]	0.79[a]
Korea	-0.40	0.80	0.91[b]	-0.92
Taiwan	—	—	1.75[a]	-0.77
Indonesia	-0.01	2.82[a]	2.46[a]	-0.50[a]
Malaysia	-0.29	1.30[b]	1.59[a]	-0.50[b]
Singapore	-0.12	0.58[b]	1.86[a]	0.44[a]
New Zealand	-0.34[b]	0.39	3.04[a]	-1.09[a]
USA	—	2.91[a]	—	0.26[b]

It was not possible to estimate a statistically robust model for Fiji

a. Statistically significant at the 5% level

b. Statistically significant at the 10% level

— Variable was omitted from the model as it added no further explanatory power

Source BTCE estimates

As for foreign business visitors, the estimated Australian and foreign GDP elasticities for Australian business travellers were both positive. The relationship between Australian business travel demand and these two variables is similar to that for foreign business visitors (see the previous section for a more detailed explanation).

In the majority of markets, the real exchange rate was found to be a significant determinant of Australian business travel demand. As for foreign business travel, changes in the real exchange rate will affect Australian business travellers through a number of linkages. Both positive and negative relationships between Australian business demand and the real exchange rate were found. For the UK, Korea, Taiwan, Indonesia, Malaysia and New Zealand, the number Australian business travellers was estimated to fall after a rise in the real exchange rate, whereas results indicate that Australian business travel to Germany, Italy, Japan, Singapore and the USA would increase following a strengthening of the real exchange rate.

CONCLUSIONS

This work was undertaken with the primary aim of producing current and market-specific price elasticity estimates for travel to and from Australia. The modelling approach also made it possible to estimate elasticities for the broad economic variables of income, GDP and the real exchange rate.

Airfares, income and relative prices were found to be important determinants of leisure travel to and from Australia, whereas income and relative prices were found to be the most important determinants of business air travel.

Business travel was found to be less responsive to changes in airfare than leisure travel, and airfares were found to be less significant overall in explaining business travel demand.

Airfare elasticities were found to differ, often significantly, between passenger type and origin–destination market. For example, elasticities for Australian leisure departures ranged between -0.23 and -1.19, and for foreign leisure arrivals, between -0.5 and -1.86.

The first two of the above findings are consistent with earlier empirical research, both in Australia (for example, BTCE 1988), and overseas (for example, Oum, Waters and Yong 1992).

The third finding highlights the importance of using market-specific rather than aggregate elasticity estimates in demand modelling work. While it is difficult to *directly* compare estimates of elasticities from different studies, (as modelling techniques and data series will differ), it is nonetheless interesting to note that estimates derived in this study fall broadly within the range of estimates from other reliable studies.

Some specific comparisons are of course interesting to make. For example, this study estimated an Australian leisure airfare elasticity to New Zealand of -0.68, whereas BTCE (1988) estimated -1.33. For Japanese leisure visitors to Australia an estimated airfare elasticity of -0.79 compares with estimates of -4.57 (BTE 1978) and 0.43 (BTCE 1988). Other comparisons (if required) can be made between table 4.1 and tables 6.1 to 6.4.

Many interesting issues remain to be investigated concerning the dynamics and the future of Australian air travel markets.

APPENDIX I DIAGNOSTIC TESTS

Diagnostic tests were carried out to ascertain the robustness of the demand models and resultant elasticity estimates. The key features of these tests are described below.

Adjusted R-squared statistic

The adjusted R-square statistic (Adj. R^2) measures the proportion of the total variation of the dependent variable accounted for by changes in the explanatory variables.

In this study, all models explained at least 65% of the variation in demand, except for the model of inbound business travel from Italy (24%) and the model for outbound non-business travel to Singapore (51%).

The F-statistic

The F-statistic (F) is used to test the significance of all the explanatory variables together. An F-statistic higher than the appropriate critical value (about three at the five per cent level) will lead to rejection of the null hypothesis that all coefficients on the explanatory variables equal zero. In effect, this means that the model provides significant explanation of the variation in the dependent variable.

In this study, all models provided significant explanation (at the five per cent level) of the variation in demand, except the model for inbound business travel from Italy.

The Lagrange Multiplier statistic for serial correlation

The Lagrange Multiplier statistic (LM-statistic) is used to test for serial correlation in the residuals. If the LM-statistic is less than the five per cent critical value of 16.9 (with nine degrees of freedom) or 18.3 (with ten degrees of freedom), then the null hypothesis of no serial correlation is not rejected.

In this study, no LM statistics exceeded the appropriate critical values, indicating there were no problems with serial correlation in the residuals.

The Ramsey Reset test statistic

This is a general test for misspecification of the model. If the reset statistic is below the critical value (of approximately four at the five per cent level) then there is no misspecification in the model.

Generally, in this study, the test statistic for misspecification was insignificant at the five per cent level, indicating there was no misspecification of the demand models.

The Lagrange Multiplier statistic for ARCH effects

This is a Lagrange Multiplier test for ARCH (Autoregressive Conditionally Heteroskedastic) effects in the residuals. An ARCH statistic below the critical value of 3.84 (with one degree of freedom) indicates there is no ARCH effect in the residuals.

The LM test for ARCH effects indicated that there are no ARCH effects in any of the demand models used in this study.

The Breusch–Pagan Test for heteroskedasticity

This statistic tests for unknown forms of heteroskedasticity in the residuals. A Breusch–Pagan statistic of less than the critical value of 16.9 (with nine degrees of freedom) means that the null hypothesis of no heteroskedasticity cannot be rejected.

In some of the demand models, the BP statistic indicated the presence of heteroskedasticity in the residuals. The estimated standard errors were corrected in these equations using White's (1980) variance–covariance matrix.

The Jarque–Berra Test for normality of the residuals

The Jarque–Berra statistic is used to test for normality of the residuals. If the JB statistic is less than the five per cent critical value of 5.99 (with two degrees of freedom), then the null hypothesis that the residuals are normally distributed is not rejected.

APPENDIX II REPRESENTATIVE AIRFARES

Table II.1 shows the city–pair airfares used as proxies for total origin–destination traffic between Australia and each of the countries modelled.

TABLE II.1 REPRESENTATIVE AIRFARE FOR EACH
ORIGIN-DESTINATION MARKET

Country to Country OD Market	City-Pair Airfare
Australia–Germany	Sydney–Frankfurt
Australia–Italy	Sydney–Rome
Australia–UK	Sydney–London
Australia–Japan	Sydney–Tokyo
Australia–Korea	Sydney–Seoul
Australia–Taiwan	Sydney–Taipei
Australia–Indonesia	Sydney–Jakarta
Australia–Malaysia	Sydney–Kuala Lumpur
Australia–Singapore	Sydney–Singapore
Australia–Fiji	Sydney—Nadi
Australia–New Zealand	Sydney–Auckland
Australia–USA	Sydney–Los Angeles

APPENDIX III   DATA SOURCES

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Statistical Yearbook of Indonesia 1991, Central Bureau of Statistics, Jakarta, Indonesia.

APPENDIX IV   ESTIMATED REGRESSION EQUATIONS

GERMANY

TABLE IV.1 LEISURE TRAVEL BY GERMAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-54.156	18.240
Demand (lagged 4)	0.505	0.119
Airfare (lagged 4)	-0.617	0.350
Income (lagged 4)	2.305	0.671
Relative price (lagged 4)	-0.260	0.145
Seasonal dummy Q1	-0.037	0.048
Seasonal dummy Q2	-0.432	0.119
Seasonal dummy Q3	-0.286	0.078
Dummy[a]	-0.119	0.099
Dummy[b]	0.046	0.099
Dummy[c]	-0.022	0.046

a. Dummy variable for German unification, 1991Q1

b. Dummy for Australia's 1988 Bicentenary

c. Dummy for the Gulf War, 1990Q3 – 1991Q1

Period		1986Q1 to 1994Q2	
Functional form		Double log	
Adj R^2	0.94	F(10,23)	55.74
ARCH	0.01	RESET(3)	3.58
LM	8.36	RESET(4)	2.64

TABLE IV.2 LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO GERMANY

Variable	Estimated coefficient	Standard error
Constant	-821.780	1231.000
Demand (lagged 2)	0.351	0.169
Airfare (lagged 1)	-2.078	1.050
Income (lagged 3)	0.105E-06	0.526E-07
Relative price (lagged 3)	1032.600	493.200
Seasonal dummy Q1	-2235.400	192.700
Seasonal dummy Q2	1943.800	328.000
Seasonal dummy Q3	2495.600	767.600

Period	1986Q1 to 1994Q2		
Functional form	Linear		
Adj R²	0.94	F(7,26)	73.37
ARCH	1.12	RESET(3)	4.14
LM	3.35	RESET(4)	2.86

TABLE IV.3 BUSINESS TRAVEL BY GERMAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	405.060	682.600
Demand (lagged 4)	-0.239	0.144
Airfare (lagged 1)	-0.292	0.207
AGDP (lagged 3)	0.587E-07	0.146E-07
Relative price (lagged 1)	884.220	195.100
Relative price (lagged 2)	-933.260	234.500
Seasonal dummy Q1	-17.390	71.390
Seasonal dummy Q2	-604.630	88.020
Seasonal dummy Q3	-728.260	127.500
Dummy[a]	229.620	71.150
Dummy[b]	-297.460	83.720
Dummy[c]	-108.290	114.400

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for German unification, 1990Q1

c. Dummy for the Gulf War, 1990Q3-1991Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.67	F(11,22)	7.03
ARCH	0.05	RESET(3)	1.30
LM	9.40	RESET(4)	1.08

TABLE IV.4 BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO GERMANY

Variable	Estimated coefficient	Standard error
Constant	-6308.000	935.900
AGDP (lagged 4)	0.648E-07	0.351E-07
FGDP (lagged 4)	0.154E-08	0.949E-09
Relative price (lagged 4)	331.880	205.200
Seasonal dummy Q1	1005.600	238.200
Seasonal dummy Q2	1204.200	176.600
Seasonal dummy Q3	1135.500	185.800
Dummy[a]	-482.380	193.700

a. Dummy for German unification, 1990Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.72	F(8,25)	11.52
ARCH	0.00	RESET(3)	0.54
LM	5.56	RESET(4)	0.66

ITALY

TABLE IV.5 LEISURE TRAVEL BY ITALIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-67.587	10.080
Demand (lagged 1)	0.216	0.909E-01
Airfare (lagged 4)	-0.438	0.200
Income (lagged 3)	2.392	0.280
Relative price (lagged 4)	-0.883E-01	0.186
Seasonal dummy Q1	-0.546	0.569E-01
Seasonal dummy Q2	-1.041	0.599E-01
Seasonal dummy Q3	-0.252E-01	0.955E-01
Dummy[a]	0.171	0.468E-01
Dummy[b]	0.412	0.487E-01
Dummy[c]	-0.128	0.108

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the America's Cup, 1986Q4 -1987Q1

c. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period		1986Q1 to 1994Q1	
Functional form		Double log	
Adj R²	0.94	F(10,22)	52.95
ARCH	1.22	RESET(3)	0.12
LM	4.80	RESET(4)	0.11

TABLE IV.6 LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO ITALY

Variable	Estimated coefficient	Standard error
Constant	8045.000	2440.000
Demand (lagged 4)	-0.471	0.108
Airfare (lagged 4)	-4.536	1.635
Income (lagged 4)	0.765E-07	0.489E-07
Relative price (lagged 2)	2.531	1.304
Seasonal dummy Q1	-2855.500	314.600
Seasonal dummy Q2	9913.700	1071.000
Seasonal dummy Q3	8382.600	692.600

Period		1986Q1 to 1994Q1	
Functional form		Linear	
Adj R²	0.96	F(7,25)	98.61
ARCH	1.94	RESET(3)	0.11
LM	11.08	RESET(4)	0.79E-01

TABLE IV.7 BUSINESS TRAVEL BY ITALIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-1582.500	1056.000
Demand (lagged 4)	-0.428	0.199
AGDP (lagged 1)	0.209E-07	0.278E-07
FGDP (lagged 1)	0.317E-12	0.103E-11
Relative price (lagged 3)	1.261	0.396
Seasonal dummy Q1	-185.320	120.200
Seasonal dummy Q2	106.240	113.500
Seasonal dummy Q3	-149.510	84.810
Dummy[a]	230.440	93.240
Dummy[b]	240.170	76.020

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the America's Cup, 1986Q4 -1987Q1

Period		1986Q1 to 1994Q1	
Functional form		Linear	
Adj R^2	0.24	$F_{(9,23)}$	2.12
ARCH	0.04	RESET(3)	1.80
LM	5.78	RESET(4)	1.24

TABLE IV.8 BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO ITALY

Variable	Estimated coefficient	Standard error
Constant	-1830.000	626.200
Demand (lagged 4)	-0.307	0.117
Airfare	-0.130	0.327
AGDP (lagged 3)	0.134E-07	0.275E-07
FGDP (lagged 3)	0.173E-11	0.180E-11
Relative price (lagged 2)	0.782	0.286
Seasonal dummy Q1	210.660	75.970
Seasonal dummy Q2	825.090	104.700
Seasonal dummy Q3	559.440	186.200

Period		1986Q1 to 1994Q1	
Functional form		Linear	
Adj R^2	0.71	$F_{(8,24)}$	10.97
ARCH	0.00	RESET(3)	1.05
LM	11.63	RESET(4)	0.72

UNITED KINGDOM

TABLE IV.9 LEISURE TRAVEL BY UK RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	36576.000	0.348E+05
Airfare (lagged 1)	-96.658	49.790
Income (lagged 1)	0.127E-05	0.394E-06
Relative price (lagged 1)	-0.660	0.199E+05
Seasonal dummy Q1	-2848.400	2072.000
Seasonal dummy Q2	17981.000	3051.000
Seasonal dummy Q3	27023.000	5571.000
Dummy[a]	966.610	2591.000
Dummy[b]	-1828.800	2257.000

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.98	F(9,24)	164.53
ARCH	1.12	RESET(3)	0.25
LM	10.44	RESET(4)	0.34

TABLE IV.10 LEISURE TRAVEL BY AUSTRALIA RESIDENTS TO THE UNITED KINGDOM

Variable	Estimated coefficient	Standard error
Constant	-42189.000	0.1318E+05
Demand (lagged 4)	-0.242	0.138
Airfare (lagged 1)	-9.845	5.573
Income (lagged 4)	0.175E-05	0.263E-06
Relative price (lagged 3)	72089.000	0.180E+5
Seasonal dummy Q1	-7425.000	1546.000
Seasonal dummy Q2	32700.000	3925.000
Seasonal dummy Q3	30581.000	2886.000

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.96	F(7,26)	122.42
ARCH	0.29	RESET(3)	4.69
LM	10.95	RESET(4)	3.06

TABLE IV.11   BUSINESS TRAVEL BY UK RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-6530.500	3529.000
Demand (lagged 4)	-0.559	0.165
Airfare	-1.945	2.404
AGDP	0.495E-06	0.187E-06
AGDP (lagged 1)	-0.398E-06	0.217E-06
FGDP (lagged 3)	0.843E-07	0.746E-07
Relative price (lagged 3)	9735.600	4853.000
Seasonal dummy Q1	5289.500	2147.000
Seasonal dummy Q2	-468.940	882.400
Seasonal dummy Q3	-689.690	974.000
Dummy[a]	667.690	450.200

a. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.64	$F(10,23)$	6.93
ARCH	0.86	RESET(3)	1.48
LM	4.91	RESET(4)	1.63

TABLE IV.12   BUSINESS TRAVEL BY AUSTRALIA RESIDENTS TO THE UNITED
                KINGDOM

Variable	Estimated coefficient	Standard error
Constant	-3604.100	2470.000
Airfare (lagged 1)	-0.630	0.437
AGDP	0.956E-07	0.670E-07
FGDP (lagged 3)	0.692E-07	0.362E-07
Relative price (lagged 4)	-3985.800	2113.000
Seasonal dummy Q1	1407.500	367.400
Seasonal dummy Q2	3448.500	438.600
Seasonal dummy Q3	2442.000	538.400
Dummy[a]	-312.030	231.700

a. Dummy for Gulf War, 1990Q3 - 1991Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.88	$F(8,25)$	30.21
ARCH	0.30	RESET(3)	0.20
LM	10.86	RESET(4)	0.37

JAPAN

TABLE IV.13   LEISURE TRAVEL BY JAPANESE RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	22962.000	4287.000
Demand (lagged 1)	0.487	0.124
Airfare (lagged 4)	-0.190	0.103
FGDP (lagged 4)	0.295E-09	0.918E-10
Relative price (lagged 4)	-297.700	110.700
Seasonal dummy Q1	2894.900	4491.000
Seasonal dummy Q2	-14465.000	4209.000
Seasonal dummy Q3	713.710	3919.000
Dummy[a]	13649.000	7255.000
Dummy[b]	6664.200	4016.000
Dummy[c]	-4963.400	4690.000

a. Dummy for increased competition, 1991Q2

b. Dummy for the America's Cup, 1986Q4 -1987Q1

c. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.96	F(10,23)	80.47
ARCH	0.10	RESET(3)	0.97
LM	13.43	RESET(4)	0.96

TABLE IV.14   LEISURE TRAVEL BY AUSTRALIA RESIDENTS TO JAPAN

Variable	Estimated coefficient	Standard error
Constant	2.761	8.178
Demand (lagged 4)	0.301	0.148
Airfare (lagged 4)	-0.816	0.447
Income (lagged 3)	0.304	0.467
Relative price (lagged 1)	0.928	0.238
Relative price (lagged 4)	-0.734	0.231
Seasonal dummy Q1	-0.264	0.990E-01
Seasonal dummy Q2	-0.333E-01	0.693E-01
Seasonal dummy Q3	-0.679E-01	0.703E-01
Dummy[a]	-0.169	0.815E-01
Dummy[b]	0.356	0.659E-01
Dummy[c]	-0.117	0.947E-01

a. Dummy Australia's 1988 Bicentenary

b. Dummy for increased competition, 1991Q2

c. Dummy for the America's Cup, 1986Q4 -1987Q1

Period		1986Q1 to 1994Q2	
Functional form		Double log	
Adj R^2	0.81	$F_{(11,22)}$	13.39
ARCH	6.91	RESET(3)	3.19
LM	10.66	RESET(4)	2.33

TABLE IV.15   BUSINESS TRAVEL BY JAPANESE RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	5345.700	403.400
Demand (lagged 4)	-0.230	0.101
Airfare (lagged 1)	-0.855E-02	0.466E-02
AGDP (lagged 4)	0.731E-07	0.343E-07
Relative price (lagged 1)	91.571	13.370
Relative price (lagged 2)	-59.304	13.600
Relative price (lagged 4)	-18.488	9.602
Seasonal dummy Q1	-87.516	309.900
Seasonal dummy Q2	-690.620	305.400
Seasonal dummy Q3	-1067.800	274.400
Dummy[a]	-1262.700	293.100
Dummy[b]	-99.929	475.9

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the America's Cup, 1986Q4 -1987Q1

Period	1986Q1 to 1994Q2		
Functional form	Linear		
Adj R²	0.77	F(11,22)	11.20
ARCH	0.07	RESET(3)	0.11
LM	10.03	RESET(4)	0.19

TABLE IV.16   BUSINESS TRAVEL BY AUSTRALIA RESIDENTS TO JAPAN

Variable	Estimated coefficient	Standard error
Constant	-91.178	11.080
Demand (lagged 4)	-0.324	0.122
FGDP	2.894	0.341
Relative price	0.722	0.130
Relative price (lagged 3)	0.327	0.123
Seasonal dummy Q1	-0.322	0.466E-01
Seasonal dummy Q2	0.562E-01	0.375E-01
Seasonal dummy Q3	-0.105	0.389E-01
Dummy[a]	0.976E-01	0.525E-01

a. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period	1986Q1 to 1994Q2		
Functional form	Double log		
Adj R²	0.93	F(8,25)	53.78
ARCH	2.30	RESET(3)	0.19
LM	9.62	RESET(4)	3.66

KOREA

TABLE IV.17   LEISURE TRAVEL BY KOREAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	18.942	7.657
Demand (lagged 2)	0.651	0.128
Airfare	-0.173	0.754
FGDP (lagged 4)	0.706	0.317
Relative price (lagged 1)	-1.927	0.863
Relative price (lagged 4)	-1.490	0.772
Seasonal dummy Q1	0.100	0.929E-01
Seasonal dummy Q2	-0.431	0.117
Seasonal dummy Q3	-0.299	0.164
Dummy[a]	0.845E-01	0.674E-01

a. Dummy for Australia's 1988 Bicentenary

Period	1986Q1 to 1993Q4	
Functional form	Double log	
Adj R^2	0.94	F(10,21)	53.49
ARCH	1.67	RESET(3)	0.28E-01
LM	4.91	RESET(4)	1.81

TABLE IV.18   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO KOREA

Variable	Estimated coefficient	Standard error
Constant	-137.660	46.710
Airfare (lagged 3)	-1.143	0.675
Income (lagged 2)	5.903	1.569
Relative price (lagged 1)	1.407	0.936
Seasonal dummy Q1	-0.670	0.845E-01
Seasonal dummy Q2	-0.735	0.166
Seasonal dummy Q3	-0.763E-02	0.741E-01
Dummy[a]	-0.218	0.897E-01

a. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period	1986Q1 to 1993Q4	
Functional form	Double log	
Adj R^2	0.80	F(7,24)	18.67
ARCH	2.97	RESET(3)	0.98E-01
LM	7.84	RESET(4)	1.31

TABLE IV.19 BUSINESS TRAVEL BY KOREAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-33.893	46.840
Demand (lagged 2)	0.362	0.931E-01
Airfare	-0.127	0.528
AGDP (lagged 4)	2.250	1.402
FGDP (lagged 3)	0.492	0.278
Relative price (lagged 1)	-1.237	0.724
Relative price (lagged 4)	-2.043	0.548
Seasonal dummy Q1	0.222	0.153
Seasonal dummy Q2	0.281	0.137
Seasonal dummy Q3	0.272E-01	0.117
Dummy[a]	-0.271	0.910E-01

a. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period		1986Q1 to 1993Q4	
Functional form		Double log	
Adj R^2	0.90	$F(10,21)$	29.97
ARCH	0.24	RESET(3)	1.30
LM	11.21	RESET(4)	1.20

TABLE IV.20 BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO KOREA

Variable	Estimated coefficient	Standard error
Constant	327.340	3006.000
Demand (lagged 3)	0.358	0.209
Airfare	-0.237E-03	0.765E-03
AGDP (lagged 1)	0.164E-01	0.850E-02
FGDP (lagged 4)	0.675E-08	0.301E-07
Relative price (lagged 1)	-0.761	1.286
Seasonal dummy Q1	-100.450	130.300
Seasonal dummy Q2	-35.144	145.800
Seasonal dummy Q3	255.230	108.700
Dummy[a]	-160.740	56.840

a. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R^2	0.68	$F(9,22)$	8.43
ARCH	0.07	RESET(3)	3.09
LM	8.85	RESET(4)	2.60

TAIWAN

TABLE IV.21   LEISURE TRAVEL BY TAIWANESE RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-8.052	7.764
Demand (lagged 3)	-0.212	0.981E-01
Airfare (lagged 1)	-1.009	0.373
Income (lagged 4)	2.696	0.4304
Relative price (lagged 1)	-2.937	0.761
Seasonal dummy Q1	0.288E-01	0.146
Seasonal dummy Q2	-0.913	0.138
Seasonal dummy Q3	-0.653	0.139
Dummy[a]	0.168	0.139

a. Dummy for Australia's 1988 Bicentenary

Period	1986Q1 to 1993Q4	
Functional form	Double log	
Adj R^2	0.92	F(8,23)	43.04
ARCH	0.01	RESET(3)	1.27
LM	8.71	RESET(4)	0.81

TABLE IV.22   LEISURE TRAVEL BY AUSTRALIA RESIDENTS TO TAIWAN

Variable	Estimated coefficient	Standard error
Constant	-119.340	44.920
Demand (lagged 4)	0.576	0.159
Airfare	-0.506	0.379
Income (lagged 4)	4.912	1.884
Relative price (lagged 1)	1.899	0.596
Seasonal dummy Q1	0.233	0.154
Seasonal dummy Q2	0.920E-01	0.710E-01
Seasonal dummy Q3	0.264E-01	0.667E-01
Dummy [a]	0.153	0.126

a. Dummy for increased competition, 1992Q1

Period	1986Q1 to 1993Q4	
Functional form	Double log	
Adj R^2	0.95	F(8,23)	68.12
ARCH	0.13	RESET(3)	0.83
LM	7.02	RESET(4)	1.44

TABLE IV.23   BUSINESS TRAVEL BY TAIWANESE RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-39.185	21.560
Demand (lagged 1)	0.573	0.140
AGDP (lagged 4)	1.864	0.899
Relative price (lagged 2)	-1.283	0.532
Seasonal dummy Q1	0.190	0.139
Seasonal dummy Q2	-0.921E-02	0.127
Seasonal dummy Q3	-0.348E-01	0.113
Dummy[a]	-0.132	0.973E-01
Dummy[b]	-0.262	0.120

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period	1986Q1 to 1993Q4		
Functional form	Double log		
Adj R^2	0.83	F(8,23)	19.78
ARCH	1.14	RESET(3)	0.12
LM	12.94	RESET(4)	0.41

TABLE IV.24   BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO TAIWAN

Variable	Estimated coefficient	Standard error
Constant	20.397	544.900
Demand (lagged 3)	0.501	0.121
FGDP (lagged 4)	0.422E-03	0.917E-04
Relative price (lagged 3)	-23.039	15.240
Seasonal dummy Q1	-127.110	84.140
Seasonal dummy Q2	304.180	61.670
Seasonal dummy Q3	-84.599	82.050
Dummy[a]	-95.594	68.020
Dummy[b]	-156.560	123.500

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period	1986Q1 to 1993Q4		
Functional form	Linear		
Adj R^2	0.91	F(8,23)	38.29
ARCH	0.30	RESET(3)	0.82
LM	5.87	RESET(4)	0.57

INDONESIA

TABLE IV.25   LEISURE TRAVEL BY INDONESIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	4.635	4.584
Airfare (lagged 2)	-2.374	0.508
FGDP (lagged 4)	2.047	0.318
Relative price (lagged 4)	0.526	0.220
Seasonal dummy Q1	-0.140	0.861E-01
Seasonal dummy Q2	-0.7750E-01	0.783E-01
Seasonal dummy Q3	0.261	0.859E-01
Dummy 1[a]	0.112	0.886E-01
Dummy 1[b]	0.106	0.999E-01

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Americas Cup, 1986Q4 - 1987Q1

Period		1986Q1 to 1993Q4	
Functional form		Double log	
Adj R^2	0.83	F(8,23)	20.43
ARCH	2.09	RESET(3)	1.79
LM	10.40	RESET(4)	1.24

TABLE IV.26   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO INDONESIA

Variable	Estimated coefficient	Standard error
Constant	-32761.000	7154.000
Demand (lagged 4)	0.543	0.946E-01
Airfare	-25.232	31.83
Income (lagged 1)	0.147E-05	0.378E-05
Relative price	3.065	1.633
Seasonal dummy Q1	-6028.000	1666.000
Seasonal dummy Q2	926.190	907.000
Seasonal dummy Q3	3840.100	1145.000

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R^2	0.93	F(7,24)	62.94
ARCH	0.34	RESET(3)	3.37
LM	4.20	RESET(4)	3.15

TABLE IV.27   BUSINESS TRAVEL BY INDONESIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-30.750	25.770
Airfare	-0.622	0.348
AGDP (lagged 1)	0.970	0.970
FGDP (lagged 4)	1.645	0.349
Relative price (lagged 2)	-1.547	0.301
Relative price (lagged 3)	0.848	0.328
Relative price (lagged 4)	0.762	0.293
Seasonal dummy Q1	-0.199	0.915E-01
Seasonal dummy Q2	0.689E-01	0.600E-01
Seasonal dummy Q3	0.512E-01	0.542E-01
Dummy[a]	0.118	0.482E-01

a. Dummy for Australia's 1988 Bicentenary

Period	1986Q1 to 1993Q4	
Functional form	Double log	

Adj R^2	0.93	F(10,21)	40.13
ARCH	0.08	RESET(3)	1.22
LM	5.68	RESET(4)	0.77

TABLE IV.28   BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO INDONESIA

Variable	Estimated coefficient	Standard error
Constant	-7498.900	248.000
Demand (lagged 4)	0.412	0.107
Airfare	-0.317E-01	1.899
AGDP (lagged 2)	0.972E-07	0.401E-07
FGDP (lagged 4)	0.172	0.350E-01
Relative price (lagged 4)	-0.833	0.504
Seasonal dummy Q1	-238.320	146.700
Seasonal dummy Q2	-438.840	313.900
Seasonal dummy Q3	230.640	171.200
Dummy[a]	-388.020	341.400

a. Dummy for Gulf War, 1990Q3 - 1991Q1

Period	1986Q1 to 1993Q4	
Functional form	Linear	

Adj R^2	0.92	F(9,22)	41.70
ARCH	0.10	RESET(3)	1.44
LM	13.36	RESET(4)	1.16

MALAYSIA

TABLE IV.29   LEISURE TRAVEL BY MALAYSIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	2064.500	3287.000
Demand (lagged 4)	0.820	0.202
Airfare	-1.624	5.576
FGDP (lagged 4)	0.129	0.603E-01
Relative price (lagged 2)	-3461.500	1028.000
Seasonal dummy Q1	-364.900	529.900
Seasonal dummy Q2	-657.830	802.700
Seasonal dummy Q3	-1200.300	1054.000
Dummy[a]	1624.500	593.600
Dummy[b]	372.450	1229.000

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Americas Cup, 1986Q4 - 1987Q1

Period	1986Q1 to 1993Q4	
Functional form	Linear	
Adj R^2	0.86	F(9,22)	22.18
ARCH	2.25	RESET(3)	2.23
LM	8.74	RESET(4)	1.53

TABLE IV.30   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO MALAYSIA

Variable	Estimated coefficient	Standard error
Constant	-1165.500	4251.000
Demand (lagged 4)	0.451	0.965E-01
Airfare (lagged 1)	-14.162	5.345
Income (lagged 4)	0.256E-06	0.121E-06
Relative price (lagged 4)	2811.000	493.400
Seasonal dummy Q1	-1113.400	597.200
Seasonal dummy Q2	-1976.100	584.100
Seasonal dummy Q3	-1034.200	639.600
Dummy[a]	-1816.900	518.600
Dummy[b]	-1401.100	551.800

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Americas Cup, 1986Q4 - 1987Q1

Period	1986Q1 to 1993Q4	
Functional form	Linear	
Adj R^2	0.88	F(9,23)	27.71
ARCH	0.08	RESET(3)	3.33
LM	15.52	RESET(4)	2.29

TABLE IV.31   BUSINESS TRAVEL BY MALAYSIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-1113.000	930.400
AGDP	0.106E-07	0.190E-07
FGDP (lagged 4)	0.244E-01	0.278E-02
Relative price (lagged 4)	-216.020	124.500
Seasonal dummy Q1	-194.220	199.800
Seasonal dummy Q2	8.348	187.100
Seasonal dummy Q3	2.020	165.600
Dummy 1[a]	310.110	111.800

a. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R²	0.73	F(7,25)	13.17
ARCH	0.33	RESET(3)	4.01
LM	6.73	RESET(4)	2.56

TABLE IV.32   BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO MALAYSIA

Variable	Estimated coefficient	Standard error
Constant	-5263.700	3647.000
Demand (lagged 1)	-0.369	0.136
Airfare	-1.324	1.644
AGDP (lagged 2)	0.107E-06	0.615E-07
FGDP	0.804E-01	0.129E-01
Relative price	-543.790	315.300
Relative price (lagged 4)	-461.950	278.900
Seasonal dummy Q1	-650.220	225.600
Seasonal dummy Q2	-554.470	454.600
Seasonal dummy Q3	294.150	207.200

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R²	0.87	F(9,23)	24.17
ARCH	0.10	RESET(3)	0.77
LM	6.94	RESET(4)	0.86

SINGAPORE

TABLE IV.33   LEISURE TRAVEL BY SINGAPOREAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-2.253	2.098
Demand (lagged 4)	0.640	0.922E-01
Airfare	-0.670	0.389
FGDP (lagged 4)	1.022	0.234
Relative price (lagged 4)	-0.725	0.159
Seasonal dummy Q1	-0.255	0.765E-01
Seasonal dummy Q2	-0.167	0.780E-01
Seasonal dummy Q3	-0.330	0.959E-01
Dummy[a]	0.689E-01	0.462E-01
Dummy[b]	0.467E-01	0.562E-01

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the America's Cup, 1986Q4 - 1987Q1

Period		1986Q1 to 1993Q4	
Functional form		Double log	
Adj R^2	0.96	F(9,22)	80.54
ARCH	0.29	RESET(3)	4.20
LM	6.75	RESET(4)	2.78

TABLE IV.34   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO SINGAPORE

Variable	Estimated coefficient	Standard error
Constant	12192.000	9596.000
Airfare (lagged 1)	-25.098	13.970
AGDP (lagged 3)	0.134E-06	0.269E-06
Relative price (lagged 3)	5863.300	3333.000
Seasonal dummy Q1	-3808.200	1019.000
Seasonal dummy Q2	-4444.500	960.100
Seasonal dummy Q3	-2850.400	1419.000
Dummy[a]	-1349.400	739.200

a. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R^2	0.51	F(8,23)	5.07
ARCH	0.70	RESET(3)	0.23
LM	9.91	RESET(4)	0.15

TABLE IV.35   BUSINESS TRAVEL BY SINGAPOREAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-963.280	1782.000
Demand (lagged 3)	0.475	0.125
Airfare	-0.137	0.469
AGDP (lagged 3)	0.221E-07	0.397E-07
FGDP (lagged 4)	0.340E-01	0.168E-07
Relative price	1154.900	487.000
Relative price (lagged 2)	-1438.100	535.500
Seasonal dummy Q1	216.330	131.300
Seasonal dummy Q2	-56.541	147.000
Seasonal dummy Q3	-288.800	291.200
Dummy[a]	254.350	165.000

a. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R²	0.80	F(10,21)	13.66
ARCH	0.02	RESET(3)	3.75
LM	6.59	RESET(4)	6.04

TABLE IV.36   BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO SINGAPORE

Variable	Estimated coefficient	Standard error
Constant	-13850.000	5023.000
Demand (lagged 4)	-0.234	0.160
Airfare	-0.849	2.863
AGDP (lagged 1)	0.234E-06	0.854E-07
FGDP (lagged 4)	0.873E-01	0.488E-01
Relative price (lagged 3)	1806.700	617.800
Seasonal dummy Q1	-1268.300	362.600
Seasonal dummy Q2	1437.300	330.400
Seasonal dummy Q3	1019.300	275.300
Dummy[a]	-650.120	310.400
Dummy[b]	-258.010	251.800

a. Dummy for the Gulf War, 1990Q3 - 1991Q1

b. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1993Q4	
Functional form		Linear	
Adj R²	0.88	F(10,21)	23.32
ARCH	0.03	RESET(3)	0.41
LM	9.83	RESET(4)	0.91

FIJI

TABLE IV.37   LEISURE TRAVEL BY FIJIAN RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-2.939	7.564
Demand (lagged 1)	0.361	0.153
Airfare (lagged 3)	-0.512	0.319
FGDP (lagged 3)	0.540	0.348
Relative price (lagged 4)	0.102	0.132
Seasonal dummy Q1	-0.453	0.901E-01
Seasonal dummy Q2	-0.561	0.729E-01
Seasonal dummy Q3	-0.571	0.517E-01
Dummy[a]	0.105	0.623E-01

a. Dummy for Australia's 1988 Bicentenary

Period	1986Q1 to 1993Q4	
Functional form	Double log	

Adj R^2	0.78	F(8,23)	14.90
ARCH	0.73	RESET(3)	3.28
LM	4.30	RESET(4)	2.18

TABLE IV.38   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO FIJI

Variable	Estimated coefficient	Standard error
Constant	11242.000	9865.000
Demand (lagged 1)	-0.383	0.223
Demand (lagged 4)	0.231	0.135
Airfare (lagged 1)	-53.245	27.420
Income (lagged 2)	0.500E-06	0.371E-06
Relative price (lagged 3)	7198.400	7018.000
Seasonal dummy Q1	-5839.400	1422.000
Seasonal dummy Q2	-7987.300	2409.000
Seasonal dummy Q3	305.820	2305.000
Dummy[a]	-3866.500	2056.000

a. Dummy for Australia's 1988 Bicentenary

Period	1986Q1 to 1993Q4	
Functional form	Linear	

Adj R^2	0.63	F(9,22)	6.86
ARCH	0.03	RESET(3)	0.38
LM	2.63	RESET(4)	0.59

NEW ZEALAND

TABLE IV.39   LEISURE TRAVEL BY NEW ZEALAND RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-8641.800	0.294E+05
Demand (lagged 1)	0.498	0.114
Airfare (lagged 3)	-128.900	77.250
FGDP (lagged 4)	0.132E-05	0.529E-06
Relative price (lagged 4)	27600.000	0.139E+05
Seasonal dummy Q1	-34865.00	3617.000
Seasonal dummy Q2	14265.000	7809.000
Seasonal dummy Q3	22476.000	5259.000
Dummy[a]	26150.000	5172.000
Dummy[b]	7998.900	5059.000

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Americas Cup, 1986Q4 -1987Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.87	F(9,24)	26.26
ARCH	2.17	RESET(3)	2.28
LM	3.18	RESET(4)	1.86

TABLE IV.40   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO NEW ZEALAND

Variable	Estimated coefficient	Standard error
Constant	21831.000	0.242E+05
Demand (lagged 3)	0.167	0.106
Airfare (lagged 3)	-60.276	113.000
Income (lagged 3)	0.122E-05	0.361E+05
Relative price (lagged 4)	-43898.000	0.178E+05
Relative price (lagged 3)	55382.000	0.235E+05
Seasonal dummy Q1	11639.000	1795.000
Seasonal dummy Q2	-27082.000	1432.000
Seasonal dummy Q3	24072.000	1780.000
Dummy[a]	-8977.400	2557.000
Dummy[b]	-8044.500	2586.000

a. Dummy for Australia's 1988 Bicentenary

b. Dummy for the Americas Cup, 1986Q4 -1987Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.87	F(10,23)	22.92
ARCH	0.75	RESET(3)	0.48E-01
LM	10.35	RESET(4)	0.20

TABLE IV.41 BUSINESS TRAVEL BY NEW ZEALAND RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-9526.300	6978.000
Demand (lagged 1)	0.559	0.119
Demand (lagged 4)	-0.458	0.186
Airfare	-5.364	7.738
AGDP (lagged 2)	0.292E-06	0.161E-06
FGDP (lagged 3)	0.556E-06	0.217E-06
Relative price (lagged 1)	-4359.400	2048.000
Relative price (lagged 2)	-7109.400	3393.000
Seasonal dummy Q1	-25.000	466.300
Seasonal dummy Q2	2340.300	1094.000
Seasonal dummy Q3	4198.900	696.200
Dummy[a]	-177.360	586.700

a. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.88	F(11,22)	22.86
ARCH	1.08	RESET(3)	1.05
LM	6.77	RESET(4)	1.23

TABLE IV.42 BUSINESS TRAVEL BY AUSTRALIA RESIDENTS TO NEW ZEALAND

Variable	Estimated coefficient	Standard error
Constant	-16713.000	3959.000
Airfare (lagged 1)	-13.594	8.061
AGDP (lagged 4)	0.103E-06	0.116E-06
FGDP (lagged 4)	0.121E-05	0.207E-06
Relative price	-14830.0	2113.000
Seasonal dummy Q1	1031.700	928.200
Seasonal dummy Q2	194.560	845.900
Seasonal dummy Q3	2301.700	622.500

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.79	F(7,26)	18.38
ARCH	0.00	RESET(3)	1.59
LM	5.29	RESET(4)	1.32

UNITED STATES OF AMERICA

TABLE IV.43   LEISURE TRAVEL BY USA RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-22.441	11.310
Demand (lagged 3)	0.241	0.122
Airfare (lagged 3)	-1.405	0.731
Income (lagged 3)	1.430	0.528
Relative price (lagged 3)	-0.330	0.236
Seasonal dummy Q1	-0.329E-01	0.369E-01
Seasonal dummy Q2	-0.277	0.454E-01
Seasonal dummy Q3	-0.244	0.548E-01
Dummy[a]	0.959E-01	0.753E-01
Dummy[b]	0.103	0.554E-01
Dummy[c]	-0.758E-01	0.464E-01
Dummy[d]	0.238	0.469E-01

a. Dummy for increased competition, 1991Q2 - 1992Q1

b. Dummy for Australia's 1988 Bicentenary

c. Dummy for the Gulf War, 1990Q3 - 1991Q1

d. Dummy for the America's Cup, 1986Q4 - 1987Q1

Period		1986Q1 to 1994Q2	
Functional form		Double log	
Adj R^2	0.68	F(11,22)	7.24
ARCH	2.30	RESET(3)	1.64
LM	11.98	RESET(4)	1.05

TABLE IV.44   LEISURE TRAVEL BY AUSTRALIAN RESIDENTS TO THE UNITED STATES OF AMERICA

Variable	Estimated coefficient	Standard error
Constant	-15.246	13.800
Demand (lagged 4)	0.309	0.128
Airfare (lagged 3)	-0.437	0.2139
Income	1.053	0.606
Relative price (lagged 4)	0.932	0.238
Seasonal dummy Q1	-0.114	0.421E-01
Seasonal dummy Q2	0.106	0.655E-01
Seasonal dummy Q3	0.113	0.480E-01

Period		1986Q1 to 1994Q2	
Functional form		Double log	
Adj R^2	0.94	F(7,26)	70.45
ARCH	0.98	RESET(3)	2.60
LM	6.41	RESET(4)	2.74

TABLE IV.45   BUSINESS TRAVEL BY USA RESIDENTS TO AUSTRALIA

Variable	Estimated coefficient	Standard error
Constant	-24131.000	2475.000
Airfare	-3.080	1.394
AGDP (lagged 1)	0.266E-06	0.142E-06
FGDP (lagged 4)	0.773E-08	0.227E-08
Relative price (lagged 4)	-8646.300	1767.000
Seasonal dummy Q1	295.620	715.600
Seasonal dummy Q2	1942.700	537.700
Seasonal dummy Q3	1705.700	362.400
Dummy 1[a]	1276.700	534.000
Dummy 2[b]	1911.400	670.100
Dummy 3[c]	-1514.100	410.500

a. Dummy for increased competition, 1991Q2 - 1992Q1

b. Dummy for Dummy for Australia's 1988 Bicentenary

c. Dummy for the Gulf War, 1990Q3 - 1991Q1

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.78	$F_{(10,23)}$	12.78
ARCH.	0.02	RESET(3)	0.66
LM	3.62	RESET(4)	0.44

TABLE IV.46   BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO THE UNITED
STATES OF AMERICA

Variable	Estimated coefficient	Standard error
Constant	-27625.000	4878.000
Demand (lagged 4)	0.267	0.929E-01
AGDP	0.528E-06	0.889E-07
Relative price (lagged 3)	3307.700	1955.000
Seasonal dummy Q1	4747.400	740.700
Seasonal dummy Q2	5713.100	736.300
Seasonal dummy Q3	4657.300	780.600
Dummy 1[a]	-746.620	487.300

a. Dummy for Australia's 1988 Bicentenary

Period		1986Q1 to 1994Q2	
Functional form		Linear	
Adj R^2	0.88	$F_{(7,26)}$	34.00
ARCH	0.61	RESET(3)	0.74E-01
LM	12.62	RESET(4)	0.50E-01

APPENDIX V ELASTICITY ESTIMATES BY COUNTRY

This appendix lists the estimated elasticities, as in Chapter 6, but groups them by country.

In all tables the notes should be interpreted as follows:

a. statistically significant at the 5% level

b. statistically significant at the 10% level

na not applicable

— variable was omitted from the model as it added no further explanatory power

Germany

TABLE V.1 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND GERMANY

Market		Elasticity		
	Airfare	Australian income	Foreign income	Real exchange rate
German leisure arrivals	-1.23[a]	na	4.60[a]	-0.52[a]
Australian leisure departures	-0.50[b]	1.09[b]	na	0.51[a]
German business arrivals	-0.55	1.61[a]	—	-0.04[a]
Australian business departures	—	1.84[b]	1.57[b]	0.28[b]

Italy

TABLE V.2 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND ITALY

Market		Elasticity		
	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
Italian leisure arrivals	-0.56[a]	na	3.05[a]	-0.12
Australian leisure departures	-0.29[a]	0.21[b]	na	0.20[b]
Italian business arrivals	—	1.01	0.23	0.99[a]
Australian business departures	-0.19	0.54	1.06	0.55[a]

United Kingdom

TABLE V.3   DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND THE UNITED KINGDOM

Market		Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
			Elasticity		
UK leisure arrivals		-1.79[a]	na	2.37[a]	-0.88[a]
Australian leisure departures		-0.14[b]	1.03[a]	na	0.57[a]
UK business arrivals		-0.21	0.53[a]	0.72	0.41[b]
Australian business departures		-0.20	0.79	0.91[b]	-0.26[b]

NORTH–EAST ASIA

Japan

TABLE V.4   DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND JAPAN

Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
		Elasticity		
Japanese leisure arrivals	-0.79[b]	na	2.15[a]	-0.85[a]
Australian leisure departures	-1.16[b]	0.44	na	0.28[a]
Japanese business arrivals	-0.24[b]	0.47[a]	–	0.18[b]
Australian business departures	–	–	2.19[a]	0.79[a]

Korea

TABLE V.5   DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND KOREA

Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
		Elasticity		
Korean leisure arrivals	-0.50	na	2.02[a]	-9.45[a]
Australian leisure departures	-1.14[b]	5.90[a]	na	1.41[b]
Korean business arrivals	-0.20	3.53[b]	0.77[b]	-5.13[a]
Australian business departures	-0.40	0.80	0.91[b]	-0.92

Taiwan

TABLE V.6   DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND TAIWAN

Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
		Elasticity		
Taiwanese leisure arrivals	-0.83[b]	na	2.22[a]	-2.42[a]
Australian leisure departures	-1.19	11.58[a]	na	4.46[a]
Taiwanese business arrivals	–	4.36[a]	–	-3.01[a]
Australian business departures	–	–	1.75[a]	-0.77

SOUTH–EAST ASIA

Indonesia

TABLE V.7 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND
INDONESIA

	Elasticity			
Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
Indonesian leisure arrivals	-1.46[a]	na	2.37[a]	-0.42[a]
Australian leisure departures	-0.48	3.41[a]	na	0.25[b]
Indonesian business arrivals	-0.62[b]	0.97	1.65[a]	0.06[a]
Australian business departures	-0.01	2.82[a]	2.46[a]	-0.50[a]

Malaysia

TABLE V.8 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND
MALAYSIA

	Elasticity			
Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
Malaysia leisure arrivals	-0.78	na	5.51[a]	-4.01[a]
Australian leisure departures	-0.95[a]	1.36	na	1.01[a]
Malaysia business arrivals	–	1.80[a]	0.52	-0.42[b]
Australian business departures	-0.29	1.30[b]	1.59[a]	-0.50[b]

Singapore

TABLE V.9 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND
SINGAPORE

	Elasticity			
Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
Singaporean leisure arrivals	-1.86[b]	na	2.83[a]	-2.01[a]
Australian leisure departures	-0.54[b]	0.44	na	0.59[b]
Singaporean business arrivals	-0.22	1.08	1.42[a]	-0.43[a]
Australian business departures	-0.12	0.58[b]	1.86[a]	0.44[a]

OCEANIA

Fiji

TABLE V.10 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND FIJI

Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
			Elasticity	
Fijian leisure arrivals	-0.80[b]	na	0.84[b]	0.16
Australian leisure departures	-0.53[b]	0.84	na	0.36
Fijian business arrivals	–	–	–	–
Australian business departures	–	–	–	–

New Zealand

TABLE V.11 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND NEW ZEALAND

Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
			Elasticity	
NZ leisure arrivals	-0.68[b]	na	1.11[a]	0.69[b]
Australian leisure departures	-0.23	0.86[a]	na	0.26[a]
NZ business arrivals	-0.16	1.06[b]	1.33[a]	-0.79[a]
Australian business departures	-0.34[b]	0.39	3.04[a]	-1.09[a]

UNITED STATES OF AMERICA

TABLE V.12 DEMAND ELASTICITIES FOR TRAVEL BETWEEN AUSTRALIA AND THE UNITED STATES OF AMERICA

Market	Airfare	Australian income/GDP	Foreign income/GDP	Real exchange rate
			Elasticity	
USA leisure arrivals	-1.85[b]	na	1.88[a]	-0.43
Australian leisure departures	-0.64[b]	1.52[b]	na	1.35[a]
USA business arrivals	-0.45[a]	1.22[b]	2.51[a]	-0.56[a]
Australian business departures	–	2.91[a]	–	0.26[b]

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ATC	Australian Tourism Commission
BTCE	Bureau of Transport and Communications Economics
BTR	Bureau of Tourism Research
IAC	Industries Assistance Commission
OD	origin-destination
OECD	Organisation for Economic Co-operation and Development
VR	visiting relatives