Modelling air passenger movements through Australia's non-capital city airports

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ABSTRACT

Long-term forecasts of air passenger movements are crucial for planners and investors to attain optimal decisions in the air transport industry. The Bureau of Infrastructure, Transport and Regional Economics (BITRE) has published forecasts of air passenger movements through Australia's capital city airports in recent years. However, forecasts of air passenger movements through Australia's non-capital city airports are lacking at present. This study attempts to develop long-term forecasts of air passenger movements through non-capital city airports by specifying econometric air passenger demand models. The models reinforce the fact that the number of air passenger movements depends largely on population, real incomes, prices of travel and accommodation, and exchange rates.

Forecasts suggest that the number of passenger movements through Australian non-capital city airports will continue to increase over the next twenty years.

1. Introduction

Passenger movements through Australian non-capital city airports have been growing strongly over the last 19 years, largely due to increasing real incomes and decreasing airfares making air travel more affordable. Airfares have become increasingly competitive since 2000, following the introduction of low-cost carriers on Australia's domestic and international routes. The number of air passenger movements through Australia's non-capital city airports has increased by an average 5.4 per cent a year over the last 19 years, from 9.6 million in 1991-92 to 26.2 million in 2010-11 (Figure 1.1). Domestic and international passenger movements increased by 5.4 and 5.2 per cent a year over the same period to 24.8 and 1.3 million, respectively, in 2010-11. Around 481,000 Australian residents and 864,000 overseas visitors passed through all non-capital city airports in 2010-11.

In 2010-11, capital city and non-capital city airports accounted for 80.6 and 19.4 per cent of total air passenger movements through Australian airports respectively. Among total passenger movements through non-capital city airports, 94.9 per cent were domestic movements and 5.1 per cent were international movements (Figure 2). Around 64.2 per cent of international passenger movements were Australian residents and the remaining 35.8 per cent were overseas visitors.

The five largest non-capital city airports in terms of passenger movements are Gold Coast, Cairns, Townsville, Newcastle and Launceston, accounting 20.9, 14.9, 6.2, 4.6 and 4.4 per cent of total air passenger movements through all non-capital city airports respectively, in 2010-11 (Figure 3). Together, these five airports account for approximately 51.0 per cent of all air passenger movements through non-capital city airports.

Figure 1: Air passenger movements through non-capital city airports of Australia, 1985-86 to 2010-11

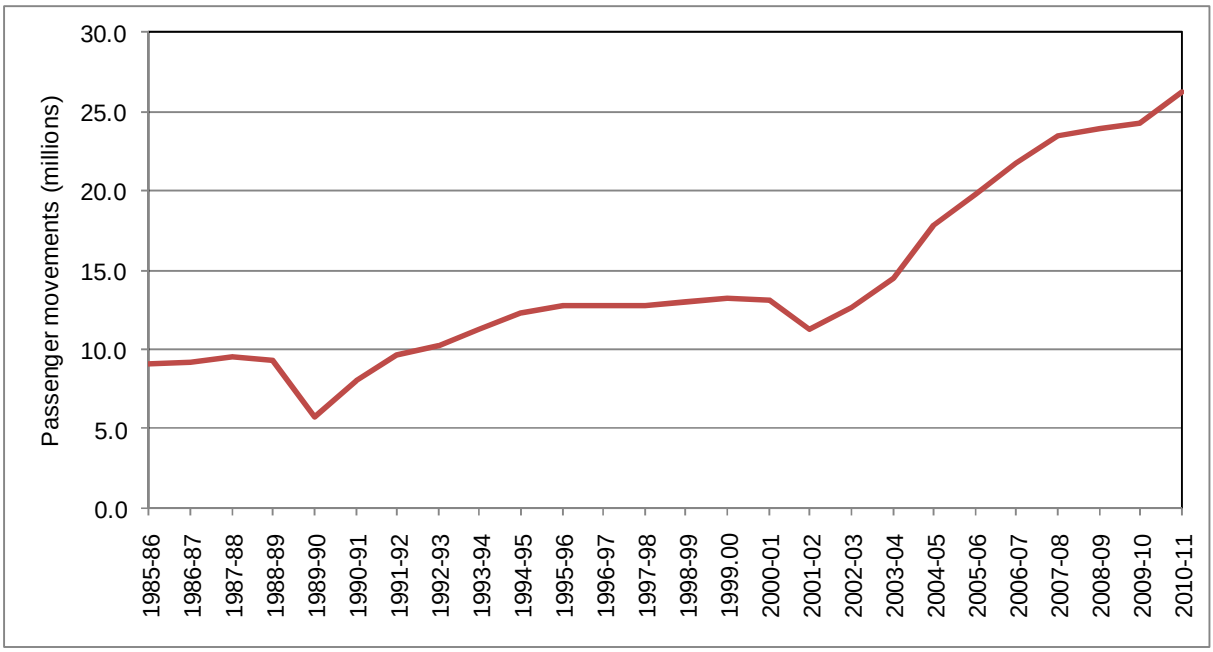
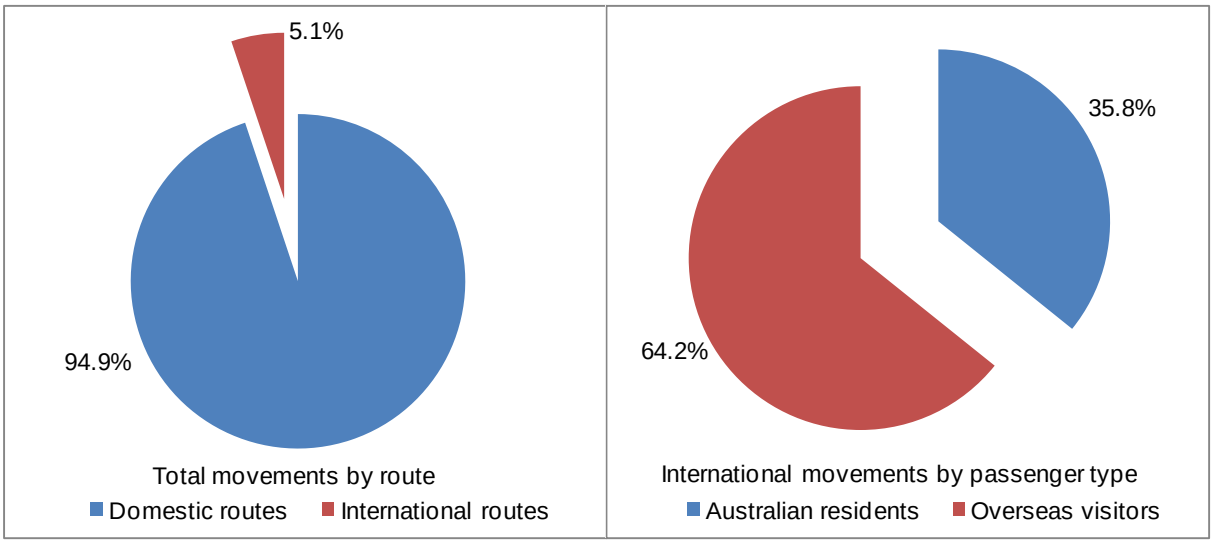
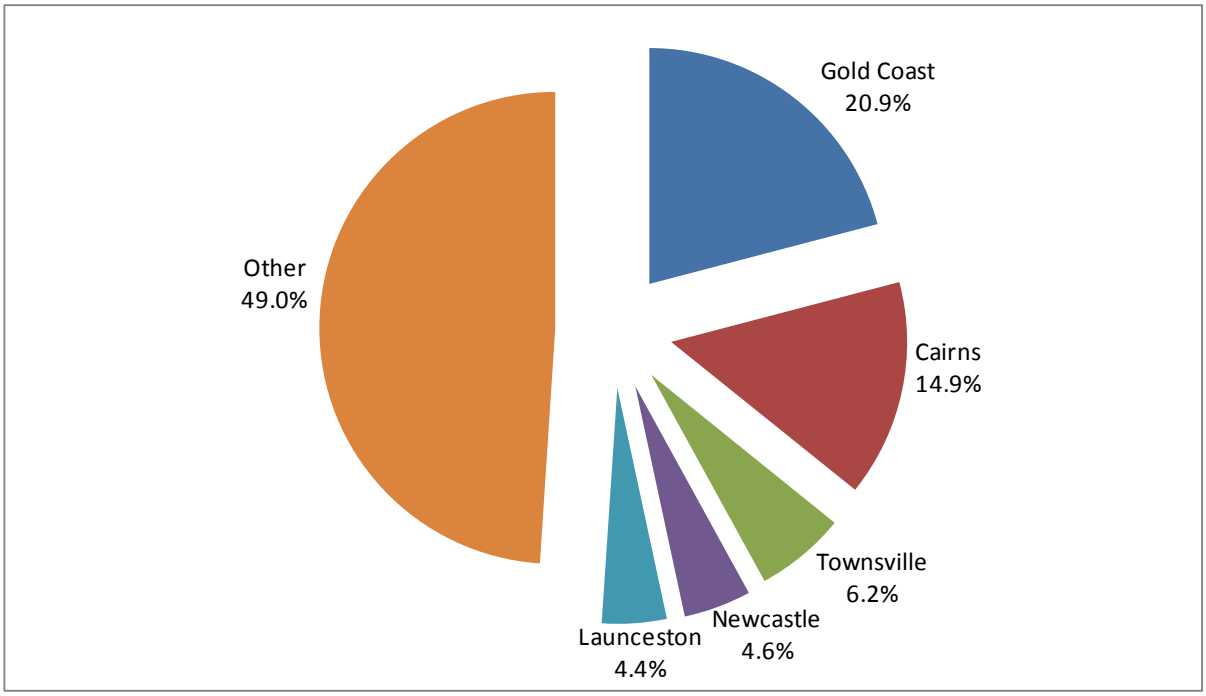


Figure 2: Air passenger movements through non-capital city airports of Australia, 2010-11



Air transport related infrastructure such as airports, aircraft and roads and railways linking airports take a considerable time to develop. Therefore, planning and investment decisions in air transport need to be made on the basis of an understanding of long-term trends in the industry. This means that long-term forecasts of air passenger movements are crucial for planners and investors to attain optimal decisions in the air transport industry. In this study, an attempt has been made to develop econometric demand models of air passenger movements through Australia's non-capital city airports in order to use them to prepare long-term (20 years) forecasts of air passenger movements for non-capital city airports.

Figure 3: Airport shares in passenger movements through non-capital city airports, 2010-11



2. Air passenger demand models

In this study, econometric air passenger demand models have been specified in terms of macroeconomic variables and population. The models depict the underlying relationship between passenger movement numbers and their quantitative driving factors. The models are single equation models and are specified in a double logarithmic linear functional form. They are easy to estimate and provide superior fit. The estimated parameters can be directly interpreted as elasticities. The models have been widely used in many tourism and transport demand forecasting studies, such as Loeb (1982), Witt and Witt (1992), Hamal (1997a, 1997b and 2004) and BITRE (2008 and 2010).

There are three distinct segments of air passenger movements: international movements of Australian residents, international movements of overseas visitors and domestic movements of all passengers. Separate forecasting models were developed for each market segment to account for the influence of different factors in each market segment. For example, real income levels of Australians largely influences international and domestic movements of Australian residents, whereas the real income level of overseas visitors drives the international and domestic movements of overseas visitors to and from Australia and within Australia.

The econometric models include population, income, exchange rates, domestic airfares and the prices of domestic and overseas travel and accommodation. The models were estimated using historical annual data covering the period 1991–92 to 2010-11. The models of Australian residents, overseas visitors and domestic movements through the non-capital city airports are specified in equations 1, 2 and 3 respectively.

A model of international movements of Australian residents is specified in terms of population, real income proxied by real gross domestic product (GDP), the price of overseas travel and accommodation and a dummy variable (see equation 2.1). The model of international movements of overseas visitors is specified in terms of population, real foreign income (proxied by OECD GDP), exchange rates and two dummy variables (see equation 2.2). The model of domestic movements of all passengers is specified in terms of population,

real income (proxied by GDP), real discounted domestic airfares and a dummy variable (see equation 2.3).

$$\ln PCIMAR_{it} = \alpha_{0i} + \alpha_{1i} \ln PCRGDPAU_t + \alpha_{2i} \ln OTAAU_t + \alpha_{3i} DSEP11_t \quad (2.1)$$

$$\ln PCIMOV_{it} = \beta_{0i} + \beta_{1i} \ln PCRGDPOE_t + \beta_{2i} \ln EUSAU_t + \beta_{3i} \ln DSEP11_t + \beta_{4ij} DAA0607 + u_{it} \quad (2.2)$$

$$\ln PCDOPM_{it} = \gamma_{0i} + \gamma_{1i} \ln PCRGDPAU_t + \gamma_{2i} \ln RDDAFAU_t + \gamma_{3ij} DANSETT_t + v_{it} \quad (2.3)$$

where:

- PCIMARi = Per capita international movement of Australian residents through the ith airport in thousands
- PCIMOVi = Per capita international movements of overseas visitors through the ith airport in thousands
- PCDOPMi = Per capita domestic airline passenger movements through the ith airport in thousands
- PCRGDPAU = Per capita real gross domestic product in Australia in billion dollars
- PCRGDPOE = Per capita real gross domestic product (GDP) in OECD countries in billion US dollars
- OTAAU = Relative price of overseas travel and accommodation for Australian residents (that is, the ratio of the price of travel and accommodation in overseas destinations and the price of travel and accommodation in Australia)
- EUSAU = Exchange rates in US dollars per Australian dollar
- RDDAFAU = Real discounted domestic airfares in Australia
- DSEP11 = Dummy variables to capture a large variation in passenger movements due to 9/11 terrorism incident in the USA
- DAA0607 = Dummy variables to capture a large variation in passenger movements due to the collapse of Australian Airlines in June 2006
- DANSETT = Dummy variables to capture a large variation in passenger movements due to the collapse of Ansett Airlines in September 2001
- ε, u and v = error terms
- α's, β's and γ's = regression coefficients.

Since OECD countries account for around 70 per cent of Australia's total overseas visitor arrivals, the population and real income of all OECD countries are used as proxies for the population and real income of overseas visitors to Australia.

Visitor arrivals from China and India have been growing at a significantly higher rate in recent years, implying that these countries will be a growing component of Australia's inbound tourism in near future. However, the influence of their economic growth on air passenger movements through Australian airports has not been directly included in passenger movement forecasts presented in this report as forecasts of visitor arrivals have been developed on aggregate level, not by visitor source market. The influence of Chinese and Indian economic growth on Australia's visitor arrivals is indirectly captured in OECD GDP in the sense that the Chinese and Indian economic growth depends largely on the economic

growth of OECD countries, mainly US, Japan, UK, Germany and Italy. These OECD countries fall within the top ten export destinations of China and India and account for a significant proportion of total exports from China and India.

In above demand models, passenger movements and real GDP are included on a per capita basis, mainly to avoid the consequences of possible collinearity between population and real income. The estimated demand elasticities and the adjusted R-square values of the estimated models, which indicate the goodness of fit of the forecasting models, are presented in Table 1.

Table 1: Estimated demand elasticity and adjusted R-square of air passenger demand models of non-capital city airports

Passenger type	Real income	Own price	Cross price	Relative price	Exchange rate	Adjusted R-square
Australian residents	2.847	-0.618	NS	NS	NS	0.93
Overseas visitors	1.674	NS	NS	NS	-0.214	0.85
Domestic	1.208	-0.327	NS	NS	NS	0.97

NS = Not statistically significant

The adjusted R-square values presented in Table 1 suggest that the estimated models predict historical growth reasonably well, with an adjusted R-square value ranging from 0.85 to 0.97. In other words, these models have good predictive power.

According to the estimated coefficients, the number of international movements of Australian residents is positively influenced by the per capita real income of Australian residents and negatively influenced by the price of overseas travel and accommodation (own-price). Air travel demand is relatively elastic in income (ie. elasticity > 1) across all travel segments. The estimated value of income and price elasticities appears to be reasonable. The estimated elasticity of income indicates that a 1 per cent increase (decrease) in per capita real income level of Australian residents will increase (decrease) the number of international movements by Australian residents by 2.8 per cent. Similarly, a 1 per cent increase (decrease) in the price of overseas travel and accommodation will cause the number of international movements of Australian residents to decrease (increase) by 0.6 per cent.

The estimated coefficients also suggest that the number of international movements of overseas visitors is positively influenced by the per capita real income of visitors, and negatively influenced by the exchange rate, expressed in US dollars per Australian dollar. The estimated income elasticity suggests that a 1 per cent increase (decrease) in the per capita real income of overseas visitors will result in an increase (decrease) in the number of international movements of overseas visitors by 1.7 per cent. Similarly, the estimated elasticity of exchange rate indicate that a 1 per cent decrease (increase) in the value of the Australian dollar relative to the US dollar will increase (decrease) the number of international movements of overseas visitors by 0.2 per cent.

Similarly, the estimated demand elasticities of domestic passenger movements imply that per capita real income of passengers and real discounted domestic airfares (cross price) are the main drivers of domestic passenger movements though Australian airports. Domestic passenger travel demand is more sensitive to changes in per capita incomes than airfares. The model estimates imply a 1 per cent increase (decrease) in the level of per capita real income of domestic air passengers will result in the number of domestic passenger movements increasing (decreasing) by 1.2 per cent; whereas a 1 per cent decrease (increase) in the real discounted domestic air fares will cause the number of domestic airline passenger movements to increase (decrease) by 0.3 per cent.

3. Historical data and future assumptions

The historical data that were used to estimate the passenger movement models were obtained from several different sources. Data on international and domestic air passenger movements, population, GDP, exchange rates, discounted domestic airfare and the prices of domestic and overseas travel and accommodation were sourced from ABS (2011), BITRE (2011), Deloitte Access Economics (2011) and OECD (2011). Long-run assumptions on population and macroeconomic variables that were used in the estimated air passenger movement models to develop the long-run forecasts of passenger movements through non-capital city airports were obtained from Treasury (2010), Deloitte Access Economics (2011) and OECD (2011). Some of these forecast assumptions are available only to 2020-21, and where this is the case, it was assumed that growth in GDP, travel and accommodation prices, exchange rates and real domestic airfares between 2020-21 and 2030-31 would be the same as in 2020-21. The assumptions are summarised in Table 2.

Table 2: Macroeconomic and population assumptions

Variable	1990-91 to 2010-11	**2010-11 to 2030-31**
Annual average growth rates (%)		
Real GDP		
Australia	3.5	**2.9**
OECD	2.2	**2.3**
Domestic price of travel and accommodation	2.6	**2.7**
Overseas price of travel and accommodation	1.6	**2.3**
Population		
Australia	1.4	**1.3**
OECD	0.7	**0.7**
Real domestic airfare	-3.6	**2.7**
Exchange rate (US$/A$)	0.73	**0.81**

*Numbers in bold are forecasts.

Real GDP of Australia and all OECD countries, which grew annually by 3.5 and 2.2 per cent respectively over the last twenty years, are forecast to increase by 2.9 and 2.3 per cent a year respectively over the next twenty years. The higher expected economic growth in Australia and the OECD countries will have a positive influence on Australia's inbound and outbound air freight movements.

The population of Australia and all OECD countries grew by 1.4 and 0.7 per cent per annum respectively in the last twenty years, and are expected to increase at about the same rate over the next twenty years.

The average annual exchange rate for the last twenty years is observed to be US 73 cents per Australian dollar, and despite its current high levels it is expected to be US 81 cents per Australian dollar over the next twenty years.

4. Forecasts

As mentioned earlier, the estimated air passenger movement models and the long-run assumptions on population and macroeconomic variables have been used to forecast air passenger movements through Australian non-capital city airports over the next twenty years.

The total number of passenger movements through all non-capital city airports increased by 5.4 per cent a year over the last 19 years, from 9.6 million in 1991-92 to 26.2 million in 2010-11 (Figure 4 and Table 3). Domestic and international passenger movements increased by 5.4 and 5.2 per cent a year over the same period to 24.8 and 1.3 million, respectively, in 2010-11.

Total passenger movements through all non-capital city airports are projected to grow by 3.2 per cent a year over the next 20 years to 48.8 million in 2030–31. Domestic and international passenger movements are forecast to grow by 3.0 and 5.2 per cent a year over the same period to 45.1 and 3.7 million, respectively, in 2030-31.

The number of international movements of Australian residents and overseas visitors through all non-capital city airports is expected to increase by 5.4 and 5.1 per cent a year over the forecast period to 1.4 and 2.3 million, respectively, in 2030-31.

Figure 4: Air passenger movements through all non-capital city airports

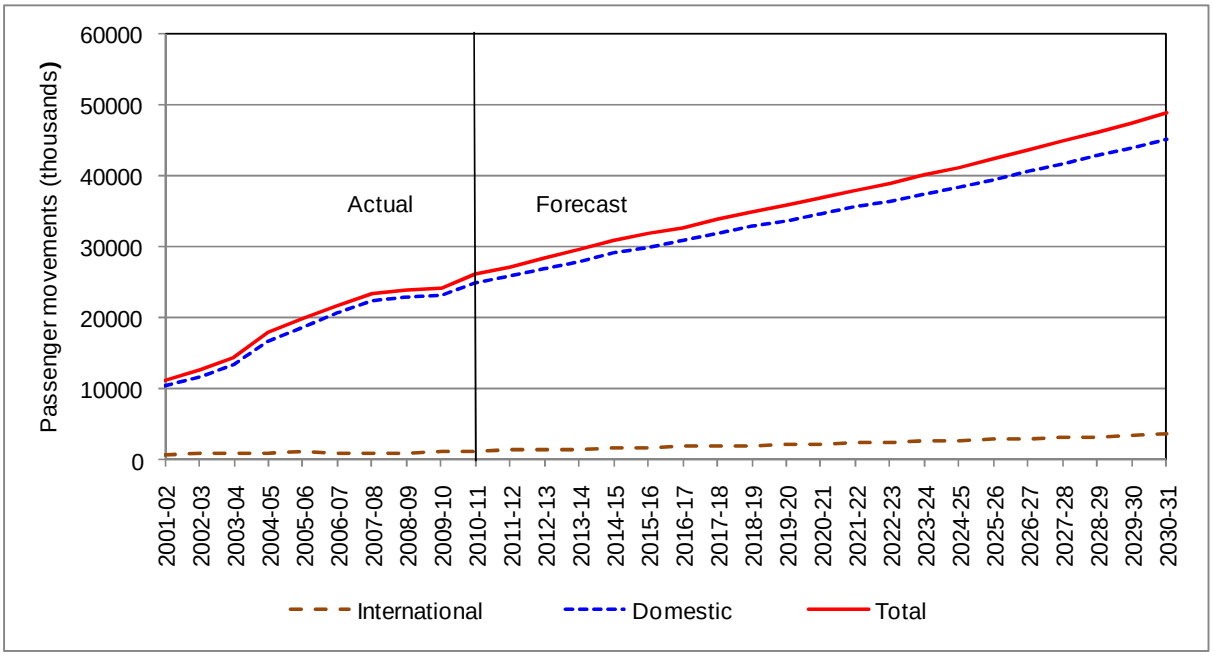


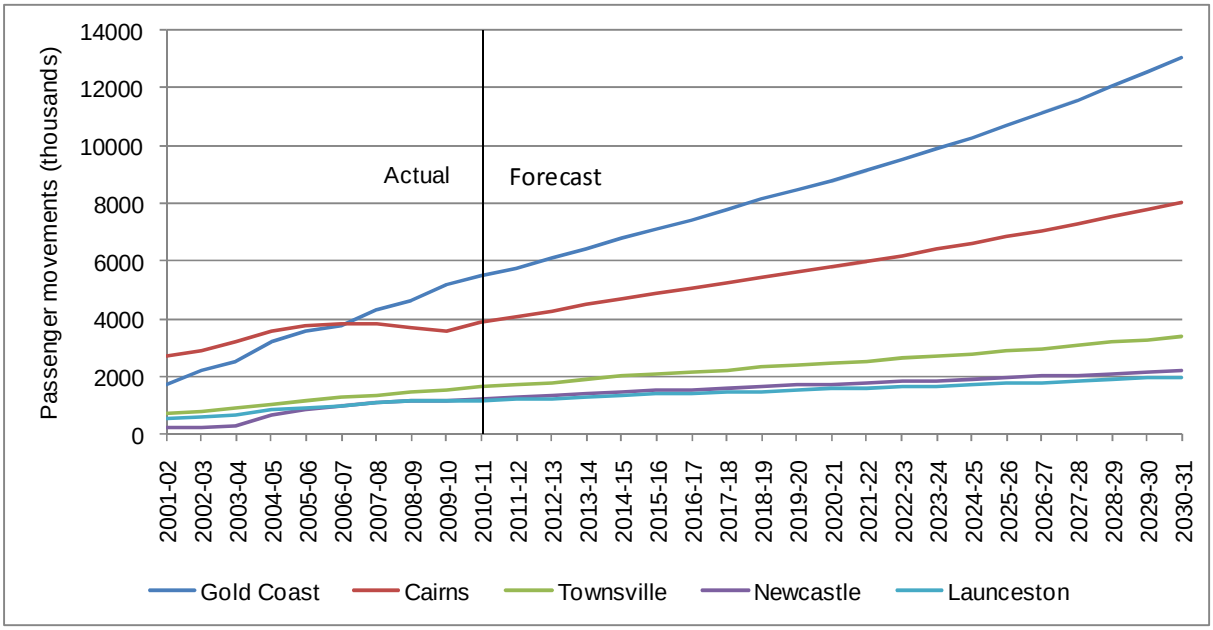
Table 3: Air passenger movements through all non-capital city airports

Year	International			Domestic	Total	Change in total (per cent)
	Australian residents	Overseas visitors	Total			
	(thousands)					
1991-92	100	415	515	9085	9599	
2001-02	103	724	827	10436	11263	1.6
2002-03	114	820	934	11724	12658	12.4
2003-04	126	864	990	13441	14431	14.0
2004-05	143	930	1073	16758	17831	23.6
2005-06	168	952	1120	18711	19831	11.2
2006-07	172	814	987	20710	21697	9.4
2007-08	229	783	1013	22499	23512	8.4
2008-09	315	758	1072	22904	23976	2.0
2009-10	418	788	1206	23068	24274	1.2
2010-11	481	864	1345	24847	26191	7.9
2011-12	**515**	**898**	**1413**	**25808**	**27221**	**3.9**
2012-13	**550**	**941**	**1491**	**26859**	**28350**	**4.1**
2013-14	**587**	**993**	**1579**	**27985**	**29564**	**4.3**
2014-15	**625**	**1046**	**1672**	**29161**	**30832**	**4.3**
2015-16	**658**	**1099**	**1758**	**30025**	**31783**	**3.1**
2016-17	**695**	**1155**	**1850**	**30924**	**32774**	**3.1**
2017-18	**734**	**1215**	**1949**	**31885**	**33834**	**3.2**
2018-19	**776**	**1278**	**2054**	**32869**	**34922**	**3.2**
2019-20	**813**	**1343**	**2156**	**33769**	**35925**	**2.9**
2020-21	**849**	**1411**	**2260**	**34655**	**36915**	**2.8**
2021-22	**888**	**1483**	**2370**	**35567**	**37938**	**2.8**
2022-23	**929**	**1558**	**2487**	**36507**	**38994**	**2.8**
2023-24	**972**	**1637**	**2610**	**37475**	**40085**	**2.8**
2024-25	**1019**	**1721**	**2740**	**38473**	**41213**	**2.8**
2025-26	**1069**	**1809**	**2878**	**39500**	**42378**	**2.8**
2026-27	**1123**	**1901**	**3024**	**40559**	**43583**	**2.8**
2027-28	**1180**	**1999**	**3179**	**41650**	**44828**	**2.9**
2028-29	**1242**	**2101**	**3343**	**42774**	**46117**	**2.9**
2029-30	**1306**	**2209**	**3515**	**43930**	**47445**	**2.9**
2030-31	**1369**	**2323**	**3692**	**45066**	**48757**	**2.8**
Annual average growth rate (per cent):						
1991-92 to 2010-11	8.6	3.9	5.2	5.4	5.4	
2010-11 to 2030-31	**5.4**	**5.1**	**5.2**	**3.0**	**3.2**	

*Numbers in bold are forecasts. Sources: BITRE (2011) and BITRE estimates.

According to BITRE (2012), the total number of air passenger movements through the five largest non-capital city airports is projected to increase by 3.9 per cent a year over the next 20 years, from 13.4 million in 2010-11 to 28.7 million in 2030–31. It will increase annually by 4.4 per cent in Gold Coast, 3.7 per cent in Cairns and Townsville, 3.1 per cent in Newcastle and 2.7 per cent in Launceston (Figure 4).

Figure 5: Air passenger movements through five largest non-capital city airports



6. Conclusions

In this study, econometric demand models of air passenger moments through Australia's non-capital city airports are developed to derive long-term (20 years) forecasts of passenger movements. The models were specified in terms of real income, population, air fares, exchange rates, and prices of domestic and overseas travel and accommodation.

The passenger movement forecasts presented in this report are "unconstrained" forecasts as they are solely driven by demand-side parameters related to population, income, exchange rates and price variables. They do not include the influence of supply-side parameters related to airport capacity and available air route capacity, largely due to the difficulty in estimating these effects in the absence of long time-series data on supply-side variables that influence airport activities, including passenger movements.

Continuing strong growth in passenger movements through the non-capital city airports, especially the five major ones (Gold Coast, Cairns, Townsville, Newcastle and Launceston), over the next 20 years may have significant investment implications for airports in terms of runways, taxiways, aprons, passenger terminals, freight and other general aviation facilities. The passenger forecasts presented in this report will help inform policy makers and airport planners of likely future airport capacity requirements.

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