Trends and Prospects for Australian International Air Transport

Occasional Paper

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Trends and Prospects for Australian International Air Transport

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FOREWORD

There has not been a comprehensive study of trends and changes in the institutional and commercial parameters which affect Australia's international aviation industry since the International Civil Aviation Policy review of 1978. The aim of the work reported in this Paper was to document the significant developments in international aviation on both a global scale and for Australian routes in particular. The historical trends in supply of and demand for international air passenger services to and from Australia are examined and the information used to forecast passenger numbers to the year 2000 for various markets.

This Paper was prepared by Mr M. Poole, Mr G. Davis and Mr S. James, with the assistance of other officers of the Economic Assessment Branch.

The assistance of Qantas in the provision of data, and the International Aviation Policy Division of the Department of Transport and Communications is gratefully acknowledged.

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SUMMARY

The regulatory scene for international aviation activities has changed significantly during the last 15 years, with many governments reducing their involvement in the setting and oversight of international fares and rates. Australia has moved in step with this trend, and in 1981 the Australian Government moved to allow international airlines serving Australia substantial freedom to set fares and rates in accordance with their own commercial judgment and assessment of market needs. However, over the same period many governments, including the Australian Government, moved to tighten capacity controls in bilateral agreements. This has caused some dispute as a few countries, most notably the USA, argue for market forces to operate in all areas.

In 1985 the Trade Practices Commission ruled on international airline commercial agreements within Australia. The Commission found that the agreements generally resulted in greater efficiency and benefit to the public and approved some types of agreements, but prohibited any action by airlines to enforce agreed fares. As a result all fares sold in Australia must be subject to free price competition and competitive advertising.

World international passenger numbers on scheduled services grew at an average of 5.9 per cent per annum over the period 1972 to 1986. Growth rates for travel to and from Australia were even higher, averaging 9.6 per cent per annum over the same period. The quantity of freight carried to and from Australia increased at 15 per cent per annum on average. These very high growth rates have been achieved despite the economic uncertainties of the period.

The sources of passenger traffic to and from Australia have changed substantially. In 1970, Australian residents accounted for approximately one-half of the travellers to and from Australia. This proportion increased to about 65 per cent in the mid 1970s, but with the depreciation of the Australian dollar the situation has reversed, so that now more foreign tourists visit Australia than Australian tourists go overseas. The number of tourists from Asia and North

America has been increasing rapidly and these countries are rivalling New Zealand and Europe as the main sources of tourists. The number of short-term arrivals from Japan increased by an average of 18 per cent per annum over the period 1976 to 1986, while short-term arrivals from the USA increased at an average rate of 12 per cent per annum over the same period.

Although the number of passengers carried to and from Australia increased considerably over the last decade, the number of flights remained fairly constant. This was made possible by the introduction of larger aircraft. The rapid increases in oil prices during the 1970s stimulated the introduction of more fuel efficient aircraft designs, engines and operating procedures. Very large aircraft such as the Boeing 747 are regarded as the most efficient aircraft on the longer routes such as those to and from Australia.

Despite increases in input costs, especially fuel, improved technologies and a competitive environment have resulted in a sustained decrease in real fares over the last two decades. This trend is expected to continue to the end of the century, although possibly at a reduced rate of decline. New aircraft will probably be introduced with a cost per seat-kilometre similar to or better than the Boeing 747, but with a smaller capacity enabling greater flexibility of scheduling.

The Paper includes an econometric analysis of the numbers of short-term departures of Australian residents and arrivals of overseas visitors to and from five geographic regions for both business and non-business travellers. Income, fares and relative prices (exchange rates adjusted for inflation) were used as explanatory variables for all equations. The analysis of Australians departing by region of destination was performed as an expenditure share system of equations as this better modelled switching between destinations in response to different price movements.

Forecasts were made of future numbers of overseas arrivals and departures to the end of the century based on the econometric study. Short-term non-business departures of Australian residents are expected to grow by 4.3 per cent per annum to the end of this century compared with an average annual increase of 4.2 per cent over the past 10 years. Short-term non-business arrivals of overseas residents are forecast to grow by 9.0 per cent per annum compared to the recent historical average of 11.7.

Short-term non-business arrivals from Japan are forecast to grow by almost 20 per cent per year. This is less than the annual growth

experienced over the past 10 years of 23.3 per cent, but means that Japan should become a far more important source of tourists to Australia. This trend has implications for the provision of tourist infrastructure and procedures to cope with a high proportion of tourists to Australia from non-English speaking countries. However, this is a developing market and there could well be a levelling off from the predicted exponential growth. It is impossible to tell when this may occur and so the forecasts of the number of tourists arriving from Japan are quite uncertain.

The forecasts in aggregate for arrivals of overseas residents and departures of Australians, which are less uncertain than the forecasts for arrivals from Japan, show that strong growth in passenger numbers can be expected, especially from foreign visitors. For this expected growth in passenger numbers to be sustained, a substantial increase in the number of flights to and from Australia would be required. This is a change from recent experience as the large increases in passenger numbers that have occurred over the past ten years were catered for with larger aircraft, the number of flights remaining much the same. Constraints on total flight numbers may come from several sources including the capacity of runways and related infrastructure to cope with the combined effects of domestic and international growth, and the capacity of international terminals to handle the higher level of passenger activities.

The forecasts implicitly assume that any change in tastes towards travel to Australia will continue. This will require maintenance of Australia's international profile as a tourist destination, which may require continued or higher levels of advertising and increased development of specially tailored travel packages.

CHAPTER 1 INTRODUCTION

There has been no comprehensive study of Australia's international aviation industry since the International Civil Aviation Policy review of 1978. The international aviation scene has been changing rapidly over recent years. This Paper aims to provide an overview of recent developments, explore possible future directions, and assess their implications.

The emphasis is on scheduled international passenger services. Freight is becoming an increasingly important component of international aviation services to and from Australia, but is not the subject of study in this Paper. Charter services are not considered as they currently perform only a small part of the Australian international passenger task.

The analysis reported in this Paper examines the supply of international air services as well as the demand for overseas travel. Aviation has undergone considerable technological development over its commercial lifetime. These developments have interacted with demand in many ways, including through a sustained decrease in fare levels relative to other prices in the economy.

With the uncertain outlook for commodity prices, international tourism to Australia appears set to become a very important earner of foreign exchange. The number of tourists visiting Australia is increasing rapidly. This Paper incorporates an econometric study of the demand for travel to and from Australia. The models developed were used to provide an indication of the likely level of international passenger traffic over the rest of this century.

Chapter 2 outlines the institutional parameters under which international aviation is conducted since the structure of the industry is dictated by a multilateral framework and a network of bilateral agreements. Chapter 3 attempts to put the demand for international aviation services in perspective. The number of passengers and the amount of capacity used over the past fifteen years

are discussed, together with an analysis of the costs facing the airline industry and reasons for changes in those costs. Chapter 4 concentrates on air services to and from Australia. The numbers of people flying, the destinations of Australians travelling abroad and the sources of visitors to Australia has changed considerably over the past fifteen years. The econometric study of the numbers of foreigners arriving in Australia and the number of Australians departing is presented in Chapter 5. Chapter 6 begins by reporting a survey of travel agents and inbound tour operators, which elicits their views on the state of their industry and its future prospects. Econometric forecasts based on the work of Chapter 5 are then presented, together with a brief discussion of the consequences for the Australian international airline system and associated facilities.

CHAPTER 2 LEGAL ARRANGEMENTS AND INDUSTRY STRUCTURE

An understanding of the legal framework under which the international aviation industry operates and of the industry structure is necessary for a proper analysis of the supply of or demand for international aviation services. The international aviation industry operates under a number of legal restrictions and conventions. These restrictions and conventions and their effects on the industry have changed over time. This chapter provides an overview of the main legal arrangements, the general changes that have occurred and the effects of these changes on the industry. The chapter concludes with a brief discussion of the structure of the international airline industry.

THE MULTILATERAL INTERNATIONAL CIVIL AVIATION ARRANGEMENTS

Chicago convention

The framework for the regulatory structure of international civil aviation was established in the **Chicago Convention of 1944.** The International Civil Aviation Conference at Chicago was attended by 54 of the allied and neutral states of the Second World War. It was convened with the objective of ensuring 'that civil aviation developed in a safe and orderly manner' and that international air transport services 'were established on the basis of equality of opportunity and operated soundly and commercially' (Chicago Convention, 1944, Preamble).

The British Commonwealth countries favoured the establishment of an international air transport authority with wide economic regulatory power as well as to administer regulations regarding areas such as traffic rules, safety and navigation aids. The United States of America (USA) favoured a much less regulated approach to economic questions. The compromise embodied the following points:

- Every State has complete and exclusive sovereignty over the airspace above its territory and territorial waters.
- Scheduled air services cannot be operated over, or into, the territory of a contracting State except with the special permission or other authorisation of that State.

- Mandatory co-operation between contracting States was established to secure the 'highest practical degree of uniformity in regulations, standards, procedures and organization in relation to aircraft personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation' (Chicago Convention, 1944, Article 37). This is achieved by the adoption of standards and recommended practices (SARPS) as Annexes to the Convention. Each State is required to comply with the standards if it considers it practicable to do so and, if not, to file the differences between its practices and the standard.
- An aircraft not engaged in scheduled operations has the right to fly across the territory of another State and to make stops for non-traffic purposes.
- The International Civil Aviation Organisation (ICAO) was established to oversee the provisions of the Convention.

The Chicago meeting could not agree on capacity regulation or a basis for the exchange of commercial rights to operate international air services. As a result these were left to bilateral negotiation. However, at the same time that the Chicago Convention was signed, the International Air Services Transit Agreement established amongst its signatories the first two freedoms of the air. These are the right of an aircraft on scheduled international services, first, to fly across the territory of a country without landing and, second, to land for non-traffic purposes. One hundred States had ratified this agreement by the beginning of 1987. The Chicago convention has been signed by 157 States.

The International Civil Aviation Organisation

ICAO is the body created under the provisions of Chapter VII of the Chicago Convention. It is incorporated under Canadian law and is also a specialised agency of the United Nations. Membership is open to States ratifying the Convention and to United Nations members adhering to the Convention.

The broad objectives of the organisation are to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport with an emphasis on technical matters.

The two main arms of ICAO are the Assembly and the Council. The Assembly consists of representatives of all member States and meets every third year.

The Council is the executive body, responsible to the Assembly. It prepares drafts of standards and recommended practices to be considered by the contracting States. The Council exercises ICAO's regulatory authority on safety and may adjudicate on any disagreements between member States relating to the interpretation of the Convention and its Annexes that are brought before it. Many bilateral agreements also make provision to refer disputes to the Council. Recently it has involved itself more in recommending standards for capacity controls and fare setting. Australia has been consistently elected to the Council as a State of chief importance in civil aviation.

International Air Transport Association (IATA)

IATA is an organisation of international airlines. It aims to standardise and improve airline operations and airline services. It involves itself in all aspects of airline operations, and most non-government discussions within the industry take place under IATA auspices.

One function of IATA is to operate a clearing house for inter-airline debts arising from interline traffic. Under the interlining procedure, a person can buy a normal economy or first class airline ticket from any international airport to any other. One airline writes the through ticket, but the passenger may travel on a number of airlines depending on the route travelled. The revenue to each airline is calculated by a complex formula (International Civil Aviation Organisation 1983). IATA's clearing house offsets counter claims by members, which speeds up and simplifies the process of clearing the inter-airline debts.

The most controversial activity undertaken by IATA has been its tariff co-ordination activities. During the 1950s and 1960s, fares were effectively determined by IATA Traffic Conferences. In 1979, the secretive traffic conferences were replaced by more open, co-ordinating, conferences.

The international airline network has grown and become more complex over time with the emergence of non-IATA carriers, the introduction of larger jets and the development of mass markets for tourism. Competition has increased significantly, stimulated by this growth as well as by the desire of many governments to allow greater competition in the sale of air fares.

As a result, the importance of IATA has declined, and while airlines still meet regularly to discuss fares within IATA, they are less inclined to follow IATA recommendations. IATA fares and conditions are only used as general guidelines for the industry.

In Australia, the Trade Practices Commission ruled in 1985 that participation by airlines in IATA tariff co-ordination activities did have public benefit, although the Commission prohibited any action by airlines to enforce the fares agreed in IATA traffic conferences. As a result, all fares sold in Australia must be subject to free price competition and competitive advertising.

BILATERAL AIR AGREEMENTS

The recognition of the principle of national sovereignty over airspace and the failure of the Chicago Convention to reach any multilateral agreement on the exchange of air traffic rights necessitated the negotiation of bilateral aviation agreements. The Australian Government negotiates bilateral agreements in consultation with the designated Australian international airline, Qantas. These agreements are administered by the Department of Transport and Communications.

There are four major classes of clauses found in bilateral agreements. These are:

- technical and administrative
- route description
- capacity
- tariff determination.

Technical and administrative provisions

These clauses form the bulk of the bilateral agreement in terms of volume. The standard form of bilateral agreement is likely to contain clauses dealing with topics such as registration of the agreement with ICAO, exemption of items used by airlines from national duties and charges, termination clauses and dispute settlement provisions. However, the most important function of these clauses is the grant by one party to the other of the right to operate international air services on the agreed route.

Route description provisions

One of the crucial functions of the bilateral agreement is to provide for the route to be serviced by the designated airlines of the contracting States. This is usually contained in an annex to the agreement. The routes are influenced by:

- bargaining power of the parties and the value of traffic rights each can offer;
- technical considerations (the need to land for refuelling or other reasons) although these are now of little importance;

- market factors such as traffic volume and competition; and
- the need to gain access to commercially valuable intermediate and beyond rights.

Australia, like other countries, only allows access to specific stopping points (**gateways**) in its own territory. Access is granted on a reciprocal basis, with rights of equivalent value being sought for the Australian carrier, such as access to gateways in the other country or to intermediate points. Australia is fortunate in having a number of desirable gateways.

The route descriptions can be important. Qantas, for instance, has fewer intermediate points in the Pacific than the US airlines, and only very limited rights to operate beyond the US compared with the rights the US carriers have to fly to countries beyond Australia. Qantas and the Australian Government claim these factors give the US airlines a commercial advantage.

In Australia, Qantas has stopover rights within Australia and can carry any passenger it carried internationally over routes in Australia. For example, a passenger can stopover in Sydney on an international Qantas flight and continue on to Melbourne with Qantas. Stopover rights are occasionally granted in bilateral treaties and currently these are granted in Australia to a few overseas airlines. In 1979 Qantas lost its rights to carry the international traffic of other airlines on domestic sectors. A passenger coming in on an international airline which does not have stopover rights must now disembark at one gateway and then travel within Australia on a domestic airline. These interlining rights are to be restored to Qantas from July 1988.

Capacity provisions

The capacity is the number of passenger seats flown on a particular route over a given period. It is one of the most controversial issues in bilateral agreements and was a major area of contention at the Chicago Conference. Several types of capacity control have developed over time, each of which are examined below.

Generally speaking there is an inverse relationship between involvement in capacity setting and fare determination. It is difficult to regulate both. However, by being able to exercise some control over the amount of capacity on routes, it is possible to influence fare levels. Similarly, the regulation of fares can affect demand and therefore capacity requirements on routes.

Australia's position in determining capacity is to use the true origin and destination (TOD) principle. Under this principle the amount of capacity on a route is related to the number of passengers flying from one point to another ignoring stopovers and transit points. Thus a passenger from Australia flying to London via Singapore would be counted as third freedom traffic for Qantas, fourth freedom traffic for British Airways, and as sixth freedom traffic for Singapore Airlines. Details of the various freedoms of the air are discussed in more detail in Appendix I.

The Asian airlines argue that capacity should be more determined by the flight uplift discharge (FUD) principle. It is argued, for example, that Singapore Airlines, in flying Australians to Singapore and then on to London, are exercising third and fourth freedom rights. The use of the FUD principle greatly increases the number of passengers defined to be travelling on the Australia/Asia routes and hence gives the Asian airlines an argument to increase their capacity to Australia. Australia has granted the Asian airlines some capacity to carry this traffic. In exchange, Australia has obtained extra capacity for its carrier to enable it to carry transit traffic through to Europe without reducing capacity available for the carriage of the Australian-Asian country traffic.

Pre-determination formula

This was the first method of capacity control adopted. It is favoured by most countries, which see it as the best means of ensuring that capacity does not exceed demand, resulting in uneconomic services. The formula is based on two important principles:

- The parties concerned estimate the volume of third and fourth freedom traffic making allowances for natural and promotional growth but exclusive of fifth freedom traffic. Such traffic is only taken on a 'fill up' basis.
- The parties agree beforehand on the capacity which can be provided on the agreed routes to satisfy anticipated demand. Capacity (as distinct from actual traffic) is usually divided equally between the designated airlines of the parties.

This pre-determination formula was used extensively by the Australian Government in its bilateral agreements up until the mid 1950s when Qantas was a new, small carrier and then again from about 1970 onwards when competition became very fierce. It is currently Australia's favoured position, and is used in the majority of Australia's present bilateral arrangements.

Bermuda I Formula

This type of capacity clause derives its name from an agreement negotiated between the USA and the United Kingdom (UK) at Bermuda in 1946 (Her Majesty's Stationery Office 1946). It was a compromise between the regulatory approach of the UK and the free market philosophy of the USA. There were four principles:

- capacity should bear a close relationship to market demand;
- the airlines of each country should have a fair and equal opportunity to operate services on the agreed route;
- the services provided by one airline should not unduly affect the services of the other; and
- the primary objective is the provision of third and fourth freedom traffic although allowance can be made for fifth freedom traffic.

A further term in the agreement provided for a review of any decision if either State believed the principles of the agreement had been violated.

The Bermuda principles were used by the Australian Government as the standard for its bilateral air service agreements during the period from the mid 1950s to about 1970, although generally subsequent arrangements on how the principles will be implemented have introduced the concept of pre-determination.

Bermuda II formula

The excess capacity which developed across the Atlantic in the mid 1970s caused the UK to give twelve months notice of termination of the Bermuda I agreement. The renegotiated agreement signed in July 1977, known as Bermuda II (Her Majesty's Stationery Office 1977), gave greater regulatory control over capacity. This formula was similar to Bermuda I, but imposed on governments an obligation to assume responsibility for the capacity plans of their airlines and emphasised third and fourth freedom traffic as primary and fifth freedom traffic as supplementary.

Free determination formula

This formula is currently supported by the USA, and it has negotiated agreements of this type with most of its bilateral partners, including Australia. Under this formula either party may designate however many airlines it wishes on the agreed route and, provided airlines of each country have a fair and equal opportunity to compete, capacity is not regulated. The Australian Government is currently in dispute with the USA over capacity across the Pacific. The USA's free market philosophy clashes with Australia's concern to ensure that capacity is not significantly in excess of Australia-USA traffic.

Tariff determination

Most air service agreements provide for airlines to discuss air fares in IATA, following which they are submitted to governments for approval, or resolution of any disputes that may arise.

Australia's air service agreements, with a few significant exceptions, follow this pattern. Over the last decade or so, many governments have decided to significantly reduce their involvement in the setting and oversight of international fares and rates. Australia has moved in step with this trend.

In 1981, the Australian Government moved to allow the international airlines serving Australia substantial freedom to set fares and rates in accordance with their own commercial judgment and assessment of market needs. Administrative procedures for the approval of tariffs have been greatly simplified, with the result that there is a very competitive market for the sale of air fares and rates in Australia.

Australia still retains the power to intervene in fare setting matters. However, since 1981 this has been treated as a 'reserve power' and there have been only a few instances where fare proposals have not been approved.

INTER-AIRLINE COMMERCIAL AGREEMENTS

After the multilateral conventions and the bilateral agreements, inter-airline commercial agreements constitute the third layer of economic regulation of international aviation. These agreements deal with the daily operations of the airlines. Co-operation and rationalisation of services can improve the profitability of each airline and may improve service to the consumer.

Under the bilateral arrangements most air routes have only two major carriers, the designated airlines of the two countries involved. There is a strong incentive for duopolists to enter into formal or informal co-operative agreements to share out the market. This can guarantee each airline a share of capacity or revenue, can increase load factors by removing frequency competition and can reduce costs and rationalise schedules. Departure times can be spread throughout the day and the week rather than bunching in peak periods, benefiting passengers and stimulating demand.

Pooling agreements are very widespread in Europe where 75-80 per cent of intra-European tonne-kilometres are operated on pooled services (Doganis 1985). They are forbidden to United States airlines by anti-trust legislation. Qantas currently has only a few such agreements.

The most common pooling arrangement is a revenue sharing pool in which all revenue on a route is shared by participating airlines in proportion to the capacity they offer on the route. The terms of pooling agreements can be very complicated and are often closely guarded commercial secrets.

Commercial agreements negotiated by Qantas must be authorised by the Trade Practices Commission. Four types of commercial agreements can be approved:

- Capacity leasing allows one airline to lease a number of seats and cargo space from another. Currently several carriers lease passenger and cargo capacity from Qantas.
- Capacity/frequency agreements are a consultative mechanism followed before making recommendations to government on total capacity and frequency of service.
- Revenue pooling compensates airlines for providing services on a less popular day of the week or to lower traffic points.
- Co-operative marketing involves joint promotion, scheduling and interchange of traffic documents. It can increase the level of service to the consumer by spreading departures.

At the time of the Trade Practice Commission ruling on international aviation agreements in 1985, Qantas had commercial agreements with just over one-half of the carriers operating to and from Australia. The Commission found that rationalisation of services through these agreements generally resulted in greater efficiency and were of benefit to the public.

INDUSTRY STRUCTURE

In 1986, scheduled international air services carried 196 million passengers and flew 597 billion passenger-kilometres world-wide. Charter services flew 130 billion passenger-kilometres. Charter passenger-kilometres flown have increased at an average rate of three per cent per annum over the period 1976 to 1986 compared with an average seven per cent increase for scheduled services. Charter airlines are thus becoming less important worldwide.

Non-scheduled or charter services have not been regulated by bilateral air service agreements. They are authorised at the discretion of individual states. They are very important within Europe and across the Atlantic, operating cheap no frills services for holiday makers and achieving high load factors by organising flights well ahead of departure, usually through travel agents offering holiday packages.

In Europe, more passenger-kilometres are flown on non-scheduled than on scheduled services. They are much less important in Australia and flights must be approved on an individual basis by the Government.

Domestic airline operations are larger than international operations. Scheduled domestic services carried 754 million passengers 845 billion passenger-kilometres throughout the world in 1986. Thus international scheduled services carried only 21 per cent of the total number of passengers and performed 41 per cent of the passenger-kilometres of domestic and international scheduled services combined.

The concentration of market share in the airline industry can be considered in a number of ways. Each airline's share of the passenger market can be considered as a share of passenger numbers or passenger-kilometres and its share of the freight market can be calculated from freight uplifted or tonne-kilometres performed. Each measure defines a different aspect of the situation. As many international airlines fly domestic services within their own country, the size of their domestic operations is also important.

Table 2.1 shows the top five world airlines in 1986, listed in order of size, measured in four different ways. The rankings are given for both scheduled international flights and for scheduled international plus domestic operations. The ranking of Qantas is also given for each category. Qantas ranks higher on passenger-kilometres and freight tonne-kilometres because its flights are longer than average. When domestic operations are included the American airlines dominate because of the huge United States domestic market. Note that Continental and Eastern are now both owned by Texas Air. This table only includes IATA members and so excludes Aeroflot, the USSR carrier, which is very large.

Table 2.2 shows the market concentration for international scheduled airline services in 1986, based on the four measures of size. The system of bilateral negotiation and regulation of capacity ensures the market is not dominated by a few airlines. The structure of the industry is dictated by the demand for services on each route as governments try to restrict movements to and from their country to third and fourth freedom passengers.

Profitability of International Airlines

Despite the extensive regulation, falling costs per unit in real terms and a high rate of growth in demand, international airlines have not been particularly profitable.

TABLE 2.1 RANKINGS OF AIRLINES FOR SCHEDULED INTERNATIONAL AND DOMESTIC SERVICES IN 1986[a]

	Passenger numbers	*Passenger-kilometres*	*Freight tonnes*	*Freight tonne-kilometres*
Largest five airlines for international scheduled flights	British Airways Air France Lufthansa Pan American Iberia	British Airways Japan Air Lines Pan American Lufthansa Air France	Flying Tiger Lufthansa Air France Japan Air Lines KLM	Lufthansa Japan Air Lines Air France Flying Tiger KLM
Rank of Qantas for international scheduled flights	15	6	15	9
Largest five airlines for international and domestic scheduled flights	United Airlines American Airlines Eastern Airlines Continental Airline TWA	United Airlines American Airlines Eastern Airlines TWA British Airways	Flying Tiger Federal Express Japan Airlines Lufthansa Air France	Flying Tiger Japan Airlines Lufthansa Air France KLM
Rank of Qantas for international and domestic scheduled flights	39	12	24	12

a. Only IATA members are included, so the USSR is excluded.

Source International Air Transport Association (1987).

TABLE 2.2 SCHEDULED INTERNATIONAL AIRLINE SERVICES: PERCENTAGE OF TRAFFIC CARRIED BY LARGEST AIRLINES, 1986[a]
(per cent)

Traffic carried by largest	*Passenger numbers*	*Passenger-kilometres*	*Freight tonnes*	*Freight tonne-kilometres*
Airline	6.5	6.4	7.8	8.7
5 Airlines	23.1	24.1	30.7	35.0
10 Airlines	37.1	37.9	43.1	48.1
20 Airlines	51.9	53.6	57.4	62.6

a. Only IATA member airlines are included, so the USSR is excluded.

Note The largest airlines are different for the different measures of size.

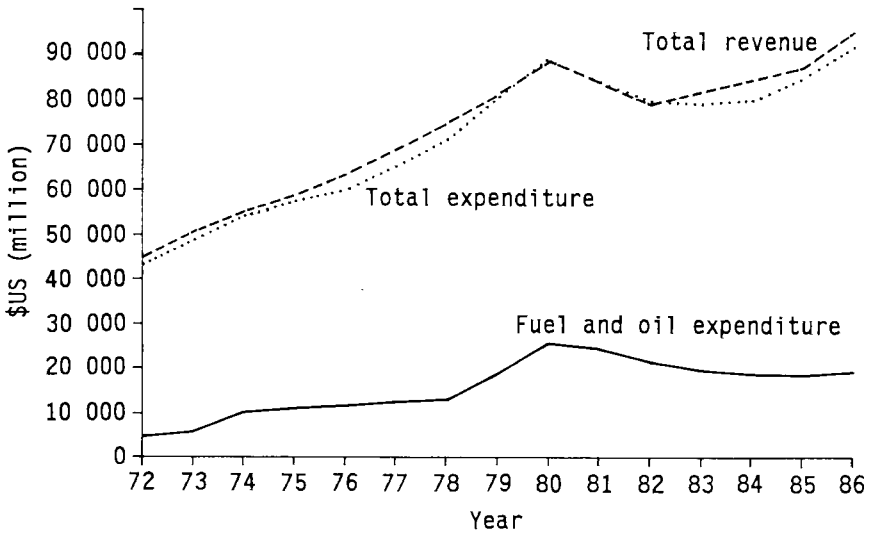
Source International Air Transport Association (1987).

The profitability of the industry has varied widely over the past 10 years. Figure 2.1 shows the real revenues and expenditure of scheduled operators throughout the world, identifying 1980 to 1982 as years where the industry as a whole made a loss. Returns, as a percentage of total revenue, ranged from a profit of 5.6 per cent to a loss of 0.7 per cent.

Qantas' profitability follows much of the same pattern as that of the world airlines in general with losses being made in 1975, 1979, 1980 and 1982, and with modest percentage profits being made in other years of between 0.1 per cent and 9.4 per cent of gross revenue. In the year ended March 1987, Qantas reported an after-tax profit of $63.4 million, representing 2.5 per cent of revenue.

Profitability of a service is not necessarily of major importance to the owners of the airline that operates the service. Two reasons for this are:

- A large number of international airlines are 'flag carriers' owned and operated by a country's government with the purpose of providing easy access to that country for tourists and businessmen, thereby increasing the inflow of foreign exchange and fostering the development of local industries.



Sources International Civil Aviation Organization (1987).
International Monetary Fund (1987).

Figure 2.1 Revenue and expenditure at constant prices: world scheduled airlines, 1972 to 1986

- Companies may operate unprofitable routes or provide some unprofitable services on particular routes in order to offer a wide range of services. The service availability/convenience factor may be important in people's decision to fly, that is, the operation of an unprofitable route may assist in maintaining or increasing the profitability of other routes. An example is the Australia-Singapore route which Qantas operated for many years with load factors well below the company average, for several reasons, one being that it allowed the company to offer more flexible stopovers at this Asian port.

Australian market structure

Scheduled flights to and from Australia represent only a small fraction of the worldwide market. In 1985, airlines carried 5.2 million passengers to or from Australia, 2.7 per cent of the total number of passengers carried by all international scheduled airline services.

Currently, thirty airlines fly to and from Australia under bilateral agreeements. The market shares in terms of passenger numbers and freight uplifted are shown in Table 2.3 for 1970 and 1985. Qantas Airways Limited, wholly owned by the Commonwealth of Australia, operates international air services as the Australian carrier. It had 42 per cent of the passenger market in 1985. The next nine airlines in terms of size carried a further 40 per cent, leaving less than 20 per cent of passengers for the remaining 19 airlines operating into and out of Australia. The main difference between 1970 and 1985 is the increase in the share carried by the Asian airlines. In February 1986 United Airlines replaced Pan American Airways as a designated USA carrier on the Australia-USA route, joining Continental and Flying Tiger.

The bilateral agreements negotiated by Australia generally regulate capacity on a pre-determination formula or under the Bermuda principles. Thus Qantas can be expected to have a market share of around 50 per cent. In practice this has never been achieved; its share of passengers has fluctuated between 41 per cent in 1972 and 46 per cent in 1974. Qantas' share of flights has varied between 34 per cent and 43 per cent, indicating that Qantas carries more passengers per flight. This, however, does not mean that Qantas is attracting higher load factors than its competitors since Qantas flies larger aircraft than many other airlines.

It was not possible with data available to the BTE to determine exactly each airline's share of foreign and Australian passengers

TABLE 2.3 AUSTRALIAN MARKET SHARE OF SCHEDULED OPERATORS, 1970 AND 1985

(per cent)

	Passenger numbers		*Freight tonnes*	
Airline	*1970*	*1985*	*1970*	*1985*
Qantas	44.9	42.1	49.5	35.7
Air New Zealand	19.5	11.0	12.6	10.5
Singapore Airlines[a]	2.9	6.6	2.3	8.6
British Airways	9.9	5.8	14.8	5.6
Cathay Pacific Airways	0.6	4.4	0.1	5.2
Garuda Indonesia	0.5	3.6	0.2	2.6
Continental Airlines	-	3.4	-	4.2
Pan American World Airways	8.7	2.7	8.2	2.4
Air Pacific	-	2.6	-	0.8
Thai Airways International	-	2.5	-	2.5
Malaysian Airline System	-	2.2	-	2.7
Japan Air Lines	1.1	1.9	1.0	2.2
Philippine Airlines	0.8	1.8	0.8	1.7
Flying Tiger Line[b]	-	-	-	3.4
Other	11.1	9.4	10.5	11.9
Total	100.0	100.0	100.0	100.0

a. 1970 figures refer to Malaysia-Singapore Airlines.
b. Flights out of Australia by Flying Tiger Line are non-scheduled and so outbound activity is not recorded.
- Less than 0.0 per cent.

Source Department of Aviation (1986).

separately. However, the Australian Tourist Commission conducts a survey of passengers in airports. They publish figures on airline of arrival which are reproduced in Table 2.4. These figures are subject to sampling error as well as non-sampling errors produced by the interview procedure.

It can be seen that the majority of passengers from each country are carried either by Qantas or the designated airline(s) of the other country. The combined market shares of the airlines of the bilateral partners vary between 60 and 80 per cent. Fifth and sixth freedom carriers provide competition on each route. The New Zealand route seems to come closest to a duopoly while the Europe/United Kingdom routes have the most number of competing carriers.

TABLE 2.4 AIRLINE OF ARRIVAL OF OVERSEAS VISITORS, 1985

(per cent)

	Country of residence								
Airline of arrival	*USA*	*Canada*	*UK and Ireland*	*Other Europe*	*Japan*	*Other Asia*	*New Zealand*	*Other*	*Total*
Qantas	52	43	34	29	38	39	40	37	39
Air New Zealand	20	30	3	3	6	4	41	5	15
Singapore Airlines	-	2	10	14	15	17	-	2	7
British Airways	1	1	24	5	-	2	2	2	5
Cathay Pacific Airways	2	1	6	1	4	9	-	-	3
Continental Airlines	11	2	1	3	-	-	8	2	4
Pan American World Airways	10	2	1	1	-	1	5	1	3
Malaysian Airline System	-	-	5	2	1	10	-	-	2
Japan Airlines	-	-	-	-	34	-	-	-	4
Other/Can't say	3	20	13	42	1	18	3	51	15
Total arrived by air	98	100	98	99	100	100	98	99	99
Total arrived by sea	2	-	2	1	-	-	2	-	1

\- Less than 0.5 per cent.

Source Australian Tourist Commission (1987).

Qantas' 39 per cent share of the total incoming passenger market in 1985 is not significantly higher than the 37 per cent share estimated in 1984. However, there were changes in the structure as big gains were made in the North American market offset by smaller shares of the UK and Ireland market.

Qantas appears to be rapidly increasing its share of US residents coming to Australia and in 1985 carried one-half of these passengers. This was a much greater share of the market than on its other routes. It was up from the 36 per cent estimated for 1984, even allowing for sampling variations. The 95 per cent confidence interval for Qantas' share of US residents coming to Australia in 1985 was between 47 and 57 per cent.

CHAPTER 3 THE INTERNATIONAL AIRLINE INDUSTRY

This chapter discusses the supply and demand for international aviation services on a global basis. Measures of the traffic task are presented with a discussion of the factors affecting the demand for international aviation. The structure of fares is considered, followed by an analysis of the costs of providing airline services. The chapter concludes with a discussion of technological changes that have occurred over recent years and that may occur in the future.

TRAFFIC TRENDS

For the purpose of this work, world international air passengers were defined as the international traffic of the scheduled services of airlines of ICAO contracting States.

During the past 15 years the world economic climate has been characterised by uncertainty. The post-war boom ended in the early 1970s with the sharp rise in oil prices in 1973-74. Low real economic growth followed combined with fairly severe inflation, especially in 1974, 1975 and 1979 to 1981 when oil prices rose rapidly. Worldwide recessions occurred in 1975 and 1982 with high rates of unemployment over the western world.

The international airline industry has maintained its high growth rate despite the economic recessions. World international air passenger numbers on scheduled services have increased at an average annual growth rate of 5.9 per cent over the period 1972 to 1986 as shown in Table 3.1. This is a stronger growth than world Gross Domestic Product (GDP) which grew at an average rate of 2.6 per cent per annum over the corresponding period.[1]

Passenger-kilometres travelled have grown at 8.0 per cent per annum, faster than passenger numbers, indicating that on average passengers are now travelling longer distances. Freight tonne-kilometres have

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1. This is approximated by the total GDP for all OECD countries.

increased at an average annual rate of 10.1 per cent over the period, making it an increasingly important section of the international air transport industry. The relationship of these three measures of international aviation activity over time is shown in Figure 3.1. As noted previously, these data refer to the international scheduled flights of all ICAO contracting States. The freight figures include scheduled services of freight-only flights such as those operated by Flying Tiger.

The supply of international air services on the world market increased significantly to cater for the increases in demand. This increase in capacity has resulted from:

- increases in the number of flights on established routes;
- the creation of new services and/or more direct routing patterns;
- increases in the average seating and freight capacity of the world aircraft fleet; and
- an increase in the total number of aircraft operating.

The average annual growth rates and percentage increases of selected supply variables for the period 1972 to 1986 are presented in Table 3.2, while Figure 3.2 shows the variations that have occurred in some of the supply variables. Although the annual rates of growth in capacity over this period has been varied, each of the variables exhibits much the same pattern of growth rate variations, with low growth being recorded in 1981 and 1982. Aircraft-kilometres have increased faster than aircraft departures, indicating longer stage lengths. Available seat-kilometres have not increased as fast as passenger-kilometres, which are shown in Figure 3.1, indicating increasing load factors.

The overall growth in capacity has largely been in response to the growth in passenger and freight demand described earlier. By providing this extra capacity through the development of new routes and increased frequency of service on existing routes, airlines have helped to increase demand by making air travel more convenient.

FACTORS AFFECTING DEMAND FOR INTERNATIONAL AVIATION

In order to determine why variations in passenger numbers have occurred it is necessary to examine the main factors that affect demand. The major influences on demand for air travel include economic growth, air fares and the level of service.

TABLE 3.1 INTERNATIONAL AIR TRAFFIC: SCHEDULED SERVICES, 1972 AND 1986

Variable	*1972*	*1986*	*Average annual growth (per cent)*
International passenger numbers (millions)	88	197	5.9
International passenger-kilometres ('000 millions)	206	603	8.0
Freight uplifted ('000 tonnes)	2 098	6 430	8.3
Freight tonne-kilometres (millions)	8 350	32 220	10.1

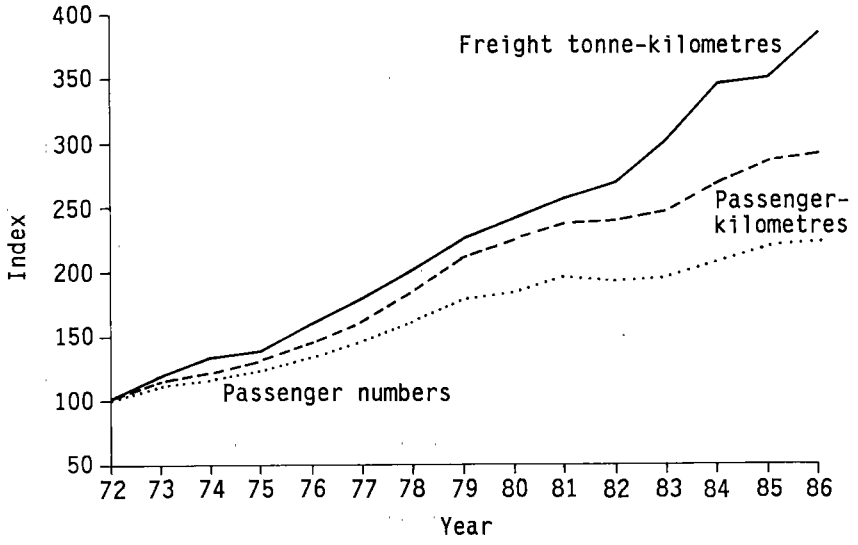
Source International Civil Aviation Organization (1983b, 1987).

TABLE 3.2 INTERNATIONAL AIR TRAFFIC: SCHEDULED SERVICES, SELECTED SUPPLY VARIABLES, 1972 AND 1986

Variable	*1972*	*1986*	*Average annual growth (per cent)*
Aircraft depatures[a] ('000s)	1 800	2 400	2.1
Aircraft hours flown[a] ('000s)	4 000	6 110	3.1
Aircraft-kilometres[a] (millions)	2 660	4 120	3.2
Average available seats per aircraft[a] (number)	141	226	3.4
Average available payload[a] (tonnes)	20	35	4.1
Seat-kilometres available ('000 millions)	383	955	6.7
Tonne-kilometres available (millions)	55 120	148 060	7.3

a. Excludes USSR.

Source International Civil Aviation Organization (1983b, 1987).



Source International Civil Aviation Organization (1983b, 1987).

Figure 3.1 World international scheduled air services, 1972 to 1986

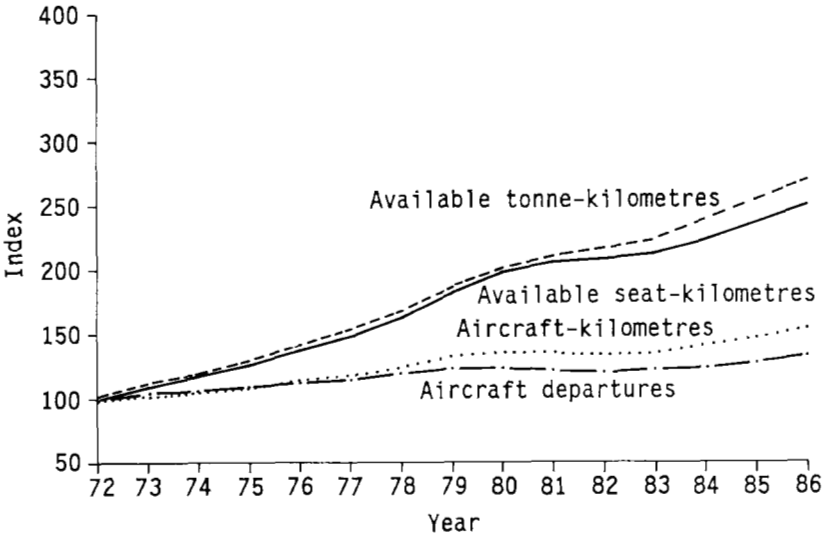
Economic growth

Economic growth is the steady process of increasing productive capacity of the economy. In an international context, economic growth increases the level of world trade and income, which influence the demand for business travel by affecting the ability and need of business representatives to undertake international journeys. Non-business travel is also affected by the level and distribution of income.

The movement in annual growth rates for total GDP in constant price terms for all OECD countries combined is compared with the movement in annual growth rates for global passenger numbers in Figure 3.3. The similar pattern of annual growth rate movements for OECD GDP and passenger numbers suggests that changes in GDP, which can be regarded as a measure of economic growth, have a large impact on changes in passenger numbers.

Air fares

A graph of the percentage changes in annual passenger numbers, together with a graph of the percentage changes in average revenue per

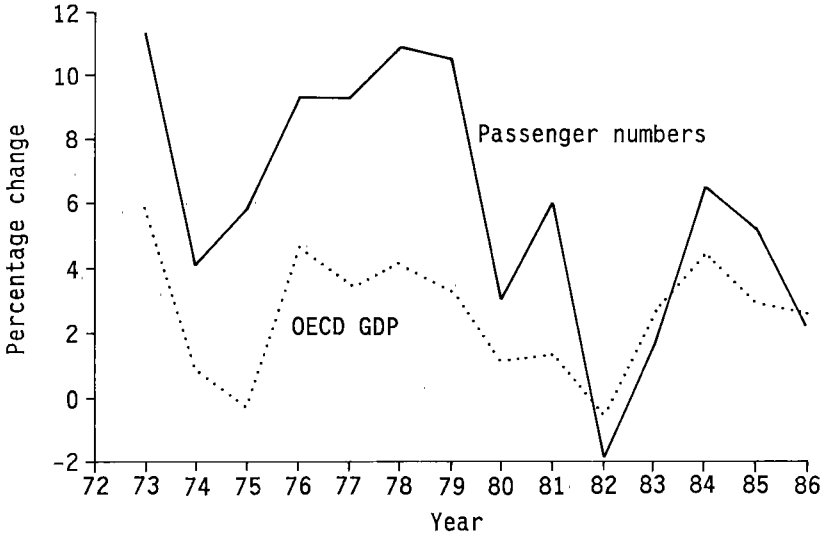


Source International Civil Aviation Organization (1983b, 1987).

Figure 3.2 Selected measures of world supply: international scheduled services, 1972 to 1986

passenger-kilometre (passenger yield), is given in Figure 3.4. This graph refers to all passengers, international and domestic, of the scheduled services of airlines of ICAO members, since financial data are not available for international flights separately. Passenger yield can be regarded as a proxy for fares although it can be distorted over time by structural changes in the airline services provided. For example, an increase in the average length of haul over the period considered would lead to a decrease in passenger yield if all fares remained constant because fares for longer hauls are generally cheaper per kilometre.

The general decrease in real fares over time, as shown by the generally negative percentage changes in passenger yield evident in Figure 3.4, should potentially have led to an increase in travel via both an income and a substitution effect. In theory, as air fares decrease in relation to income, more air travel is undertaken if it is a normal good. A decrease in air fares in relation to other goods and services should also lead to an increase in air travel as people undertake international travel rather than spend their money on something else. For example, more people are likely to holiday abroad rather than in their own country if it becomes relatively cheaper to do so. As shown in Figure 3.4, there is generally an inverse relation between fares and passenger numbers.



Note OECD GDP is at 1980 exchange rates and prices.

Sources International Civil Aviation Organization (1983b, 1987). Organization for Economic Co-operation and Development (1987).

Figure 3.3 Number of passengers on world international scheduled services and OECD gross domestic product: annual percentage changes, 1973 to 1986

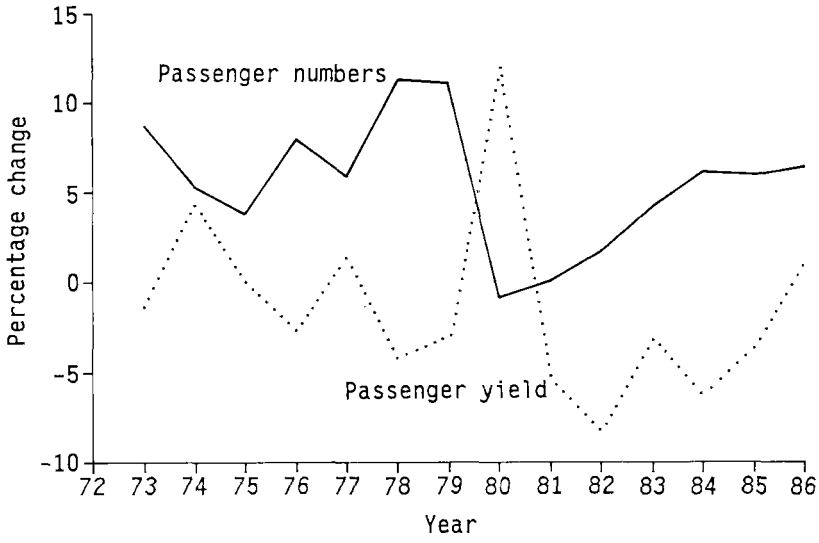
Level of service

Technological advances have led to an increase in the level of service available, such as improved seating, inflight movies, more appetising food, increased safety and decreased transit time. All these factors increase the attractiveness of air travel.

Technological improvements in the aviation industry and their adoption have occurred gradually and hence they have contributed to the general upward trend in passenger numbers.

FARE STRUCTURES

The structure of airline fares is dictated by the combination of a high fixed cost and a low marginal cost. The provision of a scheduled airline service involves a high cost but once the aircraft are flying a schedule, the cost to the airline of adding an extra passenger to an otherwise unused seat is quite low. In recovering their costs, airlines need to balance the need to provide an 'on-demand' service at reasonable frequencies for those that require it, and cater for the price sensitive leisure traveller.



Note Passenger yield is revenue per passenger-kilometre in constant $US.

Source International Civil Aviation Organization (1983b, 1987).

Figure 3.4 Passenger numbers and passenger yield: annual percentage changes, scheduled international and domestic air services, 1973 to 1986

The fixed costs of an airline service are those directly associated with flying the aircraft such as crew costs and fuel, and having available ground services such as maintenance, advertising and general administration. The marginal costs of passenger servicing are relatively small and include such things as ticketing, baggage handling and in-flight meals. From an allocative efficiency viewpoint, fares should be structured so that all passengers pay at least for the marginal costs they impose. The theoretical model would then result in fixed costs being distributed among the various user groups in relation to the elasticity of demand associated with their particular fare type. Passengers who fly first class are generally expected to be less responsive to price and so would contribute more to the recovery of fixed costs than the price conscious leisure passenger on an excursion fare. Such a pricing procedure should allow an airline to recover costs while at the same time catering for the various types of services demanded.

These theoretical principles are, in fact, closely followed by airline operators. The success of the above pricing strategy depends on the

airline being able to segment the market into several sub-markets with different elasticities.

Service conditions are one of the main mechanisms used to segment the market. These conditions are usually imposed with a view to increasing the total number of passengers carried while minimising the number of passengers moving down to lower fare alternatives. The conditions need not be related to costs and include such things as the number of allowable stopovers, advance booking requirements, minimum and maximum length of stay for return flights, and the guarantee of a seat on a specific flight.

Fares are also structured to take account of seasonal and directional imbalances. The capacity on a route will tend to be determined by the peak demand and so passengers on these flights may be expected to bear more of the capital costs than off peak-passengers.

In the terminology of the airline industry the first class, business class and economy class fares are called 'normal' fares. Fares with conditions such as advance purchase requirements, stopover limitations or limits on the period of stay, are called 'special' or 'promotional' fares.

For example, on the Sydney to London service, Qantas offers several fare types:

- First class, business class and economy. Each offers stopovers and flexible booking arrangements.
- Excursion fares permit only one stopover and return excursion fares specify a minimum stay of 21 days and a maximum stay of 12 months.

The range of tickets vary over time as airlines continually restructure their fares in response to the competitive environment. Advanced purchase fares, for example, were offered by Qantas and other airlines on this route but have since been discontinued.

In addition to the fare types regularly available, various fares are offered for a limited period for promotional or advertising purposes. For example, from the 4 June to 19 July 1985, Qantas offered a Sydney-San Francisco return fare, specifying no stopovers and a stay of 7 days for 54 per cent of the return excursion fare.

COSTS

The cost of provision of international aviation services differs

markedly between routes and has varied considerably over the past ten years. Before examining these variations, those factors which affect costs are discussed.

Factors affecting costs

A number of factors affect the cost of providing a particular air service, whether measured by total cost or cost per unit, that is, cost per seat-kilometre available. These factors have been well documented (Doganis 1985) and include:

- wage levels
- fuel prices
- airport and navigation charges
- type of aircraft used
- pattern of aircraft operations.

The way in which supply costs are affected by input prices is clear, but the affect of the type of aircraft and its pattern of operation is less obvious.

Type of aircraft

The size of an aircraft has an effect on the operating costs per available seat-kilometre. Larger aircraft tend to have lower per unit operating costs for the same trip. Reasons for this relationship are that larger aircraft have some aerodynamic benefits over smaller ones and there are some economies in labour costs per unit from larger aircraft through both flight crew and maintenance costs. Another aspect is that the engines can vary greatly in fuel efficiency.

Pattern of operations

An airline's average cost per unit depends greatly on the pattern of its operations. Factors affecting average costs include:

- stage length
- frequency of services
- length of passenger haul.

Operating costs per available seat-kilometre tend to fall as stage length increases until stage length is so long that some payload has to be sacrificed. There are a number of reasons for this which include:

- Average block speed increases with stage length due to the decreased proportion of block time spent on climb, descent and ground manoeuvring. Costs per hour are spread over more output, therefore costs per unit fall.

- Aircraft and crew utilisation improve.
- Airport charges per aircraft-kilometre and therefore per unit are reduced.
- Maintenance relating to the number of take-off and landings is also reduced per aircraft-kilometre.

Costs of ticketing and passenger and luggage handling are also lower per passenger-kilometre the longer the average length of haul.

Service frequencies operated by an airline are another factor which can affect per unit costs. High frequencies may allow for decreased per unit cost by increasing aircraft and crew utilisations.

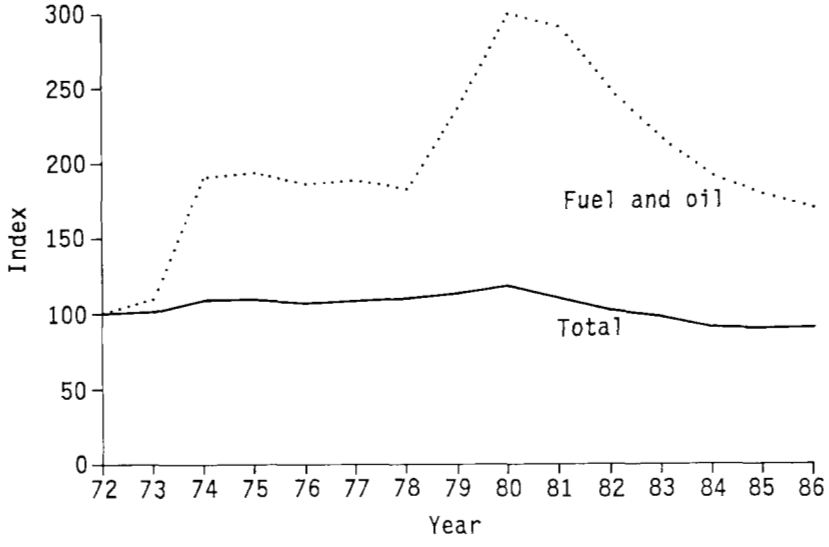
Large aircraft are generally operated on those routes which have long stage lengths. As a result, cost per unit on these routes tend to be considerably lower than for those with shorter stage lengths. Many of the routes out of Australia have relatively long stage lengths and it is therefore reasonable to expect that the cost per available seat-kilometre for these Australian services will be lower than the world average.

Trends in airline costs

The change in total international airline expenses and the variation in the share of total expenses of certain inputs are examined briefly. A more detailed examination of unit expenses is given in the next section, along with an analysis of the likely reasons behind the observed trends.

The expenses of world scheduled airlines (in 1980 prices) increased from US$47 748 million in 1972 to US$89 406 million in 1986, which represents an increase of 104 per cent. Expenditure on fuel and oil increased by 286 per cent in real terms over the same period. As a result, fuel and oil's share of total expenditure rose from 11 per cent in 1972 to 21 per cent in 1985 peaking at 29 per cent in 1981 (International Civil Aviation Organization 1987).

Probably of more interest than the total expenses are the expenses per available tonne-kilometre. Figure 3.5 shows the trends in world scheduled airline real expenses per available tonne-kilometre in index form for the period 1972 to 1986. Total expenses increased rapidly in 1974, declined to 1976, then increased to peak in 1981 and subsequently declined until the end of the period. It can be seen that oil price increases in 1974 and 1979 to 1980 caused costs per



Sources International Civil Aviation Organization (1987).
International Monetary Fund (1987).

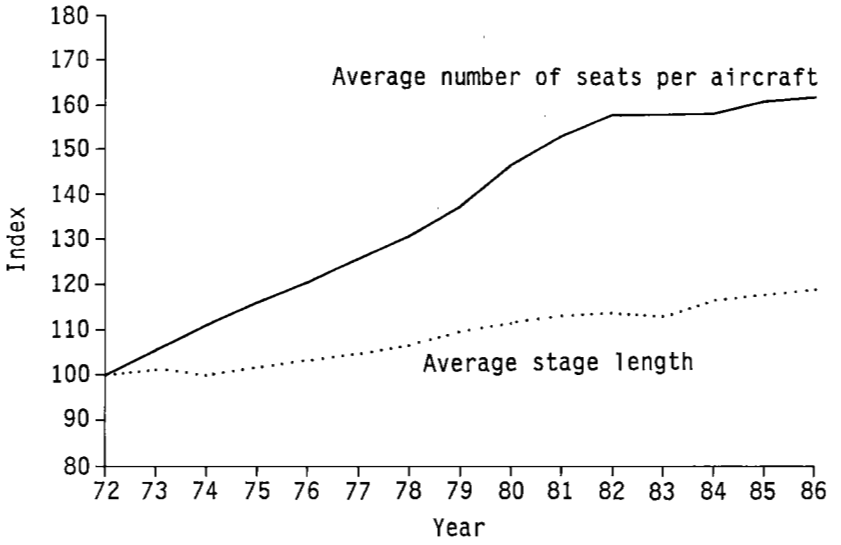
Figure 3.5 Indexes of real expenditure per available tonne-kilometre: world scheduled airlines, 1972 to 1986

tonne-kilometre to increase and the peak in total cost per tonne-kilometre corresponds to the peak in fuel and oil costs per tonne-kilometre.

Trends in factors affecting unit costs

There have been a number of changes in the physical method of supply of international aviation services that have had an affect on unit costs over the period under investigation. These include changes in average stage length, aircraft size and utilisation, and employee and fuel efficiency. From Table 3.2 it may be noted that world aircraft-kilometres flown have increased at a faster rate than the number of departures. This indicates that the distance flown per departure (that is, average stage length) has increased. This increase is estimated to be from around 1448 kilometres per departure in 1972 to 1716 kilometres per departure in 1986 (International Civil Aviation Organization 1987). Figure 3.6 shows the yearly fluctuations in stage length, indicating that there was an increase in all years from 1974 except 1983.

Table 3.2 also indicates that the size of aircraft have increased with seat-kilometres available and tonne-kilometre available increasing at



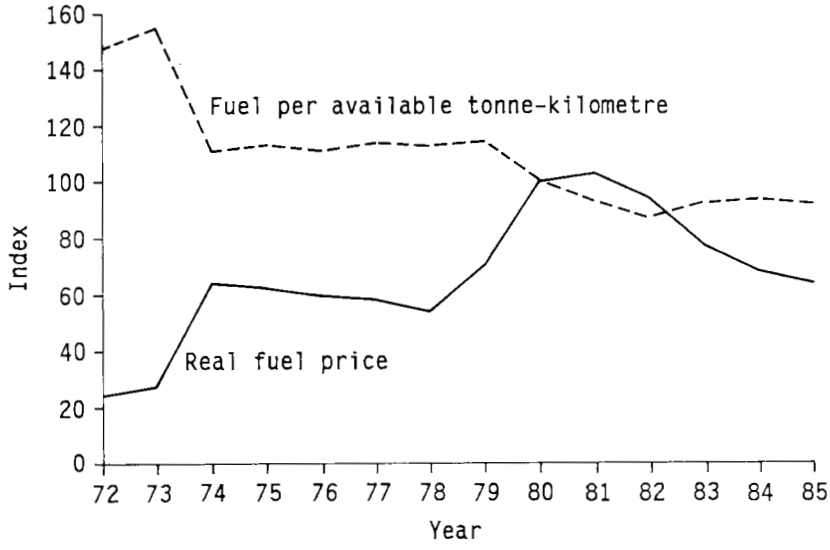
Source International Civil Aviation Organization (1983b, 1987).

Figure 3.6 Indexes of average stage length and average seats per aircraft: world international scheduled airlines, 1972 to 1986

a faster rate than aircraft-kilometres. The average number of seats per aircraft has risen from 141 in 1972 to 226 in 1986. As shown in Figure 3.6, the rate of increase has slowed over recent years.

The changes in fuel consumption per tonne-kilometre for the world fleet and aviation fuel price are shown in Figure 3.7. This figure shows that fuel consumption per tonne-kilometre decreased in response to the rapid increases in real fuel prices in 1974 and from 1979 to 1981. These increases in fuel efficiency resulted from improved operating practices and technological advances in the industry. The high price of fuel acted as a catalyst for the development and adoption of more fuel efficient engines, aircraft and operating procedures. The continued introduction of more fuel efficient engines and aircraft should further improve fuel efficiency, which may result in a decline in the relative level of fuel expenditure.

Average passenger load factor (passengers per available seats) for world international scheduled services increased from 54 to 63 per cent over the period 1972 to 1979. They have fluctuated between 61 and 65 per cent over the period 1979 to 1986.



Source BTCE estimates.

Figure 3.7 Indexes of real fuel price and fuel consumption per available tonne-kilometre: world scheduled airlines, 1972 to 1985

TECHNOLOGICAL CHANGE

Technological developments can affect supply and subsequently demand in two separate ways. The first is the effect on prices (fares) through the effect on costs. The second is the effect on the service provided by the airline. A new development may not change costs greatly but may significantly improve overall service quality which in turn affects demand. Another aspect of technological change which should be considered is improvements in the efficiency of ground operations such as may result from the introduction of a new computer booking system.

Historical changes

Unit costs of supply are affected by the technology employed. Over the past 10 to 15 years a number of technological changes have occurred which have had a significant effect on the cost of provisions of international services and, in some cases, the quality of service provided. Included in the developments have been changes to the size and type of aircraft operated and a significant improvement in the fuel efficiency of the engines used.

Type of aircraft

New aircraft are continually being developed and introduced into airline services. Developments over the last two decades have largely been centred on the introduction of larger aircraft, which are more fuel efficient and are especially suited to long stage lengths. The most successful large aircraft has been the Boeing 747 which now almost monopolises the longer routes.

Fuel efficiency

As has already been noted, fuel efficiency per available tonne-kilometre has improved over the past 10 years. Part of this improvement is due to the introduction of new types of aircraft, as discussed above. Another factor contributing to the improvement has been changes in the types of engines used. The high price of fuel provided an incentive for engine manufacturing companies to develop new engines that were more fuel efficient. Some of these more efficient engines have been introduced over the past 5-10 years, the result being that companies have been able to improve fuel efficiency while operating the same type of aircraft. Other improvements in fuel efficiency have arisen from improved operational procedures designed to minimise fuel consumption.

Other changes

Cost reductions have arisen from a number of other technological developments. Such changes include improved cockpit design to reduce crew size, and improved efficiency through computerisation of booking, ticketing and scheduling arrangements. The combined effect of improvements such as these and the introduction of larger aircraft has been to increase the number of available tonne-kilometres per employee. Taking Qantas as an example, available tonne-kilometres per employee increased from 168 505 in 1975 to 299 594 in 1985 (Qantas 1986 and earlier). Improvements in service have also occurred such as more comfortable seating.

The future

It is reasonable to assume that improvements in the operational efficiency of airlines will occur over the next few years due to the more widespread adoption of recently available technological advances, and the introduction of new developments, both in the form of new aircraft types and updating currently operational aircraft with new engines. While it is reasonably certain that operational efficiency will continue to improve with further technological change, the degree of change and its effect on costs per unit and on demand is not so clear. This will depend on the rapidity and extent of new developments, the speed at which these new developments are placed on

the market, the rate at which they are adopted by the airlines, and the changes which take place in the environment under which the airlines are operating.

In a competitive environment, the rate of adoption of new technology will depend primarily on the savings available from the new technology, the net cost of adoption and the likely increases in demand. The availability of capital for investment will also affect adoption rates.

Some new aircraft which may have a significant impact on international aviation to and from Australia are due to be introduced in the next few years. These include a group of new medium to long-range aircraft such as the McDonnell Douglas MD11 and Airbus Industrie's A340.

The MD11 is designed to fill the gap between the high capacity B747 and the smaller widebodied aircraft available, for example B767. It is smaller than the B747, carrying 321 passengers in its basic form. The A340 is designed to carry 262 passengers at the same seat-kilometre cost as the B747. Both the A340 and MD11 are designed to operate over similar distances as the B747.

The introduction of these new aircraft will mean that on the medium to long-haul routes airlines will have more options as to the type of aircraft to use, introducing more flexibility of supply. This should allow supply and demand to be more closely matched, resulting in an increase in load factors. Changes in frequency could also occur which may affect demand. The greatest effects will probably be on the less popular routes where the larger B747s could be replaced by more frequent services using smaller aircraft. The introduction of services on previously unprofitable routes which become profitable with the introduction of these new aircraft is also possible.

Capital costs for these new aircraft are expected to be significantly greater than existing aircraft on a per seat basis. Boeing (1987) states that capital investment will increase from the at cost current fleet level of $US67 000 per seat to around $US190 000 to $US230 000 per seat for new technology. At the same time this new technology is expected to reduce operating cost per seat-kilometre by 20 to 40 per cent. Boeing believe that the higher capital costs are more than offset by the lower operating costs, resulting in a net reduction in overall costs per seat.

CHAPTER 4 AUSTRALIAN INTERNATIONAL AIR SERVICES

This chapter discusses the supply and demand for international air services to and from Australia. Trends in passenger traffic are analysed by different market segments. Factors affecting the demand for air services are discussed, followed by a description of the changes in capacity and service that have accommodated the increase in traffic. The chapter concludes by looking at some of Qantas' operations.

TRAFFIC TRENDS

The Australian international travel market is influenced by both Australian and global economic conditions. There has been some uncertainty about the economic prospects of the Australian economy, and the world economy generally, over the past 15 years. Around 1973 large cuts in tariff rates and revaluing of the Australian dollar occurred. At this time the economy was characterised by increasing rates of inflation and unemployment. By 1976 some recovery was underway but it was later and generally less rapid than the other OECD countries. In recent times the economy has experienced low exchange rates and high balance of payments deficits.

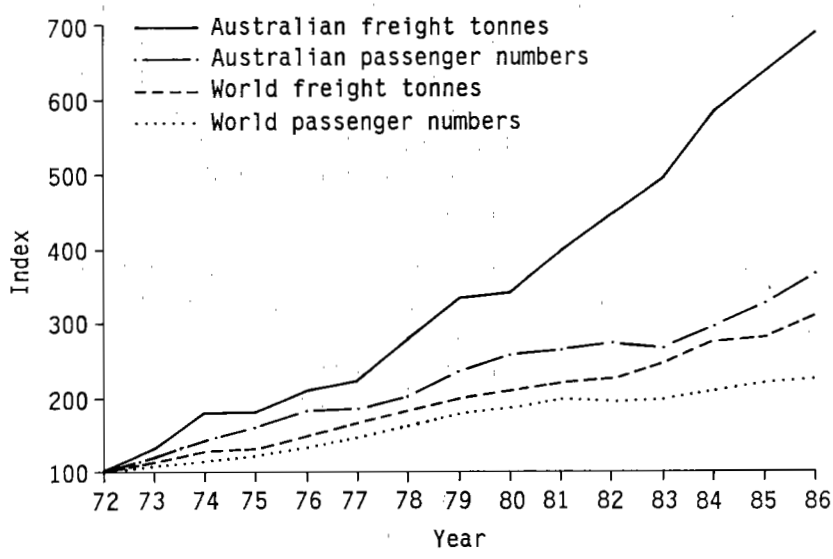
Australian international air transport statistics as published by the Department of Aviation (1987 and earlier) show total movements to and from Australia. Passenger numbers and freight uplifted for 1972 and 1986 are given in Table 4.1. Both measures have grown by considerably more than the corresponding statistics for the world as a whole (shown in Table 3.1).

Indexes of international passenger numbers and freight tonnes uplifted for Australia and the world for the period 1972 to 1986 are shown in Figure 4.1. Australian passenger growth rates, since 1979, have lagged the world trend by approximately one year. From 1972 to 1986, the amount of freight carried to and from Australia has increased at twice the rate of freight uplifted for the world as a whole. Growth rates for Australia have approximately followed fluctuations in the world market, but with a much higher overall growth.

TABLE 4.1 AUSTRALIAN INTERNATIONAL AIR TRAFFIC: SCHEDULED SERVICES, 1972 AND 1986

	1972	*1986*	*Average annual growth (per cent)*
Passengers ('000)			
Inbound	813.0	2 966.8	9.7
Outbound	794.2	2 835.7	9.5
Freight uplifted ('000 tonnes)			
Inbound	20.2	105.8	12.6
Outbound	16.0	141.2	16.8

Sources Department of Aviation (1986). Department of Civil Aviation (1973).



Sources International Civil Aviation Organization (1983b, 1987). Department of Aviation (1986).

Figure 4.1 Indexes of passengers and freight tonnes carried on international scheduled flights: world and to or from Australia, 1972 to 1986

Australian international passengers can be separated into a number of different market segments using statistics published by the Australian Bureau of Statistics (ABS) (1987a). One segmentation is between Australian residents travelling overseas and overseas residents travelling to Australia. Other distinctions are between length of stay and purpose of trip. The statistics are derived by the ABS from cards distributed to passengers on the aircraft.

The ABS statistics used for the rest of this Paper refer to Australian residents departing and overseas residents arriving. The corresponding figures for Australian residents returning and overseas residents departing are not presented because they just show the reverse situation. The most readily available figures combine the numbers of passengers travelling both by sea and by air. The sea component is very small, amounting to only 0.5 per cent of total passenger movements in 1986, and so the combined figures are used in this Paper. For overseas residents arriving, those who stated their purpose of journey as 'in transit' are excluded.

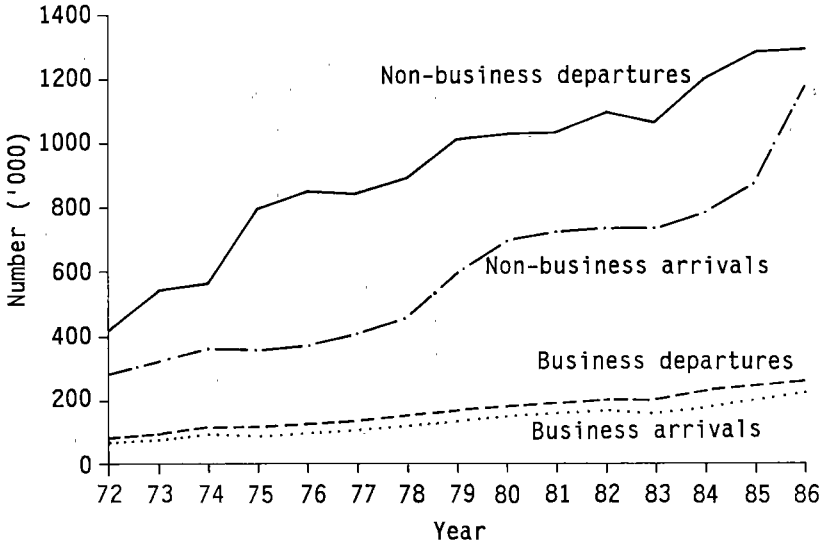
Statistics presented on a regional basis are as defined in the ABS publication (Australian Bureau of Statistics 1987a). Europe includes all countries generally defined as Europe including the USSR, Greece and Turkey. Asia encompases all countries from Japan to Israel to Indonesia. Oceania includes New Zealand and the Pacific Islands. America refers to both North, Central and South America. North America is defined in this Paper as Canada plus the USA.

Short-term movements

The length of stay is divided into short-term, long-term or permanent. Short-term is defined to be travel with an intended or actual period of stay of less than 12 months. This is the most important section of the market in terms of the number of people travelling.

Short-term movements are categorised by purpose of trip. Those passengers who said their reason for travelling was attending a convention, on business or for employment are categorised in this Paper as business passengers. Those travelling for a holiday, visiting relatives, accompanying a business traveller, education and other are categorised as non-business.

Business and non-business travel by Australian residents departing and overseas residents arriving is shown in Figure 4.2. The non-business segment of the industry is significantly greater than the business segment, for both arrivals and departures. The average annual growth in non-business travel was 10.7 per cent for overseas residents and



Source Australian Bureau of Statistics (1987a).

Figure 4.2 Short-term arrivals of overseas visitors and departures of Australian residents: business and non-business, 1972 to 1986

8.3 per cent for Australian residents from 1972 to 1986, although the pattern of growth recorded for the two categories differed significantly over the study period.

The share of overseas residents in the Australian international passenger market can be considered as the ratio of overseas residents arriving, to the sum of overseas residents arriving plus Australian residents departing. This proportion decreased from about 50 per cent in 1970 to a low of about 35 per cent in the mid 1970s and has increased again to around 46 per cent in 1986. The depreciation of the Australian dollar which has occurred since early 1985 seems to have been the cause of an increase in this share from early 1986, with the monthly seasonally adjusted figures now showing overseas arrivals exceeding departures by Australian residents.

Business travel by Australian residents and overseas residents has increased at a similar rate to non-business travel. The average annual growth rate for Australian business travellers was 8.4 per cent over the period 1972 to 1986 compared with 8.5 per cent for overseas residents. In 1986 business travellers represented 16.2 per cent of

the short-term market. The two largest routes in terms of business demand are Australia-USA and Australia-New Zealand.

Geographic patterns of travel

The number of short-term visitors arriving, by region of residence are shown in Figure 4.3. The number of Australian residents departing, by region where most time will be spent, are shown in Figure 4.4.

Europe and Oceania are traditionally the largest source of visitors, although Asia and America are rapidly catching up. Oceania (comprising 80 per cent New Zealand) has been the most unstable source. Asia and America as sources of overseas visitors have grown strongly through the 1980s. Japan represented 42 per cent of the arrivals from Asia in 1986 and 81 per cent of the arrivals from America in 1986 were residents of the United States.

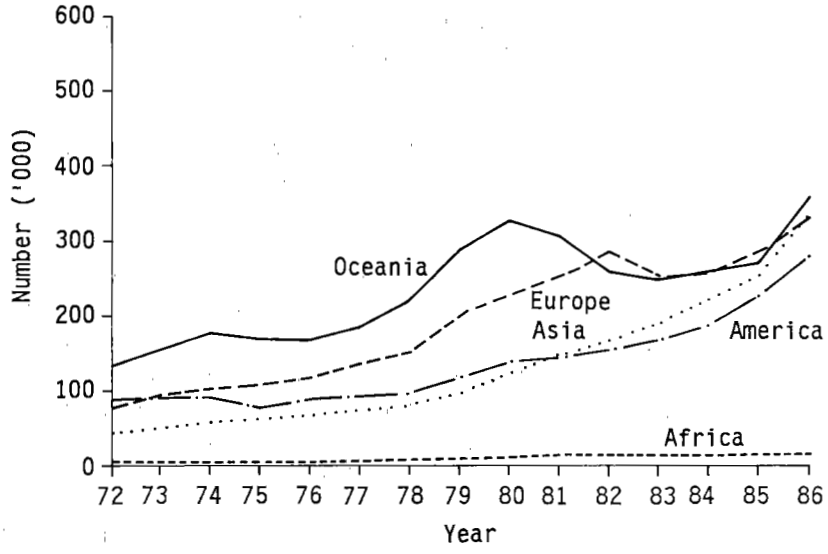
The fastest growing sources of international arrivals in terms of countries are shown in Table 4.2. Only two of the countries, Japan and the United States, had a significant market share.

TABLE 4.2 SHORT-TERM ARRIVALS OF INTERNATIONAL VISITORS: HIGH GROWTH RATE COUNTRIES, 1976 TO 1986

(per cent)

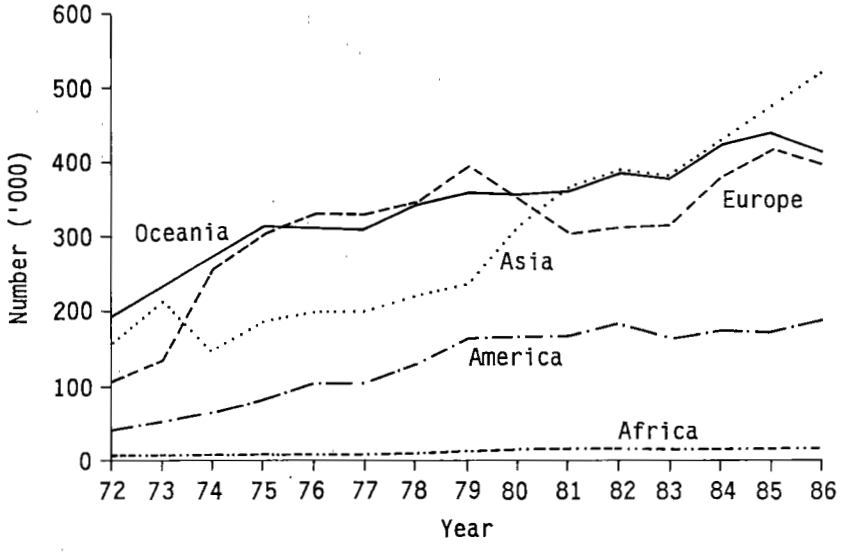
Country of residence	*Average annual growth rate 1976 to 1986*	*Market share 1986*
Japan	18.1	10.6
Singapore	16.8	3.3
Philippines	14.2	0.7
Malaysia	14.0	2.9
Germany	12.4	3.0
Hong Kong	11.8	2.4
United States of America	11.7	17.2
Canada	9.8	3.3
Indonesia	9.8	1.2
Total arrivals	11.1	100.0

Source Australian Bureau of Statistics (1987a).



Source Australian Bureau of Statistics (1987a).

Figure 4.3 Arrivals of overseas visitors: short-term, by major region, 1972 to 1986



Source Australian Bureau of Statistics (1987a).

Figure 4.4 Departures of Australian residents: short-term, by major region, 1972 to 1986

Asia has taken over from Oceania as the most popular destination for Australian travellers. Departures to America have remained virtually static throughout the 1980s, and arrivals substantially exceeded departures in 1986. On the Australia-Japan route, arrivals of Japanese residents exceeded departures of Australian residents by more than five to one.

Indonesia, Hong Kong and Singapore were the most popular destinations in Asia with a combined share of 58 per cent of Australian passenger movements to this area in 1986. New Zealand represented 62 per cent of the Oceania market in 1986 and America was dominated by the United States with 78 per cent of departures to that region. Of all Australian visitors to Europe in 1986, 52 per cent spent most time in the United Kingdom.

The fastest growing markets for Australian travellers are shown in Table 4.3. Indonesia and Hong Kong have high growth rates and a significant market share.

TABLE 4.3 SHORT-TERM DEPARTURES OF AUSTRALIAN RESIDENTS: HIGH GROWTH RATE COUNTRIES, 1976 TO 1986
(per cent)

Country of destination	*Average annual growth rate 1976 to 1986*	*Market share 1986*
Thailand	14.2	2.3
Indonesia	13.6	6.8
Philippines	12.4	1.9
Hong Kong	11.6	7.8
India	11.1	1.1
Canada	6.5	1.4
United States of America	5.4	9.5
Fiji	4.7	5.0
Japan	3.9	1.7
Total departures	4.7	100.0

Source Australian Burea of Statistics (1987a).

All of the preceding analysis was undertaken using data classified by country of residence or country where most time will be spent. These data do not give an indication stopovers. A stopover is a stay of one or more nights in any country, including the country of residence, from the time visitors left home until their return. In 1985 approximately 52 per cent of all visitors made a stopover either coming to Australia or leaving Australia (Australian Tourist Commission 1987).

Asia is the most popular region to be used as a stopover. Within Asia, the countries used most frequently for stopovers include India, Indonesia, Malaysia, Philippines, Singapore, Thailand and Hong Kong. Travellers from America use New Zealand as the most frequent stopover.

Trip purpose

Table 4.4 classifies departures of Australian residents by region and purpose of trip. The countries that have a high percentage of Australian residents visiting friends and relatives are Netherlands, Italy, Germany, Greece and the United Kingdom. Holiday passengers favour Indonesia, Fiji, Hong Kong, Singapore and Malaysia. Close to 50 per cent of Australians travelling to Japan and Papua New Guinea do so for business purposes. This far exceeds the proportions for any other country. On average, 17 per cent of Australians travelling overseas in 1986 did so for business reasons.

TABLE 4.4 SHORT-TERM DEPARTURES OF AUSTRALIAN RESIDENTS BY PURPOSE OF TRIP AND REGION OF STAY ABROAD, 1986
('000 of passengers)

	Purpose of trip			
Region	*Business*	*VFR*[a]	*Holiday/ other*	*Total*
America	47.0	27.1	111.5	185.6
Asia	88.4	51.3	380.5	520.2
Europe	46.9	140.4	209.4	396.7
Oceania	71.3	82.5	261.6	415.4

a. Visiting friends and relatives.

Source Australian Bureau of Statistics (1987a).

Table 4.5 classifies arrivals of overseas residents by region and purpose of trip. The countries from which visiting friends and relatives represent a significant proportion of total visitors include Netherlands, United Kingdom, New Zealand and Malaysia. A high proportion of total arrivals from Japan, Singapore, United States, Germany and Canada was for holiday purposes. There was no country from which business arrivals accounted for greater than 20 per cent of total arrivals.

Long-term movements

Long-term movements consist of arrivals and departures of Australian and overseas residents who were abroad or in Australia for a period greater than 12 months. Long-term movements represent a relatively small proportion of total movements: in 1986 long-term movements were approximately 3 per cent of total movements. The numbers of Australian residents departing and overseas visitors arriving on a long-term basis for the period 1972 to 1986 are graphed in Figure 4.5.

The number of Australian long-term arrivals and departures have been larger than that of overseas residents. In 1986, 59 per cent of long-term arrivals were Australian residents returning and 64 per cent of departures were Australian residents leaving Australia.

Permanent movements

This segment consists of overseas residents migrating to Australia and Australian residents migrating overseas. The number of permanent

TABLE 4.5 SHORT-TERM ARRIVALS OF OVERSEAS RESIDENTS BY PURPOSE OF TRIP AND REGION OF RESIDENCE ABROAD, 1986
('000 of passengers)

	Purpose of trip			
Region	*Business*	*VFR*[a]	*Holiday, other*	*Total*
America	46.0	40.6	195.7	282.3
Asia	52.0	44.7	237.6	334.3
Europe	53.7	133.4	144.7	331.8
Oceania	61.7	98.3	199.3	359.3

a. Visiting friends and relatives.

Source Australian Bureau of Statistics (1987a).

arrivals are considerably larger than the number of permanent departures. From Figure 4.5 it can be seen that the number of permanent arrivals have varied greatly over the past 17 years. These movements are affected by government regulations and relative economic conditions between country of origin and destination.

In 1984 Asia overtook Europe as the largest source of permanent arrivals. The share of permanent arrivals from the Asian region has increased from 12 per cent in 1971 to 38 per cent in 1986. In 1986 Europe's share was 32 per cent. This geographic change in the origin of permanent arrivals has had an impact on the origin of short-term visitors arriving to visit friends and relatives.

Permanent and long-term movements have decreased in importance over time. In 1970 they represented 20 per cent of total movements with this share decreasing to 5 per cent by 1986. This decline resulted from strong growth in short-term movements and virtually no growth in long-term movements.

FACTORS AFFECTING AUSTRALIAN DEMAND

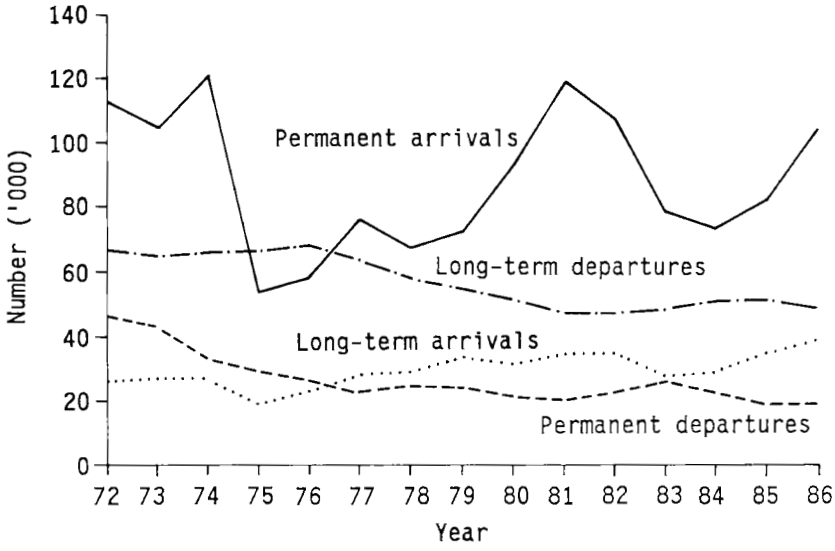
Economic growth, air fares and the level of service were identified as factors which have a major effect on the number of passengers travelling globally. These factors are also important in the Australian market. Other factors that are important for specific markets such as Australia include relevant exchange rates, terms of trade, and the relative cost of domestic travel and accommodation in Australia and overseas.

Some of these factors are examined to determine their impact on the growth of Australia's international travel market.

Economic growth

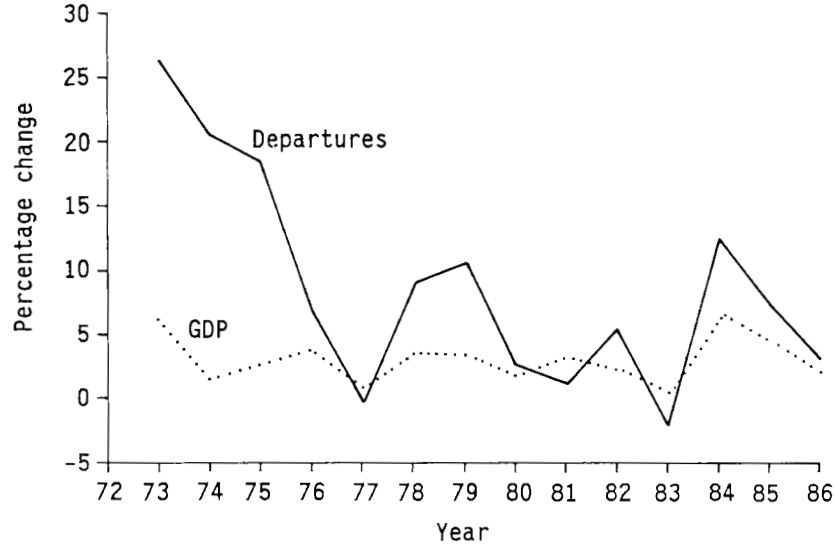
It was shown in the previous chapter that the pattern of annual growth rates for global international passenger numbers were similar to the global GDP growth rate pattern. Australian GDP will mainly affect the numbers of Australian residents departing. Overseas residents arriving will be more influenced by changes in their respective country's GDP. However, overseas residents travelling to Australia for business purposes may also be affected to some extent by the Australian GDP.

Growth rates for Australian residents departing and Australian GDP are shown in Figure 4.6. Growth in passenger numbers have not followed growth in GDP as closely for the Australian market as was the case in the global market but some influence is apparent. The reduced



Source Australian Bureau of Statistics (1987a).

Figure 4.5 Long-term and permanent arrivals of overseas residents and departures of Australian residents, 1972 to 1986



Source Australian Bureau of Statistics (1987a, 1987c).

Figure 4.6 Short-term departures of Australian residents and Australian gross domestic product at 1979-80 prices: annual percentage changes, 1973 to 1986

influence is due to the effect of local factors in the disaggregate market. For example, the high growth rates in the early 1970s were greatly influenced by the introduction of the low cost excursion fares on the Australia-Europe route.

Air fares

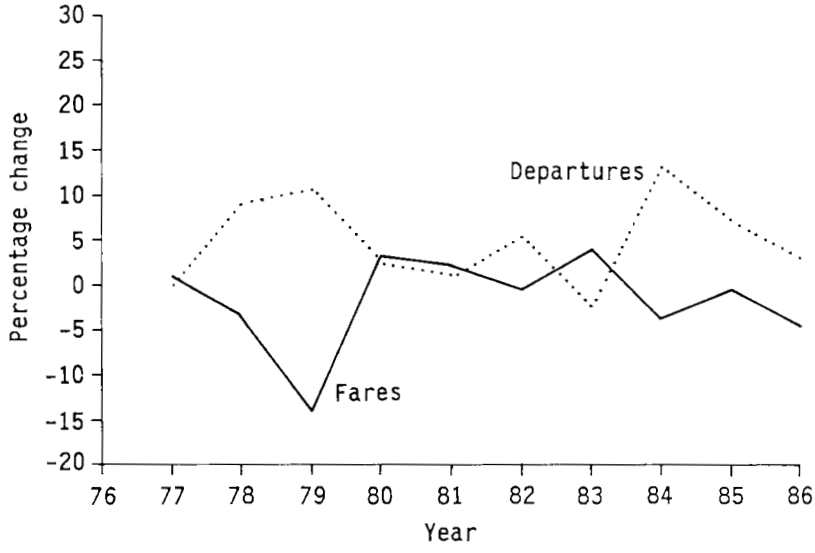
In the previous chapter a generally inverse relationship was identified between changes in global passenger numbers and changes in air fares. Unfortunately, fare data for airlines operating in the Australian market other than Qantas are not readily available and so the analysis for Australia was undertaken assuming that the Qantas data are representative of fares of all airlines operating into and out of Australia.

Indicative data on air fares were supplied in confidence to the BTE by Qantas. These quarterly data were in the form of the numbers of travellers on each fare type and the total amount of money paid by those travellers. Separate figures were supplied for Australian residents and foreign residents travelling to and from each country served by Qantas. From these data, the average fare for those travelling on either economy or special fares was calculated. The fares paid by Australians were converted to real terms using the Australian CPI. Fares paid by overseas residents were converted into the foreign country's currency, then into real terms using their CPI (1980 = 100), before being converted to US dollars at the 1980 exchange rates. The fares thus reflect the cost to consumer in each country of international air travel on Australian routes compared to the price of other goods in their economy.

An index of average fares from Australia was calculated by averaging the fares to each country weighted by the number of passengers flying to that country in 1980. A graph of the percentage changes in annual average fares and the annual percentage change in Australians departing short-term is shown in Figure 4.7. The equivalent graph for short-term arrivals of overseas visitors is given in Figure 4.8. The graphs show that there is generally an inverse relationship between fares and passenger numbers.

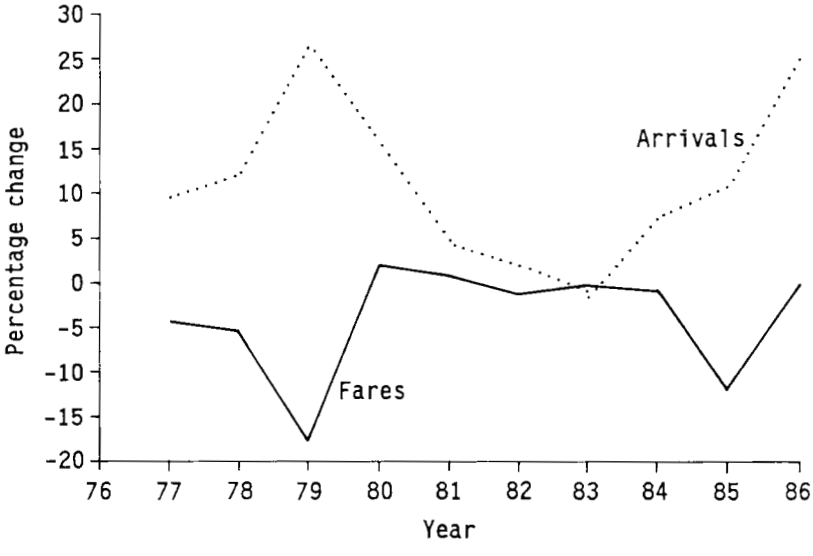
Comparison of inward and outward fares

Over a twelve-month period, inwards and outwards fares are approximately equal. Weighted average fare levels for both inwards and outwards travel, constructed from Qantas data, show that the ratio of inwards to outwards fares varied from 0.93 to 1.12 over the period 1976 to 1986. The variations are due to delays in changing fares in response to exchange rate movements and to variations in market conditions in Australia and overseas.



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 4.7 Short-term departures of Australian residents and outward air fares: annual percentage changes, 1977 to 1986



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 4.8 Short-term arrivals of overseas visitors and inward air fares: annual percentage changes, 1977 to 1986

Air fares tend to change due to large seasonal variations in the number of people travelling. Inwards fares are highest in the December and March quarters and lowest in the June quarter. The outward fare pattern is the opposite, with the high fares in June and September and the lowest fares in the December and March quarters. The high inward fares correspond to the northern winter and the high outbound fares correspond to the southern winter, when demand is likely to be strongest.

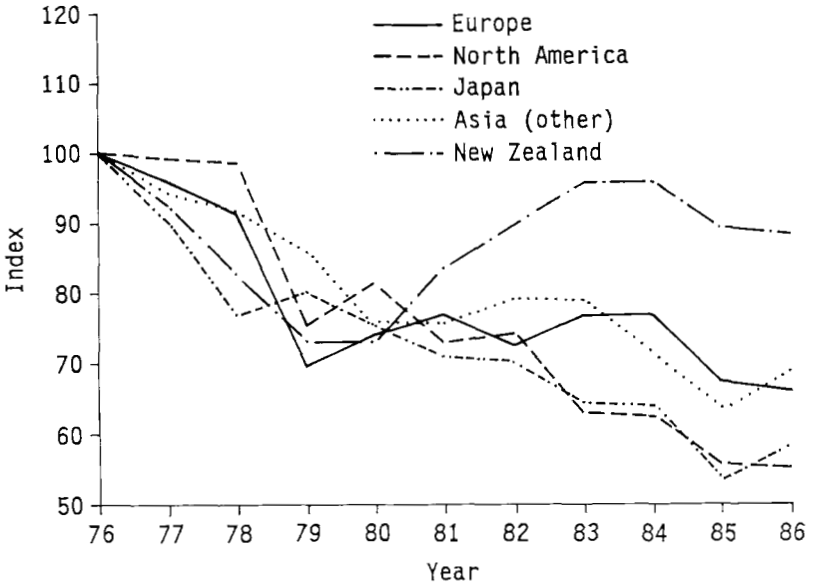
Changes in fares

The average fare paid by Australian residents to each of five regions was calculated by weighting the fares to the countries in that region by the number of Australians departing to those countries for non-business purposes. The average from each of the regions to Australia was calculated by the same method. The quarterly fares were averaged over each year and indexed to 1976 = 100.0. Graphs of the 10 indexes are shown in Figures 4.9 and 4.10.

It can be seen that with few exceptions the fares show a general downward trend, although the individual yearly movements are quite complicated. The large decreases in the early part of the graph (1976 to 1979) seem to be associated with the progressive introduction of the B747s. Movements in the indexes are affected by factors such as the costs of provision of the services, exchange rates, the competitive situation and load factors.

Boeing (1987) reports that world airline yields (revenue per passenger kilometre) declined in real terms at an average rate of 1.8 per cent per annum from 1970 to 1986 and forecasts a continuing decline to the year 2000 at an average rate of 1.3 per cent per annum. Inward fares to Australia generally fell by more than Boeing's estimate of world airline yields. Fares from Australia tended to fall by less, but if the depreciation of the Australian dollar is taken into account, they too have fallen by more than 1.8 per cent per year on average in US dollar terms. Average fares on the Australian routes seem to have fallen by more than the average for all world airline routes. This is probably because the technological advances in aviation over the past 15 years or so have given greater proportional savings to the longer routes.

The technologies being developed for introduction over the next decade are unlikely to favour the longer routes as much as in the past and so the forecasts presented in Chapter 6 are based on the assumption that fares will fall by Boeing's forecast of 1.3 per cent per annum for all routes. This would represent a considerable slowing down of the rate of decline in fares compared with the recent history.



Note These indexes can be regarded as indicative of real movements in economy and special fares.

Source BTCE estimates.

Figure 4.9 Indexes of Qantas air fares to Australia, 1976 to 1986

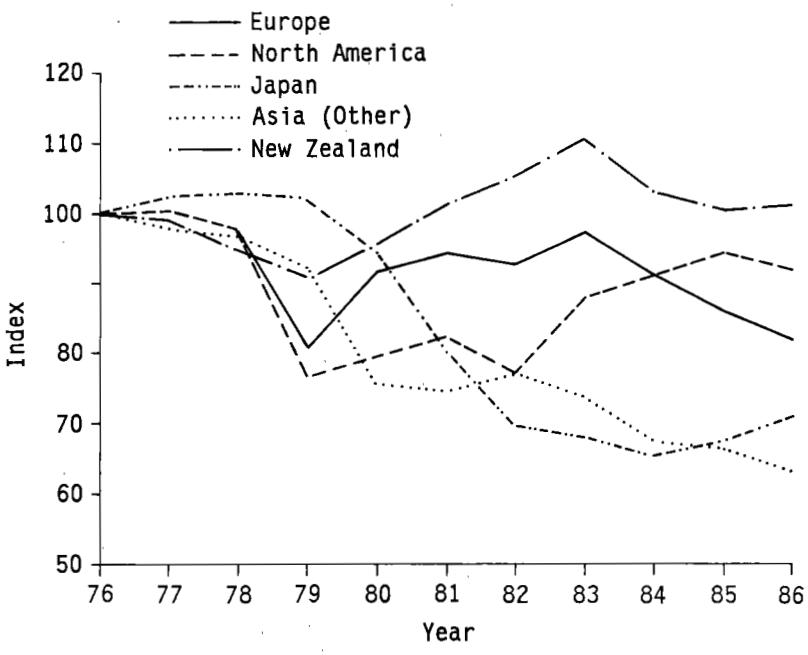
Exchange rates

The level of exchange rates affect an individual's willingness and ability to travel. Both overseas residents arriving and Australian residents departing are influenced by the exchange rate.

The real effect, however, is not due solely to the exchange rate, but the ability of a traveller to purchase goods and services in another country. This depends both on the exchange rate and the cost of living in both countries. The relative price (R) of goods and services in overseas countries compared to Australia is a function of the exchange rate (X), the level of prices in Australia (AP) and the level of prices in the overseas country (OP).

$$R = X. \frac{AP}{OP} \qquad (4.1)$$

The calculations used in this Paper use consumer price indexes as measures of price. The exchange rate (defined as the amount of foreign currency that equates with $A1) is expressed as an index number (June 1980=100) for each country and then weighted by 1980



Note These indexes can be regarded as indicative of real movements in economy and special fares.

Source BTCE estimates.

Figure 4.10 Indexes of Qantas air fares from Australia, 1976 to 1986

passenger flows (inward or outward as appropriate) to arrive at regional and aggregate exchange rates.

If the exchange rate between Australia and some other country falls (depreciation of the Australian dollar), more Australian dollars are required to buy a given amount of foreign currency. This diminishes the purchasing power of Australians at overseas destinations and discourages travel by Australians to that country. Similarly, if prices in a foreign country rise by more than the general level of prices and wages in Australia, Australians will have less purchasing power overseas compared to Australia and are discouraged from travelling to that overseas country. It is the combination of these two effects as given by the relative price variable that determines the ability of Australians to purchase goods and services abroad.

The relative price affects the demand for overseas visitors to Australia for the same reasons that it affects the amount of overseas

travel by Australian residents. Thus a fall in the exchange rate variable will increase the demand for travel to Australia as it decreases the demand for overseas travel by Australians.

A fall in relative prices should therefore increase the proportion of overseas travellers in the total Australian air passenger market. A plot of this share, together with a plot of the relative price variable for the aggregate Australian market, is shown in Figure 4.11. The two series are inversely correlated, confirming the belief that relative prices do have the effects postulated above.

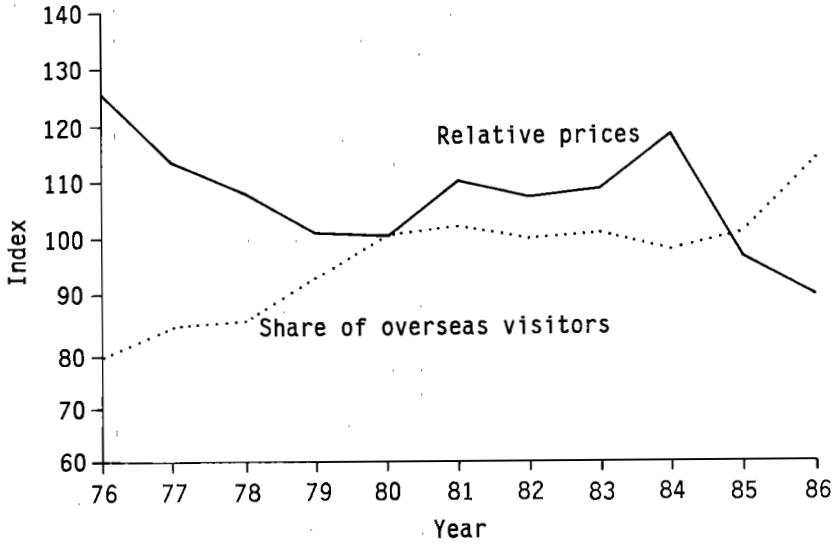
Another process that is affected by movements in exchange rates is the extent to which tourists switch between destinations. For example, if the Australian dollar depreciates against the Japanese yen, more than against the European currencies, then Australian tourists are more likely to travel to Europe rather than Japan. Therefore, whilst there may be a positive correlation between the demand for travel to a particular destination and its relative price, there is likely to be an inverse correlation with the relative prices of alternate destinations. In addition a general decline in the Australian dollar may cause travellers to switch to closer destinations or stay away for a shorter time.

The effects of changes in relative prices may occur with a lag as there is usually a delay between the decision to travel, when the ticket is purchased, and the time of actual travel. Such a lag is not obvious from the annual figures shown in Figure 4.11 but the econometric study in the next chapter indicates a lag of about three quarters of a year.

CAPACITY AND SERVICE

There are a limited number of countries to which direct flights operate out of Australia. In 1985 there were direct services to 29 destinations available, few of which had been added since 1976. The new destinations available were Vanuatu, China, Polynesia, Brunei and Zimbabwe. The service to Greece was discontinued in July 1977 and resumed in December 1984. At December 1985 no destinations had been deleted from those served directly from Australia in 1976. International services into Australia operated into ten Australian airports (excluding Norfolk Island) in 1985, four more than in 1976.

The number of international flights into and out of Australia rose from 19 434 in 1972 to 26 577 in 1975, fell to 20 114 in 1979, then rose to 27 707 in 1986. This 42 per cent increase in the number of flights over the period 1972 to 1986 compares to a 261 per cent



Note Relative price is Australia's inflation adjusted exchange rate.

Source BTCE estimates.

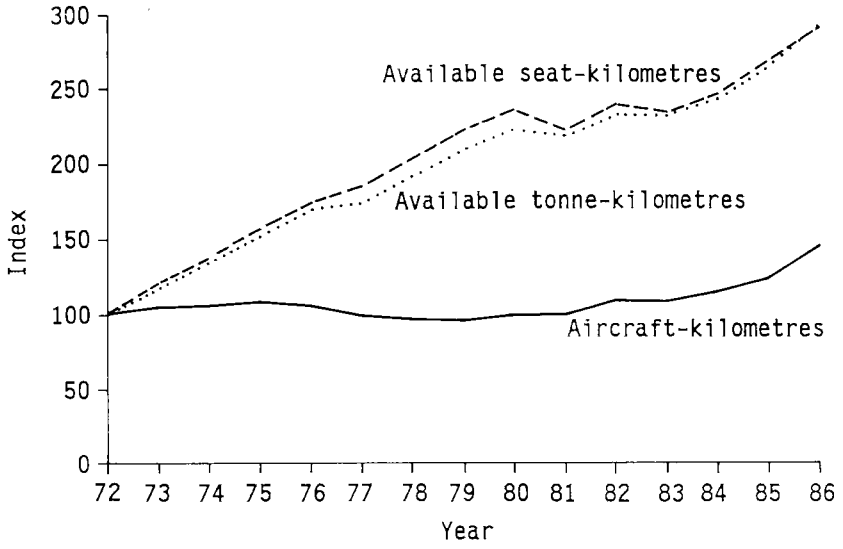
Figure 4.11 Indexes of relative prices and the share of overseas visitors in Australia's international short-term passenger market, 1976 to 1986

increase in passenger numbers. The relatively slow growth in the number of flights was the result of the progressive adoption of larger aircraft on the longer-haul routes such as those to Australia.

Apart from the number of flights there are insufficient data available for the Australian market as a whole to allow for analysis of the trends. Therefore, Qantas data have been used in the analysis as representative of the Australian market.

QANTAS

An index of selected supply variables for Qantas' services over the period 1972 to 1986 is presented in Figure 4.12. It can be seen that aircraft-kilometres decreased from 1975 to 1979 and did not show any real growth until the 1980s, while available seat-kilometres and available tonne-kilometres increased substantially. This was mainly due to a restructuring of the Qantas fleet involving the replacement of the older and smaller B707s with larger B747s. A decrease in the rate of growth or negative growth can be detected for the years 1981 and 1983 for all variables.



Source Department of Aviation (1986).

Figure 4.12 Selected measures of Qantas' supply: all services, 1972 to 1986

The average annual growth rates of selected supply variables for the period 1972 to 1986 are shown in Table 4.6. Table 3.2 enables a comparison to be made between Australia and the world market. The rate of increase in aircraft-hours and aircraft-kilometres experienced by Qantas was less than that experienced in the total world market, although the Qantas growth in seat-kilometres and tonne-kilometres available was slightly higher than that of the total world market.

Average seats per plane increased rapidly to 1980 with the introduction of the 'Jumbo' then declined steadily to 1986 with the increasing importance of freight and the use of smaller jets on the shorter routes. The average number of seats per aircraft for Qantas in 1986 was 347 which is considerably higher than for the world average, 226.

Table 4.7 identifies some of the changes that have occurred to the Qantas fleet since 1973. A change from the B707 aircraft to the larger, per unit more efficient B747 aircraft is evident. The variety of B747 aircraft employed has increased through the period, and in 1985-86 Qantas introduced six new B767-200ER aircraft to their fleet. The availability of a variety of aircraft makes it easier to employ the most efficient size, type and configurations on each route.

TABLE 4.6 SELECTED SUPPLY VARIABLES: QANTAS SCHEDULED SERVICES, 1972 AND 1986

Variable	*1972*	*1986*	*Average annual growth (per cent)*
Aircraft departures[a] ('000s)	7 504	11 987	3.4
Aircraft hours flown (number)	79 022	111 138	2.5
Aircraft-kilometres ('000s)	58 779	87 001	2.8
Average available seats per aircraft (number)	175	347	5.0
Average available payload (tonnes)	23	45.5	5.0
Seat-kilometres available ('000)	10 288	30 152	8.0
Tonne-kilometres available (millions)	1 355	3 957	8.0

a. Arriving or leaving Australia only.

Source Department of Aviation (1986).

The average load factor for the 11 years to 1985 on Qantas services varied between 60 per cent in 1977 and 69 per cent in 1980. Average load factors for Qantas and all international services into and out of Australia between 1981 and 1985 are presented in Table 4.8. This shows that load factors are higher on inbound than outbound flights, and that Qantas load factors have been below the Australian average for both inbound and outbound flights since 1982. However it should be noted that these data are obtained from airlines and relate to the number of passengers who pay more than 25 per cent of the standard fare. Not all airlines report data based strictly on the 25 per cent criterion and this may affect comparison of load factors between Qantas and all airlines.

Table 4.9 presents some key summary statistics of Qantas operations in 1975, 1980 and 1985, providing a general indication of trends within Australia's international airline. Fuel and particularly advertising, have been responsible for significantly increased proportions of the total annual expenditure by Qantas. The increased advertising expenditure reflects the more aggressive marketing strategy introduced over the past 10 years, particularly in encouraging overseas residents to travel to Australia.

TABLE 4.7 THE QANTAS AIRLINE FLEET, 1973, 1976, 1980 AND 1984

Year	*Aircraft type*	*Number*	*Seating capacity*
1973	B747-238B	6	365
	B707-338C	18	162
	DC4[a]	2	64
1976	B747-238B	12	366/398
	B707-338C	10	117/137
	DC4[a]	2	58/64
1980	B747-238B	18	422
	B747M	3	265
1984	B747-238B	17	402/433
	B747-338	1	413
	B747SP-38	2	216/302
	B747M	3	253

a. Used for domestic services, Sydney-Norfolk Island.

Sources Department of Aviation (1987). Department of Transport (1974).

TABLE 4.8 AUSTRALIAN LOAD FACTORS, PASSENGERS CARRIED PER 100 SEATS AVAILABLE, 1981 TO 1985

	Australian International		*Qantas*	
Year	*Inbound*	*Outbound*	*Inbound*	*Outbound*
1981	66.5	62.8	68.6	62.8
1982	64.4	61.2	64.4	60.9
1983	61.7	60.4	60.3	59.3
1984	65.9	64.5	65.2	62.9
1985	69.0	66.6	66.7	63.1

Sources Department of Aviation (1986).

TABLE 4.9 KEY QANTAS STATISTICS: 1975, 1980 AND 1985

	Year		
Statistic	*1975*	*1980*	*1985*
Financial statistics ('000 of 1980-81 dollars)			
Paid up capital	107 782	76 585	102 518
Fixed assets	611 741	677 878	836 454
Aircraft (depreciated value)	360 281	377 232	504 325
Operating profit (after tax)	-12 062	-19 981	2 671
Expenditure			
Manpower	247 722	311 079	310 104
Fuel	116 807	286 132	290 738
Advertising	17 888	135 137	216 190
Other	430 591	354 900	479 486
Total	813 008	1 087 248	1 296 518
Total revenue	789 264	1 045 360	1 327 062
Revenue per employee	60	77	106
Yield per revenue tonne-kilometre (cents)	55.2	51.2	49.5
Operating statistics			
Available seat-kilometres ('000)	17 532 660	23 618 314	28 641 271
Passenger-kilometres ('000)	10 695 686	15 287 213	17 613 012
Available tonne-kilometres/employee	168 505	218 991	299 594
Employees (average)	13 230	13 500	12 501

Source Qantas (1986).

The average number of Qantas employees has fallen slightly, while available seat-kilometres and available tonne-kilometres have increased significantly. The combined effect has been that tonne-kilometres available per employee have almost doubled, with revenue per employee also increasing substantially. This is a direct result of the adoption by Qantas between 1975 and 1985 of new technology

which reduced the labour requirements per seat-kilometre or tonne-kilometre available.

Between 1975 and 1985 average yield per revenue tonne-kilometre declined in terms of 1980-81 dollars from 55.2 cents to 49.5 cents. This indicates that fares and freight charges on average declined in comparison to other prices in Australia.

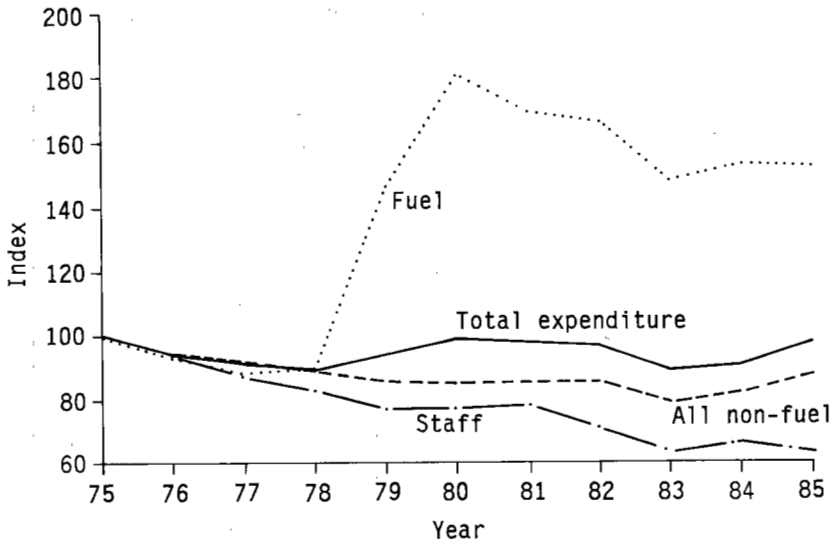
Qantas expenses in 1980-81 prices increased by 59 per cent between 1975 and 1985. This represents a more rapid increase in total expenditure by Qantas then by world scheduled airlines as a whole. Expenditure on fuel and oil increased by 149 per cent with staffing expenses changing by almost 3 per cent. Fuel's share of total expenses varied from around 14 per cent in 1975, rose to just over 26 per cent in 1980 and then declined to almost 22 per cent in 1985.

Figure 4.13 identifies the trends in Qantas expenditure per available seat-kilometre between 1975 and 1985. It shows that real costs per unit declined steadily from 1975 to 1978, rose sharply between 1978 and 1980 with the rapid increase in fuel expenditure per available seat-kilometre, then declined until 1983. The increase in 1984 and 1985 was due to the adoption costs of new aircraft. Over the period 1975 to 1985 total real expenditure per available seat-kilometre declined by 2 per cent, real expenditure on employees per seat-kilometre declined by 37 per cent, while fuel expenditure per seat-kilometre increased by 52 per cent.

The relative efficiency of Qantas' operations in comparision to those of other international airlines is difficult to determine with a high degree of accuracy. The work of Forsyth, Hill and Trengrove (1986) put the efficiency of Qantas among the lower group of the seventeen airlines studied. In general large USA airlines were ranked highly. However the methodology excluded several aspects of service quality (such as standard of in-flight catering, punctuality and extent of sales network) which were difficult to allow for quantitatively and so tended to rank lower those airlines which pitch their product at the upper end of the market. The 'no frills' operators, People Express, ranked first in this study.

THE FUTURE

The new technology that is expected to be adopted over the next decade should have the dual effects of improved per unit efficiency and increased flexibility in the size and type of aircraft used to provide the various services. The result of this increased flexibility would be higher load factors and therefore reduced cost per revenue seat-kilometre or revenue tonne-kilometre.



Sources Qantas (1986). Australian Bureau of Statistics (1986).

Figure 4.13 Indexes of real expenditure per available seat-kilometre: Qantas, 1975 to 1985

It is likely that this decline in the cost of providing international air services over the period to the end of the century should also result in declining real air fares due to the competitive international aviation environment. This decline in air fares is likely to be slower than over the past 10 years because the improvements in per unit efficiency in the near future are not expected to be as dramatic. As discussed previously, Boeing has forecast that world airline yields will decline in real terms between 1986 and 2000 at an average rate of 1.3 per cent per annum.

The large increase in passenger numbers flying to and from Australia which has occurred over the past 10 years has been mainly catered for with the introduction of larger aircraft. The number of flights remained much the same from 1975 to 1985. As it appears likely that average aircraft size will not increase and may well decrease over the next decade, any increase in demand experienced in the future will require an increase in the number of flights to and from Australia. This increase in international flights is a change from recent experience and has implications for Australia's international airports.

CHAPTER 5 QUANTITATIVE ASSESSMENT OF FACTORS AFFECTING DEMAND

This chapter provides a quantitative analysis of the factors which affect past and current demand for international air services to and from Australia using econometric modelling. To the extent that these factors can be measured and their future level predicted, it is possible to estimate the future demand for international air services. Forecasts of demand are presented in Chapter 6. Appendix II defines technical econometric terms. Appendix III provides details of the system of share equations outlined later in this chapter. Detailed results of the econometric models are reported in Appendix IV.

International airlines cater for two broad markets; leisure travel and business travel. The business market is defined as those passengers travelling for the purposes of business, employment or attending conventions and comprises about 16 per cent of total passenger movements on scheduled international airline services.[1] Non-business travel is defined as the remainder of passenger movements.

Inbound passengers are defined as arrivals of overseas residents in Australia and outbound passengers as departures of Australian residents for overseas. Inbound and outbound passengers were modelled separately. All data on passenger numbers are taken from the ABS bulletins: Overseas Arrivals and Departures, published quarterly.

Demand analysis was conducted for five separate regions: Europe, New Zealand, North America, Japan, and Asia (excluding Japan). In the cases of Europe, North America and Asia it was assumed that each of the countries within the region had similar characteristics in terms of distance from Australia and the effect of economic variables on

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1. This proportion is based on total passenger numbers over the period 1976 to 1986. ABS data on overseas arrivals and departures, which were used to derive this proportion and are the data source for all passenger numbers in this Chapter, also include travel by sea, but because this is such a small proportion of total passenger movements (half of one per cent in 1986) its effects have been ignored.

passenger numbers. Therefore, some degree of aggregation was considered appropriate.

NON-BUSINESS TRAVEL VARIABLES

The demand for international air services by non-business travellers is influenced by a number of quantitative and qualitative factors. These factors include:

- income;
- fares;
- relative prices; and
- qualitative factors such as tastes and preferences, level of service, threat of terrorism, political unrest and natural disasters.

Income

Constant price gross domestic product was used as the measure of income. For the non-business segment of the market, it would be expected that the real income level in the country of residence is positively correlated with the demand for international air services.

Fares

Data on fares were supplied to the Bureau in confidence by Qantas, and covered average fare in Australian dollars by fare type for passengers travelling to and from Australia, dissected by country. Fares were measured as a weighted average of the full economy and special fares as most leisure travel is done on these fare types. Fares, being a major determinant in the total price of overseas travel, are expected to be inversely related to the demand for travel.

Relative prices

The Australian leisure traveller is faced with a number of decisions when contemplating overseas travel. The first decision is whether to have a holiday overseas or to consume alternative goods and services which may include a holiday in Australia.

Relative prices were defined in Chapter 4 as:

$$R = X.\frac{AP}{OP} \qquad (5.1)$$

where

X is the exchange rate (the amount of foreign currency that equates to $A1)

AP is the Australian consumer price index
OP is the overseas country consumer price index.

The expectation from the discussion in Chapter 4 is that the relative price between goods and services in Australia and in the chosen destination should be positively correlated with the demand for travel from Australia to that country. However, there should be an inverse correlation with the relative prices of alternative destinations. The relative price variable for travel by overseas residents to Australia would be expected to have the opposite sign to those observed for Australians travelling overseas.

Qualitative factors

As previously noted, factors such as tastes and preferences, level of service, threat of terrorism, political unrest and natural disasters, will influence the demand for travel to various destinations. The lack of any statistical data on the precise impact of these elements of demand unfortunately precludes their use as explanatory variables in a quantitative analysis. However, their effect should not be totally ignored. For example, the threat of terrorism has reduced the attractiveness of Europe as a destination. This has probably had a direct effect on the outward bound Australian traveller and perhaps indirectly benefits the Australian tourism industry by increasing Australia's attractiveness as a destination.

BUSINESS TRAVEL VARIABLES

The explanatory variables used in the estimation of the demand for business travel were relative prices (effective exchange rate), income and fares.

Effective exchange rate

The approach taken to the estimation of the demand for business travel was based on the assumption that it is not actual trade that generates demand, but potential trade. This implies that the actual volume of trade between two countries should not be used as an explanatory variable because trade would normally occur after the business traveller has set up potential markets.

It was hypothesised that business travel is in response to changes in Australia's effective exchange rate (the exchange rate adjusted for inflation), but that this response will not be immediate. Firms conducting business in international markets must be satisfied that a change in the effective exchange rate will be sustained before restructuring to take account of the new conditions. Consequently, it will not be just the current terms of trade that affect the decision

to travel overseas and to seek potential markets, but also movements in the terms of trade over past periods.

Moreover, the expected sign of the exchange rate variable cannot be determined until the composition of trade between the countries in question has been considered. For example, if trade between Australia and another country is traditionally dominated by imports and most of the business travellers to that country are importers, then a rise in the terms of trade, which make imports relatively more attractive, is likely to increase the demand for business travel. Conversely, should trade between Australia and another country be export dominated, and most business travellers to that country are exporters, then a rise in our terms of trade, which makes exports less attractive, is likely to lead to a fall in the demand for international business travel.

Further, raw trade figures are not necessarily a guide to identifying the type of trade that is generating most international business passenger traffic. A significant amount of Australia's exports are raw materials, or bulk items, such as wool, wheat, coal and minerals. It is contended that bulk items generate significantly less business traffic per dollar value of trade than does trade in other items such as manufactured products. For this reason a better indication of the source of business traffic would be trade in non-bulk items.

Income

Income is expected to be positively correlated with the demand for business travel. The question of whether it is the income of the country of residence or destination (or both) that is important cannot be answered until the form of trade between the countries has been considered. For example, if trade is dominated by imports to Australia then Australian income (GDP) would be expected to be a significant explanator of changes in travel behaviour. If, however, trade was export dominated then the expectation would be that the income of the overseas country will be more important.

Fares

The fare variable used in the analysis was the weighted average of first class, business class and full economy fares. Although fares are still expected to affect the propensity of individuals to travel overseas on business, the elasticity values are likely to be much lower than for leisure travellers. This is due to the fact that while fares are a major proportion of the cost of an overseas holiday they are generally only a small proportion of the total cost of a business venture and hence costs are likely to be absorbed or passed on.

Other factors

Exchange rate, income and fares are by no means the only ones that influence the demand for business travel. Other possible influences are the level of foreign investment, invisibles trade (services) and business confidence. For the sake of simplicity and because of the lack of country specific data on these other factors, the analysis was restricted to the effects of changes in the terms of trade, income and fares.

THE MODELS EMPLOYED

The models used in this study for aggregate demand to and from Australia, and for demand from each region to Australia, are generally based on a single equation double-log relationship. This model did not perform satisfactorily for the analysis of departures of Australian residents to each region, so an alternative model was used based on simultaneously estimating the share of total demand that was going to each region.

The single equation estimates are based on a multiplicative or double-log relationship, which implies that the elasticities are assumed to remain constant over the portion of the demand curve that is estimated. This form was found to be superior to the linear form when the alternatives were tested against each other using the PE test of MacKinnon, White and Davidson (1983) and the J test of Davidson and MacKinnon (1981).

Demand is given by:

$$D = a(\text{FARE})^{\alpha}(\text{INCOME})^{\beta}(\text{RELATIVE PRICE})^{\gamma} \qquad (5.2)$$

or alternatively

$$\ln(D) = a' + \alpha\ln(\text{FARE}) + \beta\ln(\text{INCOME}) + \gamma\ln(\text{RELATIVE PRICE}) \qquad (5.3)$$

where

α, β and γ are the elasticities to be estimated,
a, a' are constants, $a' = \ln(a)$.

Equation 5.3 was estimated using ordinary least squares regression analysis or the Cochrane-Orcutt correction for serial correlation if required.

As discussed earlier, travellers usually decide on a destination and purchase a ticket some time before travelling. For this reason different lags were imposed on relative prices and it was found that a

lag of three quarters of a year produced the most satisfactory results. The fare variable did not suffer from this problem because it was based on data which related the fare actually paid by each traveller to the period in which they flew.

To estimate demand for travel by Australians to each region, single regression equations were found not to be adequate. It was postulated that this was due to travellers switching destinations on the basis of changes in fares and relative prices. For example, a decrease in the fare to New Zealand may cause holiday makers to go to New Zealand rather than, say, Bali. Therefore, changes in the costs of holidays in alternative destinations cause changes in passenger demand to all other regions.

The model used to overcome this problem was based on the Almost Ideal Demand System developed by Deaton and Muellbauer (1980) from the optimisation theory of consumer behaviour. That is, consumers are assumed to maximise their utility subject to constraints on expenditure. A detailed technical discussion of this model can be found in Appendix III.

The basis of the technique is to analyse the share of total expenditure on international air travel that Australians spend on fares in travel to each region. The 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.

The share equations estimated are of the form

$$s_i = \text{EXPENDITURE SHARE}$$

$$= a_i + \sum_{j=1}^{n} \alpha_{ij} \ln(\text{FARE}_j) + \sum_{j=1}^{n} \beta_{ij} \ln(\text{RELATIVE PRICE}_j)$$

$$+ c_i \ln(\text{AVERAGE EXPENDITURE}/I) \qquad (5.4)$$

where I is an index of fares and exchange rates.

AGGREGATE NON-BUSINESS TRAVEL

The estimated elasticities for the total number of Australian residents departing Australia and overseas residents arriving in Australia for non-business purposes is given in Table 5.1. The fare and relative price variables were averaged over the main countries with passenger numbers in each region in 1980 being used as weights. Australian gross domestic product at constant prices was used as a

TABLE 5.1 AGGREGATE DEMAND ELASTICITIES FOR NON-BUSINESS TRAVEL TO AND FROM AUSTRALIA

Direction of travel	*Fares*	*Incomes*	*Relative prices*
Outward	-0.62	1.30	0.21
Inward	-0.57	2.92	-0.65

Source BTCE estimates.

proxy for income in the outward leisure model and OECD gross domestic product was used in the inward leisure model. The estimated elasticities are all statistically significant and of the expected sign.

The inward equation may be expected to show higher fare and relative price elasticities compared to the outward equation. This follows from the fact that the outward elasticities relate to the total propensity of Australians to travel overseas. In contrast, the inward elasticities include the propensity of foreign travellers to choose Australia as a destination over many alternatives.

The number of foreign visitors to Australia is only a small fraction of the total number of foreigners who travel abroad, and so only a small percentage would have to switch destinations to Australia to cause a large increase in the number of visitors. This means that an increase in the attractiveness of Australia as a destination, through lower fares or more favourable exchange rates, has the potential to cause a large increase in numbers. Therefore the elasticities for these variables, are expected to be relatively high.

The fact that a small proportional switch in destination by foreign travellers can cause large changes in the number of visitors to Australia makes the inward equation harder to estimate than the outward equation. The reason for this is that the qualitative factors that are left out of the econometric analysis can cause large variations in the number of overseas arrivals. There are indications, for example, that there has been a shift in taste toward Australia by international holiday makers in response to Australia's much higher overseas profile in recent years, particularly in Japan and America.

The fare elasticities estimated are approximately equal for both the inward and outward equations (-0.57 and -0.62 respectively), while relative price elasticities (0.21 and -0.65) show the expected relative magnitudes. The income elasticity for overseas visitors is much higher than that for Australians departing and may in fact overestimate the true elasticity value. There are two possible reasons for this result: growth of OECD income does not necessarily reflect the differing growth rates of incomes in countries that are sources of visitors to Australia; and, more importantly, the shift in taste toward Australia as a destination seems to have been partly attributed by the regression to changes in the income variable.

OUTWARD NON-BUSINESS TRAVEL BY REGION

The estimated fare elasticities for departures of Australian residents for non-business purposes have been calculated from the coefficients of the expenditure share equations (Equation 5.4) and are given in Table 5.2. The method used to derive demand elasticities with respect to fares does not extend to relative prices (see Appendix III). Relative price elasticities are therefore not reported.

The three most popular destinations for leisure travellers, Europe, Asia and New Zealand, all have similar own-price elasticities (-0.86, -1.08 and -1.09 respectively). The less popular North American market seems to be relatively price elastic (-1.86) indicating that this market may be a source of potential growth if fares decrease.

TABLE 5.2 OWN AND CROSS-PRICE ELASTICITIES FOR TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS DESTINATIONS

	Alternative destination				
Destination	*Europe*	*North America*	*Asia*	*Japan*	*New Zealand*
Europe	-0.86	0.40	0.39	a	0.05
North America	1.36	-1.86	a	0.17	0.33
Asia	1.00	a	-1.08	b	0.13
Japan	a	1.48	b	-0.57	b
New Zealand	0.30	0.62	0.32	b	-1.09

a. Statistically insignificant.
b. Statistically significant but of the wrong sign.

Source BTCE estimates.

The own-fare elasticity for leisure travel to Japan (-0.57) is quite low when compared to that of other regions. An explanation of this low elasticity may be that the fare to Japan represents only a small proportion of the total cost of a holiday due to the relatively high cost of living in that country, reflecting the high value of the Japanese Yen.

The rows of Table 5.2 indicate the response of demand for travel to one region to changes in fares to alternative destinations. For example, if the fare to Asia were to fall by 10 per cent then the elasticity estimates suggest that there would be a 3.9 per cent shift in demand away from travel to Europe. Similarly, the columns of Table 5.2 indicate how a change in the fare to one region will affect demand for travel to other regions. For example, a 10 per cent fall in the fare to Europe would result in a fall in demand of 13.6 per cent to North America, 10 per cent to Asia and 3 per cent to New Zealand.

It may be noted that the gaps in Table 5.2, due to statistically insignificant elasticities, or elasticities of the unexpected sign, are in most cases associated with the Japanese market. This is consistent with the difficulties encountered when estimating inward leisure travel from Japan, which is discussed later.

INWARD NON-BUSINESS TRAVEL BY REGION

As mentioned previously, equations for inward non-business travel by region are difficult to estimate because the number of travellers coming to Australia from other regions, with the exception of New Zealand, represents only a small percentage of total overseas travel undertaken by citizens of those countries. Notwithstanding these problems, the estimated elasticities of the explanatory variables for arrivals of overseas visitors from each region is given in Table 5.3. The demand elasticities in Table 5.3 all have the expected sign with the exception of Japanese and Asian fares, which are statistically insignificant. Only in the case of New Zealand are all the elasticities significant.

There appears to have been a change in tastes on the part of residents of Japan and the United States of America towards travel in Australia. This seems to be the result of better marketing and Australia's generally higher profile in these countries. The changes in tastes appear to have been attributed to the fare variable in the case of North America and to the income variable for Japan. Both of these elasticities may be too high. The income elasticity for Europe also seems higher than may reasonably be expected.

The difficulties in estimating a model of demand for travel to

TABLE 5.3 ESTIMATED DEMAND ELASTICITIES FOR NON-BUSINESS TRAVEL BY OVERSEAS RESIDENTS TO AUSTRALIA

Country of origin	*Fares*	*Incomes*	*Relative prices*
Europe	-0.61	4.09	-0.16[a]
North America	-1.23	1.24[a]	-0.33[a]
New Zealand	-1.33	1.94	-1.47
Japan	0.43[a]	5.57	-0.11[a]
Asia	0.02[a]	1.51	-0.18[a]

a. Not statistically significant.

Source BTCE estimates.

Australia by Japanese holiday makers are consistent with those encountered in previous studies. BTE (1978a) did not find it possible to estimate a satisfactory model, while the BIE (1982) study cited collinearity between income and fares as a possible cause of problems. A factor which may contribute to the difficulties is that instead of demand reacting to changed supply conditions, as is implicitly assumed in deriving these equations, the supply conditions react to demand. For example, a low elasticity value and wrong sign for fares may not mean that travellers are unresponsive to price, but that when an exogenous rise in demand occurs, the airlines increase fares to take advantage of it.

BUSINESS TRAVEL

The outward business equations were estimated using the multiplicative or double-log model

$$\text{DEMAND} = a(\text{FOREIGN COUNTRY INCOME})^{\alpha}(\text{AUSTRALIAN INCOME})^{\beta} \cdot(\text{EFFECTIVE EXCHANGE RATES})^{\gamma}(\text{FARES})^{\delta} \qquad (5.5)$$

where

α, β, γ and δ are parameters (elasticities) to be estimated,
a is a constant.

If the parameters were found to have the wrong sign the variable in question was omitted and the equation re-estimated.

A notable aspect of the results for outward business travel reported in Table 5.4 is the relatively small fare elasticities for Europe (-0.23) and North America (-0.34), which support the theory that business travellers are less sensitive to changes in fares than are leisure travellers. The fare elasticities for the other three regions were not statistically different from zero.

As previously outlined, the effects of changes in the exchange rate are expected to follow the form of a distributed lag. The appropriate timing of the lag was not clear from intuitive reasoning and experiments were conducted with various combinations. The effective exchange rate variable subsequently used was a geometric mean of three consecutive quarterly figures as described below.

$$R' = \sqrt[3]{R_{t-i}R_{t-i-1}R_{t-i-2}} \qquad (5.6)$$

where

t is current period (quarter)
i is the least number of lags.

Effective exchange rate elasticities are reported for three regions; North America (0.71), Japan (0.48) and New Zealand (-0.34). Several

TABLE 5.4 ESTIMATED ELASTICITIES FOR BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS OVERSEAS

Destination	*Own country income*	*Australian income*	*Effective exchange rate*	*Fares*
Europe	a	1.09	a	-0.23
North America	a	3.82	0.71[b]	-0.34
Asia	1.54	a	a	a
Japan	a	2.01	0.48[c]	a
New Zealand	a	2.43	-0.34[c]	a

a. Variable ommitted because it was statistically insignificant.
b. Geometric mean of current, one and two quarter lags.
c. Geometric mean of three, four and five quarter lags.

Source BTCE estimates.

different lags were tried for each equation and at each iteration the sign on the effective exchange rate remained unaltered.

As a result of this process different lags were found to be appropriate for different regions. In the case of North America, current and one and two period lagged exchange rates were used. For both Japan and New Zealand the most appropriated lags were three, four and five periods.

In a previous discussion it was suggested that the sign of the exchange rate elasticity is influenced by the form of trade between two countries. The positive exchange rate elasticity for Japan and North America is consistent with these countries' non-bulk trade, with Australia being dominated by imports. That is, as Australia's exchange rate depreciates (falls), more business travel will disappear as a result of importers making fewer trips overseas, than will be created by more favourable export conditions.

Difficulties were encountered in estimating business equations on an aggregate basis. Problems arise from the fact that in the estimation of individual equations the exchange rate elasticity can change signs from region to region. Therefore, the aggregate exchange rate elasticity has an indeterminate sign. Attempts were made to produce an aggregate model using an aggregate exchange rate variable but the results were considered to be unreliable. Difficulties were also encountered in estimating models for inward business regional travel and no satisfactory results for this category were produced.

CONCLUSION

The results presented in this chapter are reported in detail in Appendix IV. They are consistent with earlier studies (BTE 1978a, BIE 1982) and are considered reliable enough to be used for the demand forecasts reported in Chapter 6.

CHAPTER 6 PROSPECTS FOR TRAFFIC GROWTH

Having examined historical changes in passenger demand, trends in supply of aviation services and having developed models of passenger demand, it is now possible to discuss the prospects for traffic growth in the Australian international aviation industry. This discussion is assisted by the results of a survey of travel agents which was carried out to elicit their ideas on the current and future trends in the industry. The chapter first presents the results of this survey and then quantitative forecasts based on the models presented in Chapter 5.

SURVEY OF TRAVEL AGENTS AND TOUR OPERATORS

A questionnaire was distributed to a selection of travel agents and inbound tour operators in November 1986. The survey was designed to determine the views of the industry on the current state and future prospects of the Australian international air travel market to and from Australia. Detailed results are reported in the BTE Reference Paper 121 (BTE 1987).

For the outbound survey, the Australian Federation of Travel Agents selected a sample of 97 travel agents from around Australia. All 16 members of the Inbound Tour Operators of Australia were surveyed. The response rates were 58 per cent for travel agents and 69 per cent for inbound tour operators.

Australian tourists departing

In their responses to the survey, travel agents indicated that in 1986 Asia (excluding Japan) grew as a market, there was some growth to the Pacific region, North America was either stable or declining, and travel to Europe, Japan and New Zealand declined. The prospects for the market over the next two or three years were:

- North America, the Pacific and Asia (excluding Japan) have the most growth potential;
- the New Zealand market is expected to be either stable or growing;

- travel to Europe is expected to be stable; and
- travel to Japan is likely to decline.

The questionnaire identified a number of factors influencing growth in travel. Respondents were asked to examine changes in these factors and to indicate whether they have encouraged or inhibited growth in travel to different markets. The movements in exchange rates, and the cost of accommodation and travel in overseas countries were thought to have a major inhibiting effect on outbound travel. Decreases in air fares and the level of promotion were thought to have encouraged growth, except to Japan. The majority of respondents thought that changes in air fares were the most important factor to have encouraged growth in travel to Europe, North America, New Zealand and the Pacific. For Asia (excluding Japan), air fares and cheap packages and tours were considered the most important.

A number of travel agents expressed concern about the heavy discounting being experienced in the market. This leads to an increase in uncertainty and lack of consistency in the market. It was suggested that consumers were tending to delay bookings until closer to departure dates, which makes the travel agent's job more difficult. On the other hand, discounts were considered to have been an important factor in inducing people to travel in the depressed market. Individuals travelling to visit friends and relatives have been the main group of people to take advantage of the fare discounts. Stabilization of air fares was regarded by some travel agents as crucial for future expansion of the industry.

The responses indicate that changes in the level of exchange rates have had a dramatic effect on passenger travel. They suggest that unless the Australian dollar appreciates, the industry will not fully recover until passengers have come to accept the depreciated value of the dollar and that this may take two or three years.

Several agents commented on the problems of achieving an appropriate level of service. While on some routes there was overcapacity, others lacked an adequate number of services. There have been restrictions on opening new international air routes, and some complaints were made about the timing of flights. The lack of service was reported to be more noticable from the minor gateways, such as Perth. It was also suggested that Adelaide passengers were disadvantaged if they left Australia from the Eastern States due to the add-on cost of domestic connections.

Overseas visitors arriving

The sample size for the inbound survey was much smaller than for the outbound survey and most respondents did not have experience of all markets. Consequently, there was a much more restricted range of views compared with the outbound survey.

The tour operators indicated that the North American and Japanese markets grew rapidly in 1986, with growth also in the European market. Of the very few responses for Asia, New Zealand and the Pacific, most suggested the markets have grown. The expectations for the next two or three years were:

- travel from North America and Japan will grow rapidly; and
- travel from Europe will continue to grow.

There was almost unanimous agreement that changes in exchange rates encouraged growth from all destinations. The level of promotion was thought to have had a positive effect in encouraging growth from all destinations, particularly for the North American and Japanese markets. Another factor considered important was concerns about passenger safety at alternative destinations, particularly as a result of incidents of terrorism and the Chernobyl nuclear accident.

QUANTITATIVE FORECASTS

Quantitative forecasts of demand for inbound and outbound international air passenger travel were made using the demand equations presented in Chapter 5. This required assumptions to be made about future movements in the various explanatory variables and these are presented below. The forecasts are given with their 95 per cent confidence intervals. These should be interpreted in the following way: if the assumed values for the explanatory variables are correct and if the form of the demand equation is valid and remains unchanged over the forecast period, then there is a 95 per cent chance that the confidence interval contains the actual value. The sensitivity of the forecasts to changes in the assumptions regarding the explanatory variables are given in Appendix V. A discussion of whether the demand equation will remain unchanged over the forecast period is given later in this chapter under the heading 'Implicit Assumptions'.

Forecast assumptions

Gross domestic product

Growth rates for regional gross domestic products were estimated using a combination of historical data and a number of different forecasts

available to the Bureau. Table 6.1 identifies the growth rates employed together with average annual growth rate for the past five years.

Fares

In all models it was assumed that real fares will decline at an average annual rate of 1.3 per cent. Boeing (1987) forecast for world airline yield is 'a continued decline in real terms averaging 1.3 per cent per year through the end of the century'. As discussed in Chapter 4, this seems to be a reasonable expectation for fares to and from Australia.

Relative prices

Changes in the exchange rates and relative inflation rates are very difficult to forecast. For this reason it was assumed that relative prices will remain at the level of the December Quarter 1986.

Seasonal variables

It was assumed that the quarterly seasonal pattern evident over the historical period will continue through the forecast period.

Implicit assumptions

Any econometric forecast assumes that the demand equation is correctly specified and remains unchanged over the forecast period. Demand equations will only be 'correct' provided that any factors that have not been included had no influence on demand during the estimation

TABLE 6.1 AVERAGE ANNUAL RATE OF GROWTH IN REGIONAL GDP
(per cent)

	Actual	*Assumption*
Region	*1981-1986*	*1987-2000*
Europe	1.8	1.8
North America	2.5	2.5
Japan	3.7	3.5
New Zealand	2.5	2.5
Other Asia	3.7	3.5
Australia	2.8	2.5
OECD	2.4	2.5

Sources BTCE estimates. Organisation for Economic Co-operation and Development (1987).

period, or that any effect they had was considered as an irregularity and not attributed to any other variable. Furthermore, the forecasts assume that these factors will not change in the forecast period. There are a number of reasons why various factors have not been included in the demand equations:

- no change in the variable occurred during the estimation period so the effect on demand could not be ascertained;
- it was not possible to quantify the variable (for example the impact of advertising); or
- the data were not available.

The factors that could change and cause inaccuracies in the forecasts include:

- the legal arrangements and bilateral treaties;
- the economic stability of Australia and other countries;
- the threat of terrorism;
- airline capacity being able to satisfy demand;
- the ability of facilities (for example hotels or airports) in Australia to handle the demand; and
- the tastes and preferences of potential travellers in response to changed marketing or advertising strategies or for any other reason.

It is possible that these assumptions may have been violated and the forecasts affected. The tastes of overseas travellers towards travelling to Australia appears to have changed over recent years, the consequences of which are discussed later in this chapter.

Forecast period

In general, a model which identifies only short-term effects cannot be used to forecast long-term movements. As the forecast period increases it becomes more likely that long-term effects, which may not be fully captured in the regression, will have an influence. For example, the number of Australian residents born in each overseas country will have an effect on short-term movements as people travel to visit friends and relatives. These numbers are unlikely to have changed sufficiently over the 11 year estimation period for their affects on demand to be measured, but it is likely that over a long time period they may have a significant effect.

The forecasts presented in this chapter are all based on the regression models presented in Chapter 5. Apart from the expenditure share system of equations, from which no forecasts were derived, all models feature a double log form of equation. With the exogenous variables assumed to increase by the same percentage each year, this form of model produces forecasts which compound by a constant annual percentage. As markets develop it might be expected that some saturation effects will occur, especially in the smaller regional markets such as New Zealand and demand will exhibit lower elasticities with respect to the exogenous variables than was the case in the historical period. These saturation effects were not able to be modelled and were not incorporated into the forecasts. This places another limitation on the models for long term forecasts and should be borne in mind by those using the forecasts.

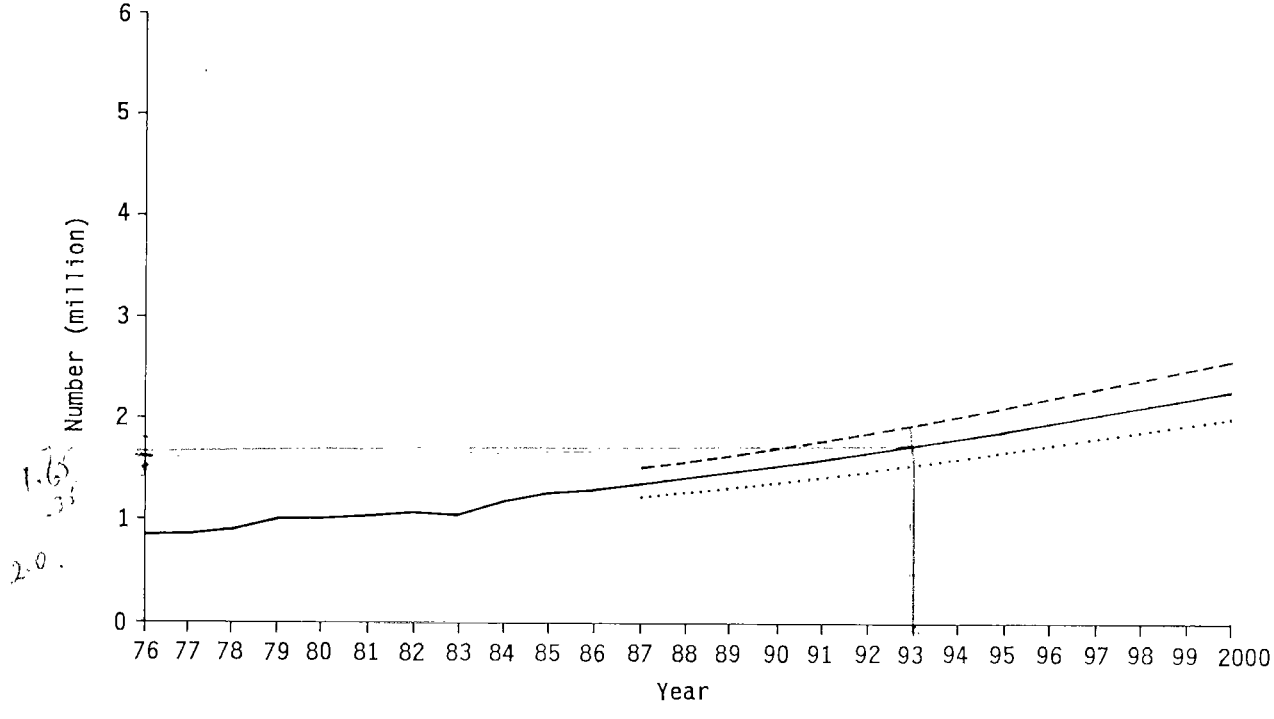
In this Paper, aggregate short-term arrivals and departures for non-business purposes have been forecast to the year 2000, while passenger numbers by region have only been forecast to 1992. Aggregate forecast to 2000 are provided because it was considered that the regression equations were sufficiently reliable and because there is a considerable interest in the estimates for such a long time ahead. Forecasts of arrivals by region are only presented over the shortened time period because the regional equations were judged to be not as reliable as the aggregate equations and regional estimates are more likely to be significantly affected by structural changes.

Non-business forecasts

Aggregate movements

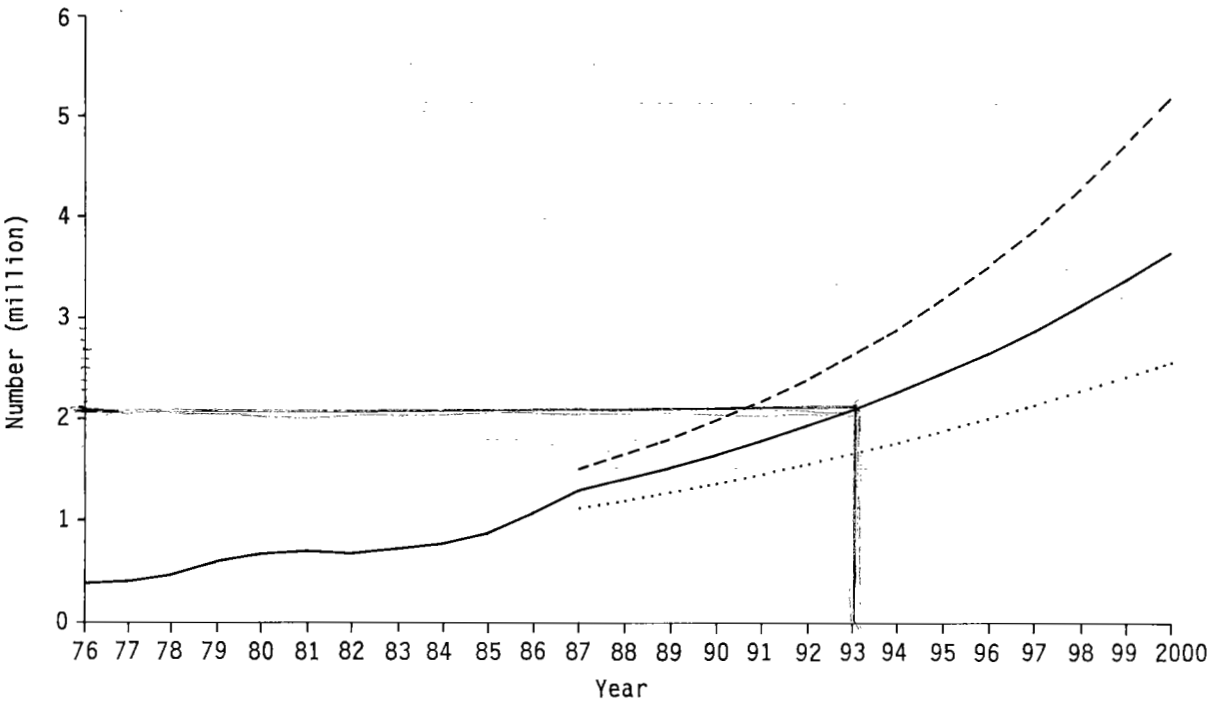
Under the assumptions outlined previously, forecasts were made for aggregate non-business passenger numbers of Australians travelling overseas and overseas residents travelling to Australia using the models presented in Chapter 5. These forecasts, together with their 95 per cent confidence intervals, are presented in Figures 6.1 and 6.2 respectively, while the growth rates are shown in Table 6.2. The average annual growth rate for foreign residents travelling to Australia for non-business purposes is forecast to be 9.1 per cent. This is twice the growth rate forecast for Australians departing, which is expected to remain relatively stable at around 4.2 per cent. In the next few years the number of foreign residents arriving can be expected to exceed the number of Australian residents departing. The forecasts suggest that by the year 2000 there will be a considerable imbalance in favour of the number of foreigners arriving.

The Australian bicentennial celebrations and the Expo in Brisbane during 1988 may well increase the demand for travel to Australia.



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 6.1 Short-term departures of Australian residents: non-business, actual and forecast with 95 per cent confidence limits, 1976 to 2000



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 6.2 Short-term arrivals of overseas residents: non-business, actual and forecast with 95 per cent confidence limits, 1976 to 2000

There could be a sustained effect on passenger numbers if this results in an increase in awareness of Australia as a tourist destination. These effects are not taken into account by the forecast methodology. The forecasts describe the underlying trend and do not show the irregularities in demand that may occur due to special circumstances in any year.

As discussed in Chapter 5, there are indications that there has been a shift in taste towards Australia by international holiday makers. It was argued that the GDP elasticity in the inbound aggregate equation was too high because the regression had attributed some of the change in tastes to changes in GDP. Since OECD GDP is forecast to grow at about the same rate as during the estimation period, it is also assumed that the change in tastes will continue at an unchanged rate.

Arrivals by region

Forecasts of arrivals of overseas visitors for non-business purposes for four of the five regions have been made to 1992 using the regional models presented in Chapter 5, together with the assumptions set out earlier in this chapter. These are presented in Figures 6.3 to 6.6 and in Table 6.3.

Australia is a fairly mature market for both New Zealand and Europe, where Australia has been a popular tourist destination for some time. The average annual growth rates forecast for these markets, with their high proportion of inbound passengers, is close to, but below that for the aggregate forecast. This is a reasonable result because they are fairly stable markets, without the major changes in tastes towards travel to Australia which appear to be occurring in the other regions. Because of likely saturation effects discussed previously, forecasts of arrivals from New Zealand cannot be made too far into the future.

The more volatile markets, and therefore more difficult to forecast, are the Japanese, North American and other Asian markets where Australia is, or may be, a destination of increasing importance. That is, demand is expanding due to changes in consumer tastes in addition to other factors such as exchange rates and increases in disposable income. It is necessary to examine each of these regions individually to determine what has been occurring, why the forecasts are at the level they are, and the likelihood of them being accurate.

Japan

The results of the forecast methodology indicate that the rate of growth of visitors arriving from Japan will remain high at around 20 per cent per year. It is difficult to see the maintenance of such a high rate of growth through to the year 2000 if for no other reason

TABLE 6.2 INTERNATIONAL PASSENGER MOVEMENTS: SHORT–TERM, NON-BUSINESS, AGGREGATE FORECASTS

	Actual			*Forecast*	
	1976	*1986*	*Average annual growth*	*2000*	*Average annual growth*[a]
Region	*('000 passengers)*		*(per cent)*	*('000 passengers)*	*(per cent)*
Foreign residents arriving in Australia	370	1 114	11.7	3 707	9.1
Australian residents departing	849	1 283	4.2	2 301	4.2

a. Average annual growth rates were calculated from the fitted 1986 and 2000 values.

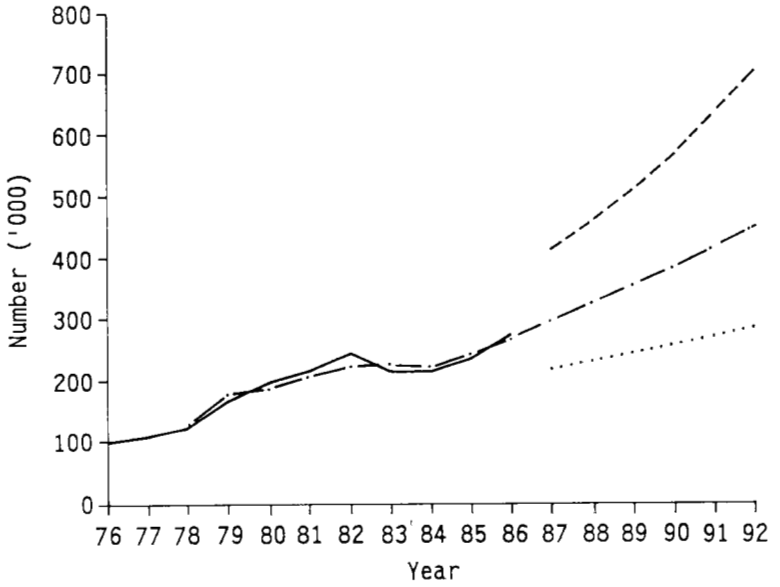
Sources Australian Bureau of Statistics (1987a). BTCE estimates.

TABLE 6.3 ARRIVALS OF OVERSEAS VISITORS: SHORT–TERM, NON-BUSINESS, REGIONAL FORECASTS

	Actual			*Forecast*	
	1976	*1986*	*Average annual growth*	*1992*	*Average annual growth*[a]
Region	*('000 passengers)*		*(per cent)*	*('000 passengers)*	*(per cent)*
Europe	96	278	11.2	455	9.0
New Zealand	99	264	10.3	433	8.7
Japan	15	122	23.3	342	20.4
Other Asia	37	160	15.8	241	8.3

a. Average annual growth rates were calculated from the fitted 1986 and 1992 values.

Sources Australian Bureau of Statistics (1987a). BTCE estimates.



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

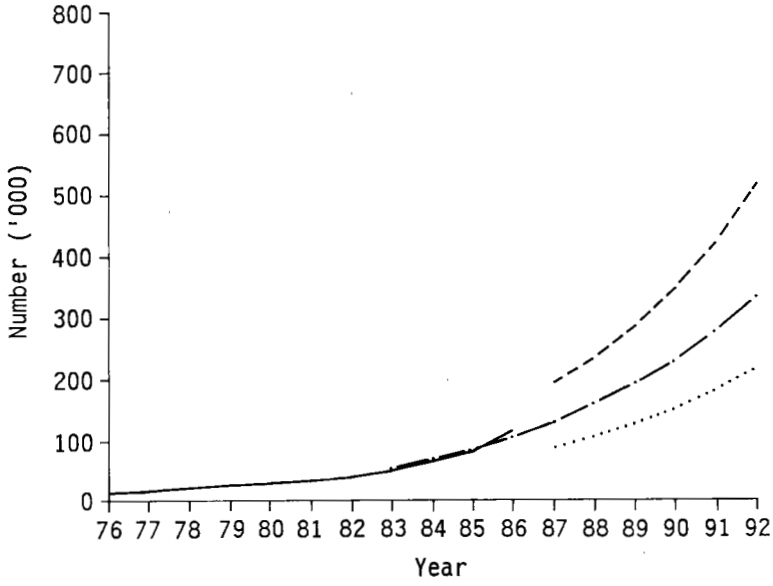
Figure 6.3 Short-term arrivals of European residents: non-business, actual and forecast with 95 per cent confidence limits, 1976 to 1992

than problems with facilities to cope with such a large number of visitors from non-English speaking countries.

Over the past decade Japan has experienced changes in taste favouring travel to Australia and increases in income, both of which have caused demand to expand. The coefficient associated with income has picked up both of these effects. As a result, with a high rate of GDP growth assumed, the growth in demand over the forecast period estimated from the model is also very high. The change in tastes may, and probably will, vary over the period. Demand may be expected to level off from the exponential growth shown in Figure 6.4. However, it is impossible to tell when this may occur and so the number of tourists from Japan in the future is very uncertain.

Other Asia

The Other Asia market is still a small and developing market. It is difficult to tell if or when demand will expand. The forecast growth rate, while fairly low, appears reasonable.



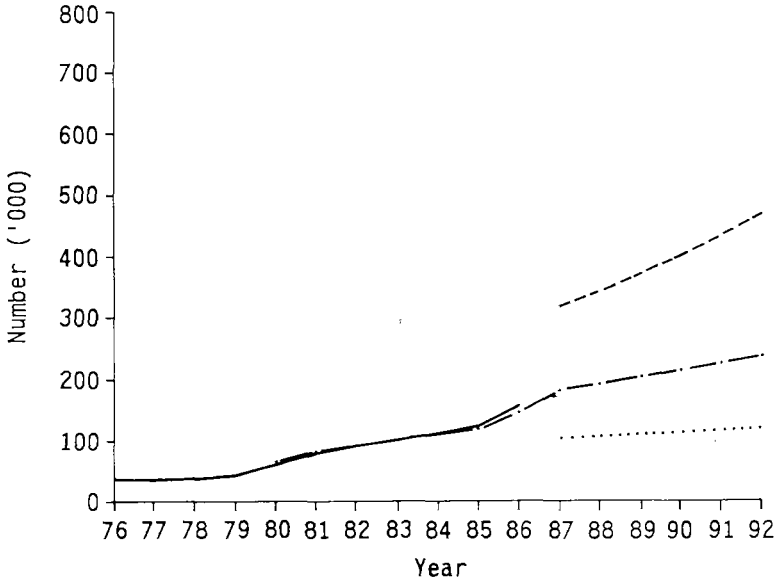
Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 6.4 Short-term arrivals of Japanese residents: non-business, actual and forecast with 95 per cent confidence limits, 1976 to 1992

North America

The demand equations have attributed the majority of the increase in the North American market over the historical period to the decrease in fares. Careful examination of the actual and predicted values, however, indicates that the coefficient on price may have also picked up some of the 'change in tastes' component. This caused forecast passenger numbers to be too low. The decline in air fares in real terms is assumed to be slower than during the estimation period, reducing the growth due to price changes in the forecast period. However, to the extent that change in tastes has been picked up by the price coefficient then the change in tastes has also been assumed to be slower, which may not be the case in practice. The model has not performed well over recent periods. Arrivals of North American tourists were underestimated in 1986 and the strong growth that has occurred in early 1987 was not predicted.

Consumer tastes appear to be changing faster in recent times than, for example, during the 1970s. It would appear that the rapid increase of arrivals in Australia by North American tourists in 1986 was due to



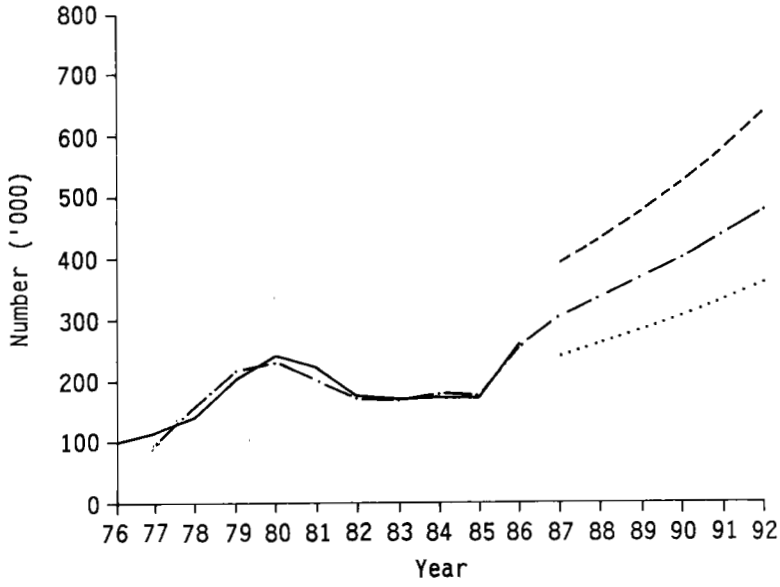
Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 6.5 Short-term arrivals of Asian residents: non-business, actual and forecast with 95 per cent confidence limits, 1976 to 1992

changes in the exchange rate as well as North American consumers' tastes in favour of travelling to Australia changing more rapidly than previously. This increase in the rate of change in consumer tastes could be attributed to several factors including the America's Cup, the film 'Crocodile Dundee' and various advertising campaigns, all of which raised overseas awareness and interest in Australia. The Chernobyl accident and the threat of terrorism decreased the attractiveness of European travel to Americans and some of that demand may have switched to Australia. As these events have occurred only recently and it was not possible to quantify their effects, the forecasts were considered not to be useful and so are not presented.

Australian residents departing by region

The regional outbound non-business demand equations were estimated in the form of a share system of equations. As explained in Chapter 3, this was necessary because travellers switch destinations in response to changes in fares and relative prices in alternative markets. Under the assumption of uniform changes in fares across all regions, the model allows no changes in expenditure shares. Destination switching only occurs when the relative attractiveness of destinations change.



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 6.6 Short-term arrivals of New Zealand residents: non-business, actual and forecast with 95 per cent confidence limits, 1976 to 1992

The elasticities given in Table 4.2 provide an indication of the response to differential changes in prices.

Effects on the Australian tourism industry

The forecasts indicate that the number of tourists visiting Australia will be much greater than the number of Australian tourists leaving. This is a major change in the situation existing over the past 15 years and suggests that international tourism is set to become a net earner of foreign exchange. However, this will depend on Australia's ability to provide the services needed to cope with large numbers of tourists. Possible limiting factors include international air terminal capacity, airport capacity, availability of suitable hotel accommodation and the provision of other leisure resources.

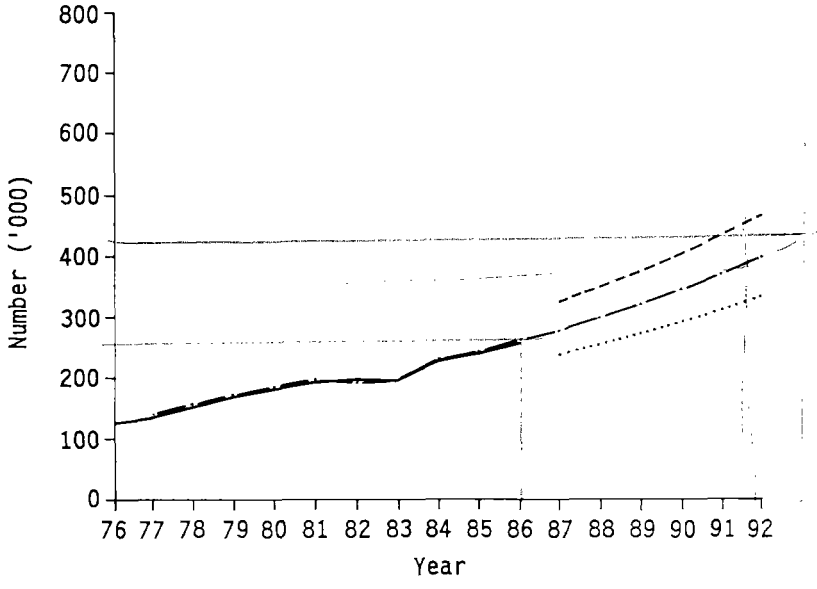
Another important implication of the forecasts is that the proportion of Japanese and Asian tourists in the incoming market will increase. This may result in a different type and level of service being required to satisfy the demands of the market.

It was argued earlier that there has been a change in taste towards travelling to Australia and that the forecasts implicitly assume that this change will continue. Such a trend will depend on Australia maintaining a high international profile and providing the services demanded by international tourists. If the majority of growth is to come from Japan and Asia, as these forecasts show, facilities and tour packages must be tailored for these groups. An awareness of Australia as a tourist destination also needs to be maintained through advertising and other mechanisms such as cultural exchanges.

Business forecasts

The problems in modelling business traffic were explained in Chapter 5. The forecasts are only presented here for completeness and it is stressed that they can only be properly interpreted with an understanding of the problems with the models.

The forecasts for aggregate outbound business travel are shown in Figure 6.7. The average annual growth rate is forecast to decrease from 7.4 per cent for the historical period to 6.6 per cent. This



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

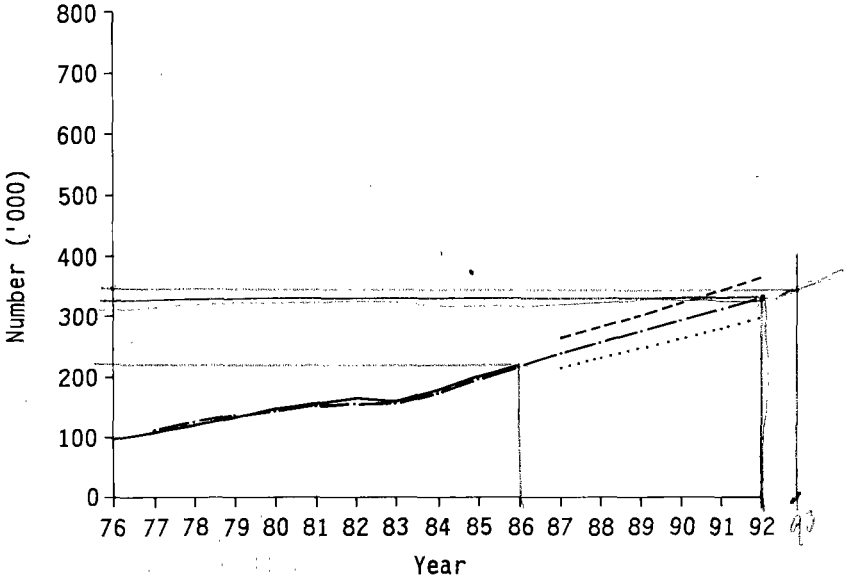
Figure 6.7 Short-term departures of Australian residents: business, actual and forecast with 95 per cent confidence limits, 1976 to 1992

growth is above the 4.2 per cent per annum forecast for outbound leisure traffic.

Forecasts for aggregate inward business are presented in Figure 6.8. Average annual growth is expected to fall from the 8.5 per cent for the historical period to 5.6 per cent, which is less than the 9.1 per cent forecast for inward leisure. Outbound business is forecast to grow faster than inward and remain the larger of the two.

Sensitivity of forecasts to assumption changes

The forecasts presented are all sensitive to some extent to changes in the explicit assumptions associated with fares, GDP and relative prices. An examination of the equations presented in Chapter 5 provides an indication of the sensitivity of each forecast. The larger the absolute value of the coefficient associated with the variable the more sensitive the forecast to changes in the assumptions made about that variable.



Sources BTCE estimates. Australian Bureau of Statistics (1987a).

Figure 6.8 Short-term arrivals of overseas residents: business, actual and forecast with 95 per cent confidence limits, 1976 to 1992

Appendix V provides information about the sensitivity of the forecasts presented to changes in the assumptions for the three variables, GDP, fares and relative prices. The sensitivities of the forecasts to changes in the assumptions vary greatly. What is evident in all cases is that changes in the assumptions, within what could be regarded as reasonable limits, cause significant variations in the predicted growth rate of passenger demand. For example, if Japanese GDP grows at 2.5 per cent per annum instead of the assumed growth of 3.5 per cent per annum, the expected number of Japanese leisure passengers will be 70 per cent of the forecast value in 1992.

On one occasion in the past (BTE 1978b) the Bureau forecast international passenger numbers using linear rather than multiplicative models. In this study multiplicative models were adopted because they provided a better explanation of historical data as was discussed in Chapter 5. The model that best fits the historical data may not necessarily provide the best forecasts, but on this occasion no reason was found to discard the multiplicative model in favour of a linear model. As a matter of interest, the linear model's forecast of aggregate outward demand for the year 2000 is close the the lower 95 per cent confidence interval for the forecasts based on the multiplicative model. For aggregate inward leisure travel, the forecasts based on the linear model are considerably lower than the preferred forecasts.

CHAPTER 7 CONCLUDING REMARKS

The Australian international airline industry has undergone considerable expansion over the past 15 years. In particular there has been a large increase in short-term arrivals of overseas visitors since 1985 in response to the depreciation of the Australian dollar and an increased awareness of Australia as a tourist destination. Forecasts suggest that in the future strong growth in passenger numbers can be expected, especially from foreign visitors. While the rate at which these numbers will grow is difficult to estimate with confidence, the expectation is that it will be slightly slower (in percentage terms) than that experienced over the past 10 years.

The continuation of the growth patterns means that the number of foreign residents arriving in Australia will be greater than the number of Australian residents departing, and the discrepancy will increase as time goes on. The forecasts that predict this senario are based on the movements over the past ten years, so only fairly short-term effects have been modelled. As stated in Chapter 6, passenger numbers by the year 2000 could be affected by more long-term factors which have not been taken into account. In particular there may possibly be some saturation effects in some countries and the growth rates may start to decrease. When these effects will occur, and their likely strength, cannot be predicted from the historical data with the models employed. However, anyone using the forecasts should be aware of the possibilities and exercise due judgement.

The forecasts of short-term arrivals of overseas residents by region are not as reliable as the aggregate forecasts. They are more likely to experience structural changes and the smaller markets are more likely to experience saturation effects. The main conclusion to be drawn from the forecasts is that the proportion of tourists from Japan and Asia is likely to increase. The Australian tourism industry will need to cater for these tourists.

The evidence available about the supply side of international aviation activities suggests that the growth in passenger numbers can be

catered for by the aviation industry, both manufacturers and operators, with the continued development and adoption of new technologies. In order for the growth to be sustained, a substantial increase in the number of flights into Australia will be necessary. This increase in flights will be a departure from recent experience as the large increases in passenger numbers that occurred over the past ten years were mainly catered for with larger aircraft. The number of flights remained much the same. Constraints on total flight numbers in future may come from several sources including the capacity of airports to cope with the combined effects of domestic and international growth, and the capacity of international terminals to cope with the higher level of passenger activity.

Provided that these constraints can be overcome there will also be a need for increased tourist facilities throughout Australia to cope with the expected increase in tourist numbers. In order for the forecast growth to be realised, Australia's international profile as a tourist destination would also have to be maintained or increased. This may require continued or higher levels of advertising, and the increased development of specially tailored travel packages.

It is interesting to note how the increased tourist numbers forecast would benefit Australia, particularly by making a significant contribution to the current account component of the balance of payments. In 1985 foreign tourists spent an average of $A1300 per visitor within Australia (Australian Tourist Commission 1987). This implies that in 1986, foreign visitors spent almost $A2000 million in Australia. Based on the forecast arrivals of overseas visitors, and assuming that the level of expenditure per visitor is maintained, total spending by overseas visitors in Australia will increase, in 1986 dollar terms, to around $A6000 million by the year 2000.

APPENDIX I FREEDOMS OF THE AIR

At the 1944 International Civil Aviation Conference in Chicago, an arrangement called the International Air Transport Agreement was drawn up to exchange commercial aviation rights on a multilateral basis. It was never widely accepted but it did define the five "freedoms of the air", which were subsequently incorporated into a large number of bilateral agreements. They have since become part of the language of international civil aviation.

FIRST FREEDOM

The privilege to fly across the territory of another State without landing.

SECOND FREEDOM

The privilege to land in another State for non-traffic purposes (that is for refuelling, mechanical reasons and so on, but not for putting down or taking on a load.)

THIRD FREEDOM

The privilege to put down in another State revenue passengers, mail and freight taken on in the State of airline/aircraft registration. (An example of third freedom rights is when Qantas discharges in another country passengers originating in Australia.)

FOURTH FREEDOM

The privilege to take on in another State revenue passengers, mail and freight destined for the State of airline/aircraft registration. (An example of fourth freedom rights is when Qantas flies passengers or freight from another country to Australia.)

FIFTH FREEDOM

The privilege for an airline/aircraft registered in one State and en route to or from that State to take on revenue passengers, mail and

freight in a second State and to put them down in a third State. (An example of fifth freedom rights is when Qantas, on a Sydney-London flight, stops at Singapore and takes on passengers bound for London.)

SIXTH FREEDOM

A number of disputes have arisen in interpreting the five freedoms mentioned above and several further uncodified freedoms have arisen, although there is no general agreement regarding their definitions. Only one is referred to in this Paper, the 'sixth freedom'.

Sixth freedom refers to the situation where an airline/aircraft registered in one State takes on revenue passengers, mail and freight in a second State, transports them via the State of registration, and puts them down in a third State. (An example is Singapore Airlines carrying passengers from Australia to London with a stopover in Singapore. The Singapore Government, however, claims it is only an exercise of third and fourth freedom rights.)

APPENDIX II GUIDE TO ECONOMETRIC TERMS

A number of econometric terms are used in the analysis presented in this Paper. Definitions are included to assist readers who are not familiar with these terms, thereby allowing for easier interpretation of the forecasting methodology and results.

The *DEPENDENT VARIABLE* is the variable that the regression equation is being used to estimate.

EXPLANATORY or *INDEPENDENT VARIABLES* are used to explain changes in the dependent variable. In regression equations, the independent variables have associated co-efficients which indicate the effect on the dependent variable of a change in that independent variable.

The *VARIANCE* is a measure of the variation of a set of observations from its mean or average value.

The *CORRELATION* between two variables is a measure of the degree of association between the two variables.

The value of a correlation coefficient varies between -1 and +1. A value near zero means that the variables are uncorrelated. Where the correlation between two variables, X and Y, lies close to -1, these variables are said to have strong negative correlation meaning that if the value of X increases, the value of Y falls. A correlation coefficient close to +1 for X and Y indicates a high positive correlation, meaning that as X increases in value then Y rises.

RESIDUALS are the difference between the regression estimate of the dependant variable and its actual value over the historical period. The classical linear regression model assumes that the error term (residuals) have a mean of zero, are normally distributed with constant variance and that they are not correlated.

AUTOCORRELATION (or Serial Correlation) is said to be present when the residuals (or error terms) from different observations are correlated.

A number of statistics are calculated to test for autocorrelations. These include:

- The *DURBIN WATSON STATISTIC* (DW) which is used to test for first order autocorrelations. DW is distributed between 0 and 4 with a value near 2 indicating no first order autocorrelation.
- *DURBIN's h* statistic which is used to test for first order autocorrelations when the model contains a lag of the dependent variable as an explanatory variable.

The R^2*-STATISTIC* is a measure of the proportion of the total variance of the dependent variable accounted for by changes in the explanatory variable. Therefore it is a measure of the goodness of fit of the estimated regression equation over the historical period. The value of R^2 ranges between zero and one. The closer R^2 is to one, the better the changes in the dependent variable are explained by the regression equation.

An estimated co-efficient is regarded as being statistically *SIGNIFICANT* at the 5 per cent level if the probability that the true value of the coefficient is zero is less than 5 per cent.

A 95 per cent *CONFIDENCE INTERVAL* is the range of values for a particular estimate so that there is a 95 per cent probability that the true value of the estimate lies within this range.

The *t-RATIO* is a measure of the statistical accuracy of the estimated co-efficient. It can be used to formulate a confidence interval for the coefficient and also to test whether the co-efficient is different from zero with a certain degree of confidence.

APPENDIX III THEORETICAL MODEL OF DEMAND SHARE EQUATIONS

This appendix provides technical details on the derivation and usage of the expenditure share equations used to model non-business travel by Australian residents to overseas destinations.

The model is based on the Almost Ideal Demand System developed by Deaton and Muellbauer (1980).

The logarithmic form of the expenditure function of the Deaton and Muellbauer model is:

$$\ln[E(\underline{P},u)] = \alpha_o + \sum_k \alpha_k \ln(P_k) + \tfrac{1}{2} \sum_k \sum_j \gamma_{kj} \ln(P_k)\ln(P_j) + u\beta_o \prod_k P_k^{\beta_k} \qquad \text{(III.1)}$$

where;
E is total expenditure of the representative consumer on the goods in question;
$\underline{P}$ is a vector of prices; and
u is utility.

For the purpose of application to the international aviation market and more particularly, the analysis of the share of expenditure devoted by Australian residents on travel to each overseas destination, a modified model was developed. The modification was based on the assumption that demand is affected by the prices of each good (air fares to each destination) as well as the relative prices (effective exchange rates) between Australia and each destination.

Therefore, for a fixed level of utility an expenditure function of the following form is proposed:

$$\ln[E(\underline{F},\underline{R},u)] = a_o + \sum_i a_i \ln(F_i) + \tfrac{1}{2} \sum_i \sum_j \tilde{\alpha}_{ij} \ln(F_i)\ln(F_j)$$

$$+ \sum_i \psi_i \ln(R_i) + \tfrac{1}{2} \sum_i \sum_j \mu_{ij} \ln(R_i)\ln(R_j)$$

$$+ \sum_i \sum_j \beta_{ij} \ln(F_i)\ln(R_j) + uc_o \prod_i F_i^{\gamma_i} R_i^{\eta_i} \qquad \text{(III.2)}$$

where,
E is the expenditure on air fares by the average consumer;
F_k is the air fare for the *k*th destination;
R_k is the relative prices between Australia and the *k*th destination.

It is postulated that the utility derived from an air trip to the *k*th destination diminishes as Australia's exchange rate depreciates and relative prices fall. For example, if Australia's exchange rate with a country depreciates significantly, a holiday in that country may tend to become impossibly expensive whatever the air fare. In this case very little utility may be gained from an air trip taken for the purpose of holidaying.

In the context of consumer theory, Shephard's lemma states that the (compensated) demand function, τ_i, of the *i*th good is given by:

$$\tau_i = \frac{\partial E}{\partial F_i} \qquad \text{(III.3)}$$

where in the international air passenger case τ_i is the number of trips demanded to the *i*th destination. Shephard's lemma holds in the modified system because it is only the partial derivatives with respect to the price of an air trip that is relevant to the proof.[1] Therefore:

$$\frac{\partial E(F,R,u)}{\partial F_i} = \tau_i(\underline{F},\underline{R},u) \qquad \text{(III.4)}$$

Note also that:

$$\frac{\partial \ln(E)}{\partial \ln(F_i)} = \frac{F_i}{E} \frac{\partial E}{\partial F_i} \qquad \text{(III.5)}$$

and therefore from Shephard's lemma:

$$\frac{\partial \ln(E)}{\partial \ln(F_i)} = \frac{F_i}{E} \tau_i$$

$$= s_i \qquad \text{(III.6)}$$

---

1. This assumes air fares and exchange rates are independent.

where s_i is the share of expenditure on air trips devoted to travel to the ith destination.

From Equations (III.2) and (III.6) we have:

$$s_i = a_i + \sum_j \alpha_{ij} \ln(F_j) + \sum \beta_{ij} \ln(R_j) + u\gamma_i c_o \prod_j F_j^{\gamma_j} R_j^{\eta_j} \qquad \text{(III.7)}$$

where $\alpha_{ij} = \tfrac{1}{2}(\tilde{\alpha}_{ij} + \tilde{\alpha}_{ji})$

Solving III.2 for $uc_o \prod_j F_j^{\gamma_j} R_j^{\eta_j}$ yields:

$$c_o u \prod_j F_j^{\gamma_j} R_j^{\eta_j} = \ln(E) - \ln [I(F,R)] \qquad \text{(III.8)}$$

where $I(\underline{F},\underline{R})$ is a price index defined by

$$\ln[I(\underline{F},\underline{R})] = a_o + \sum_i a_i \ln(F_i) + \tfrac{1}{2} \sum_i \sum_j \tilde{\alpha}_{ij} \ln(F_i)\ln(F_j)$$

$$+ \sum_i \psi_i \ln(R_i) + \tfrac{1}{2} \sum_i \sum_j \mu_{ij} \ln(R_i)\ln(R_j)$$

$$+ \sum_i \sum_j \beta_{ij} \ln(F_i)\ln(R_j) \qquad \text{(III.9)}$$

Deaton and Muellbauer (1980) approximate their corresponding price index (which contains only one vector of prices) by assuming it is proportional to Stone's (1953) index (P^*) where:

$$\log(P^*) = \sum_k s_k \log(P_k) \qquad \text{(III.10)}$$

Following this approach, equation III.9 can be approximated to take account of the vector of relative prices (R) by:[2]

$$\ln(I) = \sum_j s_j \ln(F_j/R_j) \qquad \text{(III.11)}$$

---

2. This is possibly a less accurate approximation than that applied by Deaton and Muellbauer because it assumes a restrictive form of the price index with respect to the variables F_j and R_j.

and so:

$$s_i = a_i + \sum_j \alpha_{ij} \ln(F_j) + \sum_j \beta_{ij} \ln(R_j) + \gamma_i [\ln(E) - \ln(I)] \qquad \text{(III.12)}$$

The expenditure function (Equation III.2) must be homogeneous of degree one in fares, since a doubling of fares, for example, must result in a doubling of expenditure if utility is to be held constant. This means the share functions are homogeneous of degree zero in fares. The share function should also be homogeneous of degree zero in relative prices because a uniform change in relative prices would not be expected to produce a change in expenditure shares. These conditions imply:

$$\sum_i \alpha_{ij} = 0 \quad \text{and} \quad \sum_i \beta_{ij} = 0 \qquad \text{(III.13)}$$

The symmetry property for compensated price (fare) responses states:

$$\alpha_{ij} = \alpha_{ji} \qquad \text{(III.14)}$$

To derive an estimate for the compensated fare elasticity (ϵ_{ij}) of the demand for travel to the *i*th destination with respect to the fare to the *j*th destination, note:

$$\tau_i = s_i \frac{E}{F_i} \qquad \text{(III.15)}$$

therefore

$$\ln(\tau_i) = \ln(s_i) + \ln(E) - \ln(F_i) \qquad \text{(III.16)}$$

and

$$\epsilon ij = \frac{\partial \ln(\tau_i)}{\partial \ln(F_j)} = \frac{\partial \ln(s_i)}{\partial \ln(F_j)} + \frac{\partial \ln(E)}{\partial \ln(F_j)} - \delta_{ij} \qquad \text{(III.17)}$$

where $\delta_{ij} = \begin{cases} 1 \text{ if } i = j \\ 0 \text{ otherwise} \end{cases}$

By Equation III.6 and the identity

$$\frac{\partial \ln(s_i)}{\partial \ln(F_j)} \equiv \frac{1}{s_i} \frac{\partial s_i}{\partial \ln(F_j)} \qquad \text{(III.18)}$$

ϵ_{ij} becomes

$$\epsilon_{ij} = \frac{1}{s_i}\alpha_{ij} + s_j - \delta_{ij} + \frac{\gamma_i\gamma_j[\ln(E) - \ln(I)]}{s_i} \qquad \text{(III.19)}$$

This method, however, does not extend to the case of elasticities with respect to the relative prices (R). The point here is that although

$$\frac{\partial \ln(\tau_i)}{\partial \ln(R_j)} = \frac{\partial \ln(s_i)}{\partial \ln(R_j)} + \frac{\partial \ln(E)}{\partial \ln(R_j)} \qquad \text{(III.20)}$$

the term

$$\frac{\partial \ln(E)}{\partial \ln(R_j)}$$

is not directly related to any of the shares via Shephard's lemma. The expenditure function (Equation III.2) includes parameters, ψ_i and μ_{ij} which do not occur in the system of share equations. Notwithstanding the problems of gathering data on utility, the number of parameters to be estimated in the expenditure function is many more than the number of data points available. Therefore, it is not possible to obtain numerical values of the required parameters in order to estimate relative price elasticities.

APPENDIX IV ECONOMETRIC DEMAND MODELS

This appendix reports full details of the econometric demand models outlined in Chapter 5.

GENERAL MODEL

Except for outward leisure by region (for which details of the model are presented in Appendix III) all equations are based on a multiplicative form:

$$D = e^{a_0}.Q.Y^{\alpha_4}.F^{\alpha_5}.R^{\alpha_6} \qquad \text{(IV.1)}$$

where

D is demand for international air travel
Q is a multiplicative seasonal factor
= e^{α_1} in the first quarter
e^{α_2} in the second quarter
e^{α_3} in the third quarter
1 in the fourth quarter
Y is real income
F is real air fares
R is relative price[1] (or effective exchange rate)
a_0, α_1, α_2, α_3, α_4, α_5, α_6 are parameters to be estimated.

Taking logarithms the model becomes:

$$\ln D = a_0 + \alpha_1 Q_1 + \alpha_2 Q_2 + \alpha_3 Q_3 + \alpha_4 \ln(Y) + \alpha_5 \ln(F) + \alpha_6 \ln(R) \qquad \text{(IV.2)}$$

---

1. Relative prices are defined as

$$R = X.\frac{AP}{OP}$$

where
X is the exchange rate (the amount of foreign currency that equates to $A1)
AP is the Australian consumer price index
OP is the overseas country consumer price index.

where

Q_1 = 1 in the first quarter
0 otherwise

Q_2 = 1 in the second quarter
0 otherwise

Q_3 = 1 in the third quarter
0 otherwise

and all other variables are as defined above.

The logarithmic form of the model was used to produce the reported results.

Three different methods have been employed to estimate the models:

- ordinary least squares;
- Cochrane-Orcutt correction for first order serial correlation; and
- Zellner's estimation technique for seemingly unrelated regressions (S.U.R.E.).

Unless otherwise stated the models were estimated using ordinary least squares.

Tables IV.1 to IV.5 give full details of the models discussed above and on which the elasticities reported in Chapter 5 were based.

OUTWARD LEISURE SHARE EQUATIONS

A model for estimating outward leisure shares based on work by Deaton and Muellbauer (1980) is presented in Appendix III. Applying this model to the five regional destinations[2] yields the system of share equations described below.

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

TABLE IV.1 AGGREGATE DEMAND EQUATION COEFFICIENTS FOR NON-BUSINESS TRAVEL TO AND FROM AUSTRALIA

Direction of travel	*Explanatory variables*								
				Seasonal dummy variables					
	Fares	*Income*[a]	*Relative prices*	*March*	*June*	*September*	*Constant*	$\bar{R}^2$	*Durbin-Watson*
Inward	-0.57	2.92	-0.65	-0.26	-0.50	-0.39	9.66	0.95	b
	(-2.64)	(6.13)	(-2.64)	(-9.12)	(-14.86)	(-14.72)	(-1.93)		
Outward	-0.62	1.30	0.21	-0.22	0.04	0.03	-1.60	0.95	2.10
	(-5.31)	(13.88)	(2.35)	(-13.16)	(2.37)	(1.53)	(-1.39)		

a. OECD GDP was used as a proxy for world income in the inward equation. Australian GDP was used as a proxy for Australian income in the outward equations.
b. Estimated using the Cochrane-Orcutt correction for serial correlation.

Note t-values indicating the statistical significance of the estimates are in brackets.

Source BTCE estimates.

TABLE IV.2 REGIONAL EQUATION COEFFICIENTS[a] FOR NON-BUSINESS TRAVEL BY OVERSEAS RESIDENTS TO AUSTRALIA

	Explanatory variables							
				Seasonal dummy variables				
Country of origin	*Fares*	*Income*	*Relative prices*	*March*	*June*	*September*	*Constant*	$\bar{R}^2$
Europe	-0.61	4.09	-0.16	-0.32	-1.03	-0.76	-47.69	0.96
	(-2.67)	(3.80)	(-0.59)	(-7.77)	(-24.74)	(-22.42)	(-2.86)	
North America	-1.23	1.24	-0.33	-0.12	-0.66	-0.64	3.27	0.94
	(-6.67)	(1.57)	(-1.66)	(-2.34)	(-11.28)	(-12.27)	(0.48)	
Asia	0.02	1.51	-0.18	-0.12	-0.40	-0.44	3.81	0.95
	(0.14)	(2.78)	(-0.41)	(-2.65)	(-8.83)	(-11.75)	(0.94)	
Japan	0.43	5.57	-0.11	-0.07	-0.75	-0.65	-62.09	0.97
	(1.20)	(10.09)	(-0.42)	(-1.44)	(-14.06)	(-14.10)	(-6.44)	
New Zealand	-1.33	1.94	-1.47	-0.31	0.12	0.13	3.55	0.90
	(-6.57)	(6.18)	(-5.81)	(-6.48)	(2.16)	(2.79)	(2.42)	

a. Estimated using Cochrane-Orcutt correction for serial correlation.

Note t-values indicating the statistical significance of the estimates are in brackets.

Source BTCE estimates.

TABLE IV.3 AGGREGATE DEMAND EQUATION COEFFICIENTS[a] FOR BUSINESS TRAVEL TO AND FROM AUSTRALIA

Direction of travel	*Explanatory variables*							
	OECD income	*Australian income*	*Effective[b] exchange rate*	*Seasonal dummy variables*			*Constant*	$\bar{R}^2$
				March	*June*	*September*		
Outward	3.12	0.03	0.16	0.07	0.22	0.17	-18.48	0.98
	(4.96)	(0.05)	(0.14)	(5.42)	(15.36)	(13.95)	(-7.00)	
Inward	1.60	1.21	-0.13	0.06	-0.01	0.01	-15.70	0.94
	(1.71)	(1.73)	(-0.61)	(3.28)	(-0.34)	(0.51)	(-4.35)	

a. Estimated using the Cochrane-Orcutt correction for serial correlation.
b. Geometric mean of one, two and three quarter lags.

Note t-values indicating the statistical significance of the estimates are given in brackets.

Source BTCE estimates.

TABLE IV.4 DEMAND EQUATION COEFFICIENTS[a] FOR BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS REGIONS

	Explanatory variables									
					Seasonal dummy variables					
Destination	*Region income*	*Aust-ralian income*	*Effective exchange rate*	*Fares*	*March*	*June*	*September*	*Constant*	$\bar{R}^2$	*Durbin-Watson*
Europe	1.38	1.09		-0.23	0.15	0.64	0.50	-22.60	0.96	2.04
	(1.99)	(2.80)		(-2.35)	(5.99)	(26.06)	(20.59)	(-3.43)		
North America	0.32	3.82	0.71[b]	-0.34	0.10	0.34	0.27	-36.32	0.91	1.87
	(0.48)	(6.05)	(3.40)	(-2.44)	(3.17)	(11.65)	(9.24)	(-8.60)		
Asia	1.54				0.20	0.11	0.15	1.49	0.86	1.43
	(16.14)				(4.38)	(2.63)	(3.37)	(3.31)		
Japan	1.03	2.01	0.48[c]		-0.18	0.09	-0.11	-28.40	0.87	2.34
	(1.51)	(2.04)	(3.00)		(-3.94)	(2.03)	(-2.52)	(-9.06)		
New Zealand		2.43	-0.34[c]	-0.17	0.08	0.03	0.06	-14.50	0.90	1.79
		(19.11)	(-2.73)	(-0.97)	(3.05)	(1.42)	(2.23)	(-9.55)		

a. Estimated using S.U.R.E.
b. Geometric mean of current, one and two quarter lags.
c. Geometric mean of three, four and five quarter lags.

Note Asymptotic t-values indicating the statistical significance of the estimates are in brackets.

Source BTCE estimates.

TABLE IV.5 DEMAND EQUATION COEFFICIENTS[a] FOR BUSINESS TRAVEL BY OVERSEAS RESIDENTS TO AUSTRALIA

	Explanatory variables								
					Seasonal dummy variables				
Region of origin	*Region income*	*Australian income*	*Effective exchange rate*	*Fares*	*March*	*June*	*September*	*Constant*	$\bar{R}^2$
Europe	1.91	1.67	0.03[b]		0.08	-0.15	-0.17	-36.85	0.90
	(1.35)	(2.10)	(0.22)		(2.42)	(-4.29)	(-5.52)	(-2.63)	
North America		3.33	0.48[c]		0.12	-0.05	0.02	-28.00	0.86
		(5.36)	(1.26)		(3.47)	(-1.34)	(0.69)	(-3.42)	
Asia	1.30	1.41			0.04	-0.01	-0.01	-12.82	0.96
	(7.21)	(3.83)			(1.49)	(-0.24)	(-0.44)	(-4.17)	
Japan	1.25	1.60	-0.26[d]		-0.06	-0.15	-0.11	-22.60	0.89
	(1.98)	(1.76)	(-1.80)		(-1.30)	(-3.51)	(-2.21)	(-7.98)	
New Zealand		1.78	-0.86[b]	-0.56	0.06	0.18	0.18	-4.84	0.84
		(7.35)	(-3.87)	(-2.30)	(2.30)	(5.92)	(6.76)	(-1.68)	

a. Estimated using the Cochrane-Orcutt correction for serial correlation.
b. Geometric mean of current, one and two quarter lags.
c. Geometric mean of one, two and three quarter lags.
d. Geometric mean of three, four and five quarter lags.

Note t-values indicating the statistical significance of the estimates are in brackets.

Source BTCE estimates.

$$s_1 = a_1 + \sum_{j=1}^{5} \alpha_{1j} \ln(F_j) + \sum_{j=1}^{5} \beta_{1j} \ln(R_j) + c_1[\ln(E) - \sum_{j=1}^{5} s_j \ln(F_j/R_j)] + \sum_{k=1}^{3} d_{ik} Q_k \qquad \text{(IV.6)}$$

.
.

$$s_5 = a_5 + \sum_{j=1}^{5} \alpha_{5j} \ln(F_j) + \sum_{j=1}^{5} \beta_{5j} \ln(R_j) + c_5[\ln(E) - \sum_{j=1}^{5} s_j \ln(F_j/R_j)] + \sum_{k=1}^{3} d_{5k} Q_k \qquad \text{(IV.7)}$$

where

s_i is the share of total expenditure on air fares devoted to travel to the *i*th region

F_j is the real air fare to the *j*th region

R_j is the relative prices between Australia and the *j*th region (refer to footnote 1).

Q_j is a quarterly dummy variable equal to one in the *j*th quarter and zero otherwise.

E is the expenditure on air fares by the average consumer.

The above system is singular, so that one equation (Equation IV.7) is dropped for the purpose of estimation.

The coefficients for the equation omitted from the regression can be obtained from the estimated coefficients in the other equations and the summing up restrictions.

$$\sum_{i=1}^{5} a_i = 1 \qquad \text{(IV.8)}$$

$$\sum_{i=1}^{5} \alpha_{ij} = 0 \qquad \text{for } j = 1,....5 \qquad \text{(IV.9)}$$

$$\sum_{i=1}^{5} \beta_{ij} = 0 \qquad \text{for } j = 1,....5 \qquad \text{(IV.10)}$$

$$\sum_{i=1}^{5} c_i = 0 \qquad \text{(IV.11)}$$

The underlying theoretical model of consumer behaviour has been shown in Appendix III to be homogenous of degree zero in fares and relative prices and symmetric in cross-fare responses.

In order to test whether the data supports homogeneity, a general (unrestricted) form of the model was estimated. Homogeneity in fares and relative prices holds in the *i*th equation if:

$$\sum_{j=1}^{5} \alpha_{ij} = 0 \quad \text{and} \quad \sum_{j=1}^{5} \beta_{ij} = 0 \qquad \text{(IV.12)}$$

The results of the tests are given in Table IV.6.

The condition of symmetry in cross-fare responses is supported by the data on the coefficients in the *i*th equation of the model if:

$$\alpha_{ij} = \alpha_{ji}$$

The results of the tests on the symmetry conditions in all equations are given in Table IV.7.

In about one half of the tests, homogeneity and symmetry were rejected. Deaton and Muellbauer (1980) also report rejection of homogeneity in the example they used to test their model and they suggest several possible explanations. However, when the system was

TABLE IV.6 TEST FOR THE EXISTENCE OF HOMOGENEITY IN FARES AND RELATIVE PRICES OF DEMAND SHARE EQUATIONS FOR LEISURE TRAVEL BY AUSTRALIAN RESIDENTS OVERSEAS

	Fares		*Relative prices*	
Equation	*t-ratio for tests*	*Reject/ not reject*[a]	*t-ratio for tests*	*Reject/ not reject*[a]
Europe	-1.835	Not reject	-3.818	Reject
North America	2.137	Reject	0.452	Not reject
Asia	1.806	Not reject	3.626	Reject
Japan	-1.371	Not reject	1.187	Not reject
New Zealand	3.566	Reject	-3.570	Reject

a. Tested at 5 per cent significance level.

Source BTCE estimates.

TABLE IV.7 TEST FOR THE EXISTENCE OF SYMMETRY IN CROSS-FARE RESPONSES IN DEMAND SHARE EQUATIONS FOR NON-BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS OVERSEAS

Test	*t-ratio for test*	*Reject/ not reject*[a]
$\alpha_{12} = \alpha_{21}$	2.494	Reject
$\alpha_{13} = \alpha_{31}$	-0.771	Not reject
$\alpha_{14} = \alpha_{41}$	2.640	Reject
$\alpha_{15} = \alpha_{51}$	-3.543	Reject
$\alpha_{23} = \alpha_{32}$	0.287	Not reject
$\alpha_{24} = \alpha_{42}$	-0.405	Not reject
$\alpha_{25} = \alpha_{52}$	3.420	Reject
$\alpha_{34} = \alpha_{43}$	-2.923	Reject
$\alpha_{35} = \alpha_{53}$	1.127	Not reject
$\alpha_{45} = \alpha_{54}$	0.917	Not reject

a. Tested at the 5 per cent significance level.

Note Homogeneity was imposed on the model.

Source BTCE estimates.

finally estimated, homogeneity and symmetry restrictions were imposed as there are compelling theoretical reasons why they should hold in this model. As shown in Appendix III, homogeneity and symmetry are intrinsic components of the consumer behaviour theory from which the Almost Ideal Demand System was derived.

The results of system estimation using S.U.R.E. are presented in Table IV.8, the equations for each of the five regions being of the form:

$$S_i = a_i + \sum_{j=1}^{5} \alpha_{ij} \ln(F_j) + \sum_{j=1}^{5} \beta_{ij} \ln(R_j) + c_i \ln(m^*)$$

where

$$\ln (m^*) = \ln (E) - \sum_{j=1}^{5} s_i \ln(F_j/R_j)$$

i = 1,.....5 represents the equations for Europe, North America, Asia, Japan and New Zealand respectively.

TABLE IV.8 EXPENDITURE SHARE EQUATION[a] COEFFICIENTS FOR NON-BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS DESTINATIONS

	Region				
	Europe	*North America*	*Asia*	*Japan*	*New Zealand*
Explanatory variables					
F_1 (Europe)	-0.2064	0.1312	0.0976	-0.0024	-0.0199
	(-5.10)	(4.25)	(4.05)	(-0.31)	(-1.62)
F_2 (North America)	0.1312	-0.1602	-0.0335	0.0237	0.0388
	(4.25)	(-4.21)	(-1.85)	(2.97)	(3.32)
F_3 (Asia)	0.0975	-0.0335	-0.0583	-0.0152	0.0094
	(4.05)	(-1.85)	(-3.00)	(-2.63)	(1.30)
F_4 (Japan)	-0.0024	0.0237	-0.0152	0.0074	-0.0135
	(-0.31)	(2.97)	(-2.63)	(1.53)	(-2.86)
F_5 (New Zealand)	-0.0199	0.0388	0.0094	-0.0135	-0.0148
	(-1.62)	(3.32)	(1.30)	(-2.86)	(-1.63)
R_1 (Europe)	-	-0.0043	-0.0346	0.0295	0.0094
	-	(-0.10)	(-0.90)	(3.14)	(0.70)
R_2 (North America)	0.1085	-0.0260	-0.0710	-0.0047	-0.0066
	(3.27)	(-1.04)	(-2.94)	(-0.68)	(-0.66)
R_3 (Asia)	-0.1342	0.0599	0.0956	-0.0168	-0.0045
	(-3.45)	(2.15)	(3.51)	(-2.43)	(-0.39)
R_4 (Japan)	0.0325	-0.0613	-0.0067	0.0165	0.0191
	(1.04)	(-2.32)	(-0.33)	(3.18)	(2.43)
R_5 (New Zealand)	-0.0067	0.0317	0.0168	-0.0244	-0.0173
	(-0.11)	(0.69)	(0.37)	(-2.55)	(-1.23)
m*	0.0364	0.0216	-0.0201	-0.0127	-0.0253
	(0.78)	(0.66)	(-0.61)	(-1.81)	(-2.38)
Seasonal dummy variables					
March	0.0135	-0.0070	-0.0098	-0.0045	0.0078
	(1.73)	(-1.26)	(-1.79)	(-3.87)	(4.58)

TABLE IV.8 (Cont.) EXPENDITURE SHARE EQUATION[a] COEFFICIENTS FOR NON-BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS DESTINATIONS

	Region				
	Europe	*North America*	*Asia*	*Japan*	*New Zealand*
June	0.2026	-0.0196	-0.1108	-0.0049	-0.0674
	(24.42)	(-3.32)	(-18.90)	(-3.70)	(-32.52)
September	0.1631	0.0002	-0.0938	-0.0075	-0.0621
	(19.80)	(0.04)	(-15.98)	(-5.63)	(-29.70)
Constant	0.3359	0.0532	0.3204	0.0568	0.2337
	(1.40)	(0.31)	(1.89)	(1.50)	(3.92)
$\bar{R}^2$	0.92	0.38	0.89	0.55	0.97
Durbin Watson	1.66	1.59	1.69	1.19	2.14

a. Estimated using S.U.R.E.

Note Asymptotic t-values indicating the statistical significance of the estimates are in brackets.

Source BTCE estimates.

TABLE IV.9 PER CENT SHARE OF EXPENDITURE ON AIR FARES FOR TRAVEL TO EACH DESTINATION BY AUSTRALIAN RESIDENTS (AVERAGE 1976 TO 1986)

Destination	*Share (per cent)*
Europe	53.255
North America	15.802
Asia	20.747
Japan	1.790
New Zealand	8.407

Source BTCE estimates.

From the model presented in Table IV.8, and from Table IV.9, own and cross-price elasticities with respect to fares are given by

$$\hat{\epsilon}_{ij} = \frac{1}{\hat{s}_i}\hat{\alpha}_{ij} + \hat{s}_j - \delta_{ij} + \frac{\hat{c}_i\hat{c}_j}{\hat{s}_i}[\ln(E)-\ln(I)] \qquad \text{(IV.22)}$$

where

$\hat{s}_i$ is the estimated share of expenditure on travel to the *i*th region

$\hat{c}_i$ and $\hat{\alpha}_{ij}$ are estimated coefficients

δ_{ij} = 1 if i = j

0 otherwise

The estimated own and cross-price elasticities calculated at the average shares are given in Table IV.10.

TABLE IV.10 CROSS-PRICE ELASTICITIES FOR NON-BUSINESS TRAVEL BY AUSTRALIAN RESIDENTS TO OVERSEAS DESTINATIONS

	Alternative destination				
Destination	*Europe*	*North America*	*Asia*	*Japan*	*New Zealand*
Europe	-0.86	0.40	0.39	0.01	0.05
	(-11.26)	(6.98)	(8.63)	(0.91)	(2.02)
North America	1.36	-1.86	-	0.17	0.33
	(6.98)	(-7.70)	(-0.04)	(3.32)	(4.46)
Asia	1.00	-	-1.07	-0.06	0.13
	(8.63)	(-0.04)	(-11.48)	(-1.99)	(3.69)
Japan	0.40	1.48	-0.64	-0.57	-0.67
	(0.91)	(3.32)	(-1.99)	(-2.09)	(-2.54)
New Zealand	0.30	0.62	0.32	-0.14	-1.09
	(2.02)	(4.46)	(3.69)	(-2.54)	(-10.14)

Note Asymptotic t-values indicating the statistical significance of the estimates are in brackets.

Source BTCE estimates.

APPENDIX V FORECAST SENSITIVITY

This appendix contains information about the sensitivity of the forecasts presented in Chapter 6 to changes in the assumed annual growth rates of the explanatory variables. The tables presented give an indication of the effect on the forecasts for the year 2000 of changes in each of the assumptions. The changes examined are not intended to represent the extremes of possible values for each of the explanatory variables, but are intended to be within the realms of possibility.

The sensitivity of the forecast to a change in the explicit assumptions on the explanatory variables is a reflection of the co-efficient associated with that variable in the regression equations presented in Chapter 3. The larger the absolute value of the co-efficient, the more sensitive the forecast to changes in that variable. An example of this is the sensitivity of the aggregate inbound and aggregate outbound leisure to change in GDP. The outbound traffic appears less sensitive to such changes, which would be expected as the absolute value of the coefficient associated with GDP is lower in the aggregate outbound forecast (1.3) than the aggregate inbound forecast (2.9).

Tables V.1 and V.2 show the sensitivity of the aggregate outbound and inbound forecasts respectively to changes in the growth rate assumptions for the explanatory variables. In both cases, average GDP growth rate over the period has a significant bearing on the level of forecast as does the average rate of change of fares. Relative price is the most volatile of the explanatory variables as it is possible for the magnitude to change by large amounts in either direction. While the changes in relative price given in the tables have only a small affect on the forecasts, the uncertainty associated with the value of the relative price variable is higher than for the other explanators.

Tables V.3, V.4, V.5 and V.6 present the forecast level of non-business traffic to Australia from each of the regions examined in

TABLE V.1 SENSITIVITY OF THE AGGREGATE OUTBOUND NON-BUSINESS FORECAST FOR 2000 TO CHANGES IN THE EXPLICIT ASSUMPTIONS

Assumed growth rates (per cent per annum)			Passenger forecasts		
				95 per cent confidence interval	
GDP	Fares	Relative price	Growth rate (per cent per annum)	Passenger numbers ('000 passengers)	Low	High
1.5		0.0				
	+1.0		1.5	1 589	1 401	1 802
	-1.3		3.0	1 933	1 718	2 175
	-3.0		4.1	2 240	1 949	2 575
2.5						
	+1.0		2.8	1 892	1 645	2 177
	-1.3	1.0	4.5	2 368	2 079	2 697
		0.0	4.3	2 301	2 030	2 609
		-1.0	4.0	2 236	1 973	2 535
	-3.0	0.0	5.4	2 668	2 318	3 070
3.5						
	+1.0		4.1	2 249	1 922	2 631
	-1.3		5.6	2 736	2 385	3 138
	-3.0		6.7	3 171	2 740	3 670

Source BTCE estimates.

this Paper at varying average annual rates of change in the explanatory variables. Changes in fares were not included for both the Japanese and Asian regions as the coefficient on this variable was insignificant and not the expected sign. For the other two regions, changes in the growth rates of both GDP and fares have some effect on the forecast passenger numbers. For New Zealand fares appear relatively more important, while for Japan, Asia and Europe changes in the rate of GDP growth have more effect. Changes in the level of relative prices has an effect in all regions and while these effects do not appear large it should be remembered that relative price is the most volatile of the explanatory variables.

These tables show that changes in the growth rate assumed for the

explanatory variables, even while remaining well within the realms of possibility, have a significant effect on the forecast levels of demand. This indicates that the forecast levels of demand are far from certain and that variations from the assumptions for the explanatory variables will have noticeable effects.

TABLE V.2 SENSITIVITY OF THE AGGREGATE INBOUND NON-BUSINESS FORECAST FOR 2000 TO CHANGES IN THE EXPLICIT ASSUMPTIONS

Assumed growth rates (per cent per annum)			*Passenger forecasts*			
			Growth rate (per cent per annum)	*Passenger numbers*	*95 per cent confidence interval*	
					Low	*High*
GDP	*Fares*	*Relative price*		*('000 passengers)*		
1.5		0.0				
	+1.0		4.6	2 095	1 547	2 838
	-1.3		6.0	2 507	1 962	3 204
	-3.0		7.0	2 871	2 248	3 665
2.5						
	+1.0		7.6	3 098	2 042	4 700
	-1.3	+1.0	8.3	3 394	2 362	4 877
		0.0	9.0	3 707	2 615	5 255
		-1.0	9.7	4 052	2 863	5 735
	-3.0	0.0	10.0	4 245	3 065	5 878
3.5						
	+1.0		10.6	4 564	2 674	7 788
	-1.3		12.0	5 462	3 441	8 670
	-3.0		13.1	6 254	4 079	9 589

Source BTCE estimates.

TABLE V.3 SENSITIVITY OF THE EUROPEAN INBOUND NON-BUSINESS FORECAST FOR 1992 TO CHANGES IN THE EXPLICIT ASSUMPTIONS

Assumed growth rates (per cent per annum)			*Passenger forecasts*			
			Growth rate (per cent per annum)	*Passenger numbers*	*95 per cent confidence interval*	
					Low	*High*
GDP	*Fares*	*Relative price*		*('000 passengers)*		
0.8		0.0				
	+1.0		3.5	334	230	485
	-1.3		4.9	362	252	520
	-3.0		6.0	385	268	552
1.8						
	+1.0		7.6	420	265	667
	-1.3	1.0	8.9	451	288	706
		0.0	9.0	455	291	712
		-1.0	9.2	459	293	721
	-3.0		10.1	484	311	752
2.8						
	+1.0		11.7	527	301	924
	-1.3		13.2	571	331	984
	-3.0		14.4	607	355	1 037

Source BTCE estimates.

TABLE V.4 SENSITIVITY OF THE JAPANESE INBOUND NON-BUSINESS FORECAST FOR 1992 TO CHANGES IN THE EXPLICIT ASSUMPTIONS

Assumed growth rates (per cent per annum)			*Passenger forecasts*			
			Growth rate (per cent per annum)	*Passenger numbers*	*95 per cent confidence interval*	
					Low	*High*
GDP	*Fares*	*Relative price*		*('000 passengers)*		
2.5	-1.3	0.0	14.5	352	168	377
3.5	-1.3	1.0	20.3	339	222	519
		0.0	20.4	342	222	525
		-1.0	20.6	344	222	533
4.5	-1.3	0.0	26.6	462	291	734

Source BTCE estimates.

TABLE V.5 SENSITIVITY OF THE NEW ZEALAND INBOUND NON-BUSINESS FORECAST FOR 1992 TO CHANGES IN THE EXPLICIT ASSUMPTIONS

Assumed growth rates (per cent per annum)			*Passenger forecasts*			
			Growth rate (per cent per annum)	*Passenger numbers*	*95 per cent confidence interval*	
					Low	*High*
GDP	*Fares*	*Relative price*		*('000 passengers)*		
1.5						
	1.0	0.0	3.1	315	247	401
	-1.3		6.7	389	299	506
	-3.0		9.6	456	343	607
2.5						
	1.0		4.9	351	272	452
	-1.3	1.0	7.4	403	306	529
		0.0	8.7	433	330	569
		-1.0	10.0	467	355	613
	-3.0		11.6	509	379	682
3.5	1.0		6.8	390	299	509
	-1.3		10.6	482	363	641
	-3.0		13.6	566	418	767

Source BTCE estimates.

TABLE V.6 SENSITIVITY OF THE OTHER ASIAN INBOUND NON-BUSINESS FORECAST FOR 1992 TO CHANGES IN THE EXPLICIT ASSUMPTIONS

Assumed growth rates (per cent per annum)			*Passenger forecasts*			
			Growth rate (per cent per annum)	*Passenger numbers*	*95 per cent confidence interval*	
					Low	*High*
GDP	*Fares*	*Relative price*		*('000 passengers)*		
2.5		0.0				
	-1.3		6.8	221	118	417
3.5	-1.3					
		1.0	8.1	238	121	467
		0.0	8.3	241	123	472
		-1.0	8.5	243	124	478
4.5						
	-1.3	0.0	9.8	261	128	534

Source BTCE estimates.

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
ATC	Australian Tourist Commission
BTCE	Federal Bureau of Transport and Communications Economics
DofA	Department of Aviation
DoCA	Department of Civil Aviation
DoT	Department of Transport
FUD	Flight Uplift and Discharge
GDP	Gross Domestic Product
HMSO	Her Majesty's Stationery Office
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMF	International Monetary Fund
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
SARPS	Standards and Recommended Practices
SURE	Seemingly Unrelated Regression Estimation
TOD	True Origin and Destination
UK	United Kingdom
UN	United Nations
USA	United States of America
USSR	Union of Soviet Socialist Republics

NOTATION

MATHEMATICAL SYMBOLS

AP	Australian Consumer Price Index
D	Number of passenger travelling to or from given destinations
E	Total expenditure on airfares by the average consumer
F	Air fares to or from a given destination
I	Price index of air fares and relative prices
OP	Overseas country (region) Consumer Price Index
Q	Quarterly seasonal dummy variable
R	Relative prices between Australia and given overseas country [R = X. (AP/OP)]
R'	Three quarter geometric mean of relative prices
s	Share of expenditure devoted on air fares to given region
u	Utility derived from an overseas holiday
X	Exchange rate between Australia and given overseas country (the amount of foreign currency that equates to $A1)
Y	Income (gross domestic product)
ϵ_{ij}	Cross-price (fare) elasticity of demand for travel to the ith region with respect to the jth fare
τ	Derived demand for leisure travel by Australian to a given region

GLOSSARY

Aircraft hours	The cumulative time that each aircraft is in use, calculated usually from the block times
Aircraft-kilometres	The distances flown by an aircraft
Aircraft utilization	The average number of block hours that each aircraft is in use; calculated on a daily or annual basis
Block speed	The average speed for each stage calculated from block time
Block time	The time for each stage between engines being switched on at departure and off on arrival
Business Passengers	Those passengers who state their reason for travelling as attending convention, business or employment on the incoming or outgoing passenger cards required to be completed by all international travellers entering or leaving Australia
Capacity or seat-kilometres available	The number of seats available on a flight multiplied by the stage length
Elasticity (price)	The percentage change in a variable caused by a one per cent change in price

Freedoms of the air	See Appendix I. Privileges accorded by one country to another under bilateral air agreements
Flight Uplift and Discharge (FUD) principle	Where traffic from one State to another is defined by the number of people boarding the aircraft in the first State and disembarking in the second, whether only for a stopover or not, and ignoring the true origin and destination of the passengers
Length of haul	The distance flown by passengers on a journey. The average length of haul is calculated by dividing passenger-kilometres by the number of passengers
Non-Business passengers	Those passengers not describing themselves as travelling for one of the reasons described under business passengers
Normal fares	Fares offered for first class, business class or economy class passengers
Passenger-kilometres	The number of passengers on a flight multiplied by the stage length
Passenger load factor	On a single sector this is the number of passengers flown as a percentage of the number of seats available, on a network of routes it is the total passenger-kilometres as a percentage of the seat-kilometres available
Pre-determination	The method of determining capacity on a route by governments assessing demand and only allowing airlines the capacity thought sufficient
Relative price	The inflation adjustment exchange rate as defined in Equation 3.1

Scheduled air service	An air service performed for the transport of passengers, mail or cargo for renumeration in such a manner that each flight is open to use by members of the public in accordance with a published timetable or with flights so regular that they constitute a recognisable systematic series
Special fares	Fares offered by airlines, not being normal fares. Examples are advance purchase or excursion fares
Stage length	The distance flown by an aircraft on a single flight, usually calculated by the great circle distance between airports
Freight Tonne-kilometres	The number of tonnes of freight carried on a flight multiplied by the stage length
True Origin and Destination (TOD) principle	Where traffic from one State to another is defined as the number of passengers whose initial departure is in the first State and final destination is in the second
Yield	The total passenger revenue divided by the number of passenger-kilometres performed