Pricing and Competition in Australasian Air Travel Markets

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ABSTRACT
The paper analyses more than ten thousand observations on prices charged for air travel on 1001 flights on eight New Zealand and twenty one trans-Tasman flights observed in 2004 and 2005. The main findings are (i) that routes on which Qantas competes with Air New Zealand tend to have air fares around 20% lower than routesserved only by Air NZ; (ii) Emirates and Pacific Blue offer much lower fares across the Tasman, but yet cannot achieve substantial markets share, implying that (iii) these airlines do not offer much competitive constraint on the pricing of the larger carriers, so that (iv) elimination of independent competition between Air NZ and Qantas would be likely to result in air fare increases.

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1. Introduction

This paper analyses new data on airline pricing across twenty nine routes, covering two of the three main Australasian aviation markets: domestic New Zealand, and the trans-Tasman routes that link Australia and NZ. The results document the importance of competition between the two national carriers, Qantas and Air New Zealand, which singly or together hold market shares of eighty percent or more on nearly all of these routes, and they identify the limited competitive role played on some Tasman routes by two other airlines, Pacific (Virgin) Blue and Emirates. There are implications for past, current and future regulatory policy in this and other industries.

Airline markets are important and interesting topics for economic research for a number of reasons. First, aviation is an intrinsically fascinating -- even, glamorous – industry, and one in which most people, including just about every working economist, have a serious personal interest as consumers. Second, the clear division of the product into many distinct submarkets (different city-pair routes), with differing structural characteristics, generates an unusually varied sample of behaviour with which to test our theories of competition in small-number oligopolies.

Third, the nature of that competition has been radically disturbed in recent years by the innovation of a new business model. The established 'legacy' carriers (such as Air New Zealand and Qantas) have been challenged in many markets by 'Low-Cost Carriers' (LCCs) offering no-frills point-to-point service on modern fuel-efficient jets operated by non-unionised workforces. Most of these new airlines have failed, but a few -- notably Southwest Airlines in the U.S., Ryanair and EasyJet in Europe, and Virgin Blue in Australia – have made significant inroads on short- and medium haul routes, and there have been claims that their presence or even just the threat of their presence in a market is a *force majeure* for pricing, trumping the 'old' model of structural competition between established incumbents.

Of course many legacy carriers have responded to the new competitive threat, and to the major recent technological innovation affecting the industry, which is the rise of business-to-consumer (B2C) commerce over the internet. Air New Zealand in particular has been a leader, introducing in November 2002 its internet-based 'Express' fare system, which notably abandoned the price discrimination tool that had dominated the industry since its invention in 1985 by American Airlines: namely, the attempt to partition business and leisure travellers (with their generally different willingness to pay) by the restriction on 'discount' fares that these be return tickets with a Saturday night stay-over. Air New Zealand, quickly followed by Qantas, now only sold one-way tickets, as also did the LCCs, but with the added advantage of greater choice from their breadth and depth of networks; these choices being now readily available to all consumers with access to an internet hook-up. The fares are also readily available to the researcher, and it is from the new internet-based systems that the price database used in this study was assembled.

The particular Australasian routes focussed on here are of special interest for two additional reasons: their relative openness to competition, and their central importance in two major competition policy cases; one of these being still ongoing. Most aviation markets outside of the United States are still highly regulated, either directly by government limitations on who can fly the routes, or indirectly through the allocation of scarce landing slots. In the Australasian region access to landing slots is not a major issue, and the relatively open regulatory stance of the Australian and, especially, New Zealand governments has meant that the extent of competition in these markets has in essence been the result of private sector decisions, and so should be amenable to the application of oligopoly theory.

As for the competition policy dimension, in December 2002 Qantas and Air New Zealand applied to both the Australian Competition and Consumer Commission (ACCC) and the New Zealand Commerce Commission (NZCC) for permission to form what they termed a 'Strategic Alliance' which would have in effect cartelised all routes operated to, from and within New Zealand. This application proceeded to Draft then Final Determination in both countries, being turned down at all stages, and also failed on appeal to the NZ High Court in 2004, which effectively vetoed the proposal. However, the 2004 rehearing before the Australian Competition Tribunal found in favour of the applicants, in essence because the ACT determined that competition from Pacific Blue and the '5th Freedom' carrier Emirates[1]on the trans-Tasman routes would prevent the legacy carriers' cartel from substantially lessening competition.

Encouraged by the ACT ruling, Qantas and Air New Zealand came back to the authorities in April 2006 with a 'Tasman Networks Agreement' proposal, which in effect involved the cartelisation of their operations on these routes. At time of writing, this proposal is being considered by the ACCC[2].

There has been no previous econometric analysis of pricing on the Tasman (nor of domestic NZ routes), so the present study should be valuable in filling a gap in our knowledge, in particular with respect to the key (for policy) issue of just what competitive constraint the fringe airlines Pacific Blue and Emirates impose on the larger incumbents, as well as contributing more widely to our understanding of the process of competition in this industry and others in which rapid technological change and innovation may or may not disrupt the 'normal rules' of oligopolistic behaviour.

The data will reveal that one of the normal assumptions of oligopoly modelling and indeed of price theory more generally is empirically violated in these markets. This is the assumption that a homogeneous good is sold at a single price. Instead, airlines adopt quite extensive price discrimination practices (which they term yield or revenue management) based on willingness to pay, which result in quite large differences in prices paid for tickets on a given flight. However, Hazledine (2006) extends the standard Cournot-Nash oligopoly model to the price discrimination case, and finds that (assuming linearity) the average price paid is actually unchanged by the extent of price discrimination, so that the standard model's key prediction of a relationship between the number of competitors and the (average) price in a market remains valid in the more general case. This result justifies the use of the first moment of the price distribution in the econometric modelling below.

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[1] 5th Freedom rights allow a carrier flying between its home country A and a country C via another country B to also carry point-to-point passengers between B and C. In this case countries B and C are Australia and NZ, who jointly grant these rights to, for example, Emirates flying out of Dubai (country A).

[2] And in New Zealand by the Ministry of Transport, which under a clause in the NZ Transport Act is deemed to have jurisdiction over this matter, rather than the NZCC.

The paper proceeds as follows. The next section reviews the econometric literature on airline pricing, with and without competition between legacy airlines and LCCs. Section 3 describes the new database, and section 4 reports the results of the econometric analysis. Section 5 then uses these results and other data to calibrate a Cournot-Nash oligopoly model, which is used to directly answer 'what if?' questions concerning the effects of elimination of competition between Qantas and Air New Zealand on the Tasman. Section 6 concludes.

2. Literature Review

For reasons of data availability explained in the next section nearly all econometric studies of airline pricing are of U.S. markets. Tretheway and Kincaid (2005) have provided an extensive survey of the results of these studies, focusing on the first two of three issues that are of direct concern to the present paper:

- The role of market structure
- The impact of Low-Cost Carriers
- The results of airline mergers

Market Structure

In the US, the structure-pricing relationship has been complicated in air travel markets by the remarkable rise, following the 1978 deregulation of the industry, of the 'hub and spoke' system. This allowed an airline to inexpensively increase its route coverage by routing passengers through one or two major 'hub' airports. In the classic study of the effects of the new system Borenstein (1989) found evidence of "hub premiums" -- significantly higher air fares when a particular carrier 'dominated' a particular hub airport. Tretheway and Kincaid report that subsequent studies tend to find lower hub premiums, typically by unearthing non-market power reasons why cities whose airports became hubs might also experience more expensive air travel.[3] Their summary is:

> 'After fifteen years of research, the literature continues to find that market concentration at hub airports significantly affects average air fares paid by consumers. In recent papers, however, the magnitude of this effect has been whittled down to single-digit levels. Other variables were found to be more influential on the higher fares paid at concentrated hubs.' (2005, p10)

The geography of the Australasian region does not naturally lend itself to the establishment of hub-and-spoke networks. Basically, most of the big airports in both Australia and New Zealand are laid out on two NE/SW axes about 2000 kilometres apart, and most of the air traffic between pairs of these cities is therefore point-to-point, not routed via a third similar-sized airport. The US evidence would be consistent with a finding of structure (concentration) mattering in our region, but it

[3] For example, hub airports tend to be larger, and thus to be linked to larger urban areas, which in turn may generate a higher proportion of business travel; this being associated with willingness to pay more for last-minute, flexible itineraries.

does not provide much guidance as to how large such an effect might be, given the differences in network arrangements.

Impact of Low Cost Carriers

Tretheway and Kincaid document the dramatic impact of LCC competition on many US air travel markets. An uncontroversial summary of the evidence would be that the entry or sometime even just the realistic potential entry of (in particular) the most successful of the LCCs, Southwest Airlines, has resulted in air fares being 40% or more lower than in the absence of LCC competitive pressure. There is also some evidence that this price impact was not additionally affected by the number of incumbent legacy carriers serving the route.

However, in later work Goolsbee and Syverson (2005) find that an increase in the probability of Southwest entering a route[4] has a large (20%+) and significant impact on prices when the existing level of concentration on the route is above average, but not when the route is of below-average concentration. So, there may be some disagreement about the extent to which the 'Southwest effect' is qualified by the extent of existing competition, but there seems little doubt that, overall, Southwest and perhaps some other LCCs have had a substantial impact on US airfares well beyond the tickets they sell on their own flights.

Do these results have applicability to the Australasian markets? In their submissions in support of their cartel proposal, Qantas and Air New Zealand did claim relevance[5], to the effect that the regional LCC Virgin Blue would effectively prevent the cartel from increasing its fares. However, there are reasons to doubt that the striking impact on competition of, in particular, Southwest Airlines would apply to LCC (and 5th Freedom) entry on trans- Tasman routes.

This is partly because conditions have changed, and partly because the situation has always been different in this part of the world. As noted above, in response to the dramatic impact of LCCs in the 1980s and 1990s, the legacy carriers have made adjustments which reduce their cost disadvantage. In Australasia, such adjustments include (as noted) Air New Zealand's Tasman Express fare structure, which makes cheap one-way fares available, along with some stripping out of in-flight service costs. In any case, Air New Zealand and Qantas, which have always earned most of their revenue from international travel, are more cost competitive operators than were the U.S. legacy carriers, with their bloated salary and pension structures, and have many other advantages in their regional markets over all potential competitors, including Pacific (Virgin) Blue, as will be listed below.

We do have direct econometric evidence of the impact on prices of Virgin Blue's entry into the domestic Australian market, and subsequent rapid expansion into the gap left by the sudden failure of Ansett, in 2001. This is reviewed in the NZCC's Final Determination (2003 at paragraph 531). The airlines' consultants Drs Morrison and Winston found that Qantas's fares tended to be about 6% lower in markets it had

[4] The perceived and actual probability of Southwest eventually entering a route increases sharply when it begins operating from both end-point airports on that route.
[5] The Tretheway/Kincaid paper is developed from the first author's submission to the ACT on behalf of the airlines.

shared with Ansett, and 10% lower if it was competing with Virgin. The noted econometrician Professor Jerry Hausman reran the regressions and found much smaller effects. Even the larger numbers are well within the range an oligopoly modeller would expect from the addition of a competitor to a market, without any additional *force majeure* impact such was apparently experienced by the legacy carriers in the United States when Southwest entered their markets.

Results of mergers

Only in the large and diverse US market could we expect to observe enough events to enable econometric analysis of the actual impact of mergers or other restrictions to independent competition. In a well-known study Kim and Singal (1993) analysed the 14 U.S. airline mergers that took place over 1985-88, and found that the merging firms increased their airfares by more than 9%, on average, and, interestingly, that non-merging rivals raised their prices by more than 12%. Note that this sample of course excludes mergers that were disallowed by the authorities as likely to be anti-competitive, or which were not even attempted because of the likelihood of rejection. It is probably reasonable to suggest that the latter category would include, in the United States, arrangements such as those here proposed by Qantas and Air New Zealand, given these airlines' large combined share of the affected markets

3. Data

The basic unit of analysis for this study is the 'flight', being a journey flown by an airline between two airports on a particular day and time. The flight might be non-stop, or it might be made up of two separate stages, possibly involving two different airline flight numbers.

(a) The sample

The data collected for this study cover 1001 different flights. For example, Qantas flight QF65 departing Sydney for Christchurch at 1900 hours on July 13, 2005 is one of the 1001. The data are all for Wednesday flights, this day chosen as being likely to represent relatively 'normal' mid-week business conditions. The data were collected for two different time periods. First was a sample of eight internal NZ routes plus Auckland-Sydney observed for flights on consecutive Wednesdays over an eight week period beginning on November 17, 2004, and ending with flights on January 5, 2005. The eight internal routes were chosen such that four were Air New Zealand monopolies and four were served also by Qantas. The latter include two of the three main trunk domestic routes – Auckland-Wellington and Wellington-Christchurch.[6]

The second set of data covers all the flights on the full set of direct Tasman routes, in both directions, with the exception of the vacation destinations in Queensland (eg Gold Coast), and flights from smaller NZ cities (Hamilton, Palmerston, Dunedin and Queenstown). There were thus twenty one routes; eighteen (both ways) between

[6] The other main trunk route is Auckland-Christchurch, which was considered for inclusion in the sample, but not chosen because the very large number of one-stop (usually via Wellington) itineraries offered by the airlines would make it difficult to judge just how many 'flights' actually had significant presence in the market.

Melbourne/Sydney/Brisbane and Christchurch/Wellington/Auckland, plus Auckland/Adelaide, Auckland/Perth and Perth/Auckland.[7] These routes were observed for three Wednesdays: June 29, July 6 and July 13, in 2005. The Appendix lists all the routes.

In total, our database has information on 29 routes, with 104 flight numbers observed on up to eight different flight dates 2004/05[8], and 86 flight numbers observed on three different Wednesdays around July 2005.[9] The airlines whose flights are observed include, in addition to the major carriers Qantas and Air New Zealand[10], the two substantial fringe carriers across the Tasman, Pacific Blue and Emirates. Other long-haul carriers making use of 5th Freedom rights to carry trans-Tasman passengers have a tiny share of the market and were not included in the sample.[11]

(b) Prices

Key, of course, to this study are the new price data. The main restriction on direct testing of oligopoly theory is the availability of good data on market outcomes – in particular, on prices. Concluding their survey of the literature on airline pricing and market structure, Tretheway and Kincaid note that it is 'entirely based on U.S. data' for the simple reason that only in the U.S. is there publicly available a large and suitable database: the Department of Transportation's DB1a dataset which covers a random sample of 10% of all domestic airline tickets sold. Studies for other jurisdictions 'may require the use of expensive commercial data, the use of surveys to gather primary data, or the use of propriety *[sic]* data from government agencies or the air carriers themselves' (Tretheway and Kincaid , 2005 p11).

But there is now a freely available source of public information on airfares, and that is the airlines' own websites, either observed directly or indirectly through a travel agency site.[12] These sites are particularly suited to 'B2C' transactions involving the sale of services with no physical delivery required of the seller. And the information on the sites is transparent since the adoption by Air New Zealand in November 2002 of its 'Express' fare system (quickly matched by Qantas) which notably dropped the old Saturday-night-stayover return ticket requirement that had blurred the definition of the product. Now, anyone can a get a firm quote from the website for any (one-way) flight at any time up to 364 days before the flight date.

However, although these data are free, they are not easy. Each routing and date has to be individually specified on the website, the resulting fare quotes printed out, and the price information transcribed manually to a spreadsheet. This was done, for each flight, weekly for each of weeks 8 to 1 before flight date (ie, observations were taken 56, 49, 42 etc days before flight), and then for several days in the last week before the flight, including the day before . Thus, what was noted was the lowest fare offered by

[7] At this time there was no direct service from Adelaide to Auckland.
[8] Not all the domestic NZ flights were operated on all eight flight dates.
[9] The Auckland to Sydney flights were observed in both samples.
[10] But not Air NZ's subsidiary LCC, Freedom Air, which flies mainly out of smaller NZ cities.
[11] See Table 2 in Section 5 below.
[12] The large travel agencies have programs which scour the airlines' websites for the lowest fares offered on each flight and repackage the data to offer flight options to their clients, usually with a booking fee added to the fare. Of course an airline's website only offers flights on that carrier (plus any code-shares).

the airline for a specific flight at each observation date. What, of course, we cannot observe is the number of tickets sold at each observed fare offering. And nor did we catch all price changes by observing fares daily rather than weekly.[13] Basically, then, we end up with a sample of the prices at which tickets were sold on each flight.

These price observations reveal a systematic -- though not uniform – tendency for lowest available prices to increase as the day of the flight approaches, in particular for fares offered by Qantas and Air New Zealand, which are, on average, between 35 and 40% higher the day before the flight than eight weeks earlier. The intertemporal distribution is flatter for the LCC Pacific Blue, for which fares do not change much, on average, until the last week before the flight, whereafter they are increased, on average, by around 15%. The 5th Freedom carrier Emirates behaves rather differently: its intertemporal price distribution, on average, is even more compressed than that of Pacific Blue, and on average it was actually cheapest to buy one of their tickets three weeks before the date of the journey.

The dependent variable for our pricing model will be the mean value of a sample of nine price observations for each flight – the weekly observations beginning eight weeks out, and the price offered the day before takeoff, divided by the flight distance to make different routes comparable. In essence, then, the model will be explaining a sample summary statistic of the distribution of lowest prices charged by the airlines.[14] We can note that, even after suppressing inter-temporal differences due to price discrimination, the observed prices show considerable variation. The most expensive of the 1001 flights here sampled was an Air New Zealand flight from Christchurch to Wanaka on December 22, 2004, for which the average observed fare was 94cents/km. The cheapest also flew out of Christchurch – an Emirates flight to Melbourne on which travellers who purchased the lowest fares flew for just 7 cents/km, on average. Even restricting the comparison to trans-Tasman flights, the range of prices is considerable: the most expensive came in at 32 cents/km. This variability in what will be the dependent variable in our econometric analysis is both an opportunity and a challenge for the specification of a well-fitting model.

(c) Capacities and concentration

In tests of small number oligopoly models it is usual to compress information about the number and size of competitors into a summary statistic, the most widely used being the Hirschman-Herfindahl Index (HHI), defined as the sum of the squared capacity shares of all the firms supplying a market. In most industries, firms' capacities are either not known or not even well defined, and data on actual sales are used instead. This is problematic if the variable is to be used as a regressor in a price or profitability model, because actual sales are not an independent variable -- they

[13] However it appears that fares are normally adjusted about once a week up until the last week, when they will be re-evaluated daily.

[14] The use of an unweighted average probably gives to much weight to observations many weeks out from the flight date, because it is likely (especially for 'business' routes, such as Auckland-Wellington) that relatively more tickets are sold in the week or two before take-off. In earlier work with this database the dependent variable used was a weighted average of just three of the price observations: the prices eight weeks, two weeks and the day before the flight. The results are not very sensitive to the change in specification.

will be themselves affected by price -- that is, sales are not a true supply-side variable.

In the case of airline markets, however, we do have true supply measures (and we don't, usually, have sales data), and indeed the problem now is which best to choose: for example, number (frequency) of flights on a route, or number of seats. Here we will use the (daily) number of flights by each airline as the measure of supply. We note that most of the flights in this sample of routes are operated by Boeing 737 or Airbus 320 aircraft, with fairly similar total seat numbers of around 140-160, depending on configuration. It is true, however, that some of the trans-Tasman flights are flown by larger, wide-body jets, in particular by the 5th Freedom carriers such as Emirates, whose aircraft choices are of course determined by the need to fly them over long-haul routes. But then, in the case of 5th Freedom flights, an unknown number of the seats flown across the Tasman are not available for trans-Tasman travellers, because they are reserved for long-haul passengers. No doubt some adjustment could be made to the frequency-defined HHI to allow for different sized aircraft, but I do not expect this would make a significant different to the results.[15]

The flight frequencies and resulting HHI numbers are shown in the Appendix. There were seven monopoly routes (HHI = 10,000)[16]: four in New Zealand, plus Auckland-Adelaide, Perth-Auckland and Auckland-Perth . Values of the HHI for the other routes ranged from 2,653 (Melbourne-Christchurch) to 7,810 (Wellington-Christchurch).

Of the nine main trans-Tasman routes (eighteen both ways), Air New Zealand and Qantas had just two to themselves in July 2005: Wellington-Melbourne and Wellington-Sydney. On three routes (Wellington-Brisbane, Christchurch-Brisbane, Christchurch-Sydney) they faced competition from Pacific Blue, and on two the triopoly was made up by Emirates (Auckland-Melbourne, Auckland-Sydney). Christchurch-Melbourne and Auckland-Brisbane were two routes on which all four airlines provided service.[17]

(d) Other data

Prices must be compared against costs. An airline flight incurs directly three types of cost: cost related to the distance covered (fuel, aircrew, catering, aircraft capital and maintenance costs); costs related to the number of passengers (booking, processing, baggage handling, catering), and flight-fixed costs, such as taxi-ing time and airport charges. As well, airlines incur various costs which are not flight-specific (head office, advertising, ground facilities).

We have data on flight distance (mean value = 1181 kms) but not on the other determinants of costs, and so will be assuming that these are similar across routes and

[15] Using flight frequencies unweighted by size of aircraft will turn out to be conservative for the result that there is not much discernible impact on pricing of 5th Freedom competition.
[16] This is adopting the American convention of calculating the HHI using percentage, not proportional, market shares, so that the value for a monopoly is 100x100 = 10,000.
[17] The very small market shares of other 5th Freedom carriers on some Tasman routes (mainly Auckland-Sydney) are not included in the calculations of the HHI index.

airlines, although use of panel estimation methods and specification of airline-specific dummy variables will implicitly allow for route/airline cost heterogeneity.

The Australian Bureau of Transport and Regional Economics (BTRE) publishes on its website extensive data on the number of seats and passengers flown into and out of Australia, and this can be used to construct monthly capacity utilisation measures (ratio of passengers to available seats) for each of the Tasman routes[18] (though not, of course, for the domestic NZ routes). Here, the variable (UTIL; mean = 0.67)) is calculated for the month of July 2005, which approximately matches the period over which the trans-Tasman prices were observed, and from late November 2004 to early January 2005, for the Auckland-Sydney route, which was also observed then. The expectation is that the extent of the 'overhang' of empty seats on a route will constrain pricing of all the carriers serving that route.

Finally, the following dummy variables are defined:

SOLDDUM = 1 if the flight appears to have sold-out before flight date because it disappears from the airline's website offerings (mean value = 0.13). To the extent that the airlines' yield managers can predict which flights are likely to sell out, then we would expect that they would tend to set higher prices on those flights

PEAKDUM = 1 if the flight is a short-haul (domestic NZ) flight leaving at a peak-period time for business travellers (mean value = 0.07). With these flight times being well known, we would expect that the time profile of prices would be higher to take advantage of the higher willingness to pay of business travellers.

XMAS = 1 for the last two Wednesdays in 2004 and the first Wednesday in 2005, all of which fall in the Christmas vacation season, at which time business travel is reduced and leisure travel increased.

QANTAS, EMIRATES, PACIFICBLUE: each taking the value of one if the flight is operated by that airline

TASMAN = 1 for trans-Tasman routes

4. Econometric Results

This section reports econometric regression estimates of an airline pricing model to account for variation in 1001 observations on average fares (per kilometre) offered for flights within New Zealand and between NZ and Australia.

These 1001 data points are neither pure time series nor pure cross section, but make up what looks like a 'panel' -- that is, with recognisable cross sectional groupings of data, within each of which there may be some further groupings or orderings, for example, by date. A number of possibly meaningful panels can be identified: the 29 different routes (18 if both-way flights are counted as one route); the 190 different

[18] The published BTRE utilisation data by city-pair routes are not broken down by airline; the data by airline are not broken down by route, presumably to preserve some confidentiality.

flights; the two different markets, broadly defined (Tasman, NZ); flights leaving at different times of day; flights in different weeks.

In some empirical work with micro-datasets -- in particular when the individual or household is the unit of observation – econometric models may identify significant explanatory variables while failing to explain very much of the total variation in the dependent variable. For example, a regression model to explain interpersonal variations in income will often find a significant role for years of education and a few other observables, while still missing most of the myriad of factors that account for different economic outcomes at the individual level. In such cases it is probably particularly important to make use of sophisticated econometric tools which may help compensate for the missing factors.

In the present case, however, we are testing a relatively tight economic theory, through which we hope to be able to explain variations in prices with a quite parsimonious set of regressors (because the theory is both complete and parsimonious). If we estimated a model with a measure of structural competition, and a variable for costs, along with some appropriate seasonal and other shifters, and if all these variables were highly significant and yet the total R^2 was, say, 0.15, then we would be worried -- our theory of oligopoly pricing, though not invalid as far as it goes, must be seriously incomplete! But if our model does account for a substantial fraction of the variance in prices, then perhaps we should not need the help of sophisticated econometric techniques.

Our model turns out to fit very well (for what is basically a cross sectional dataset), and fairly extensive re-estimation of the core model does not much alter the coefficients or the fit. Here we will show results estimated using EViews 5.1 Panel Least Squares, with the panels grouped by route, and using the ar(1) 'correction' for serially correlated residuals.

The model is estimated in semi-logarithmic form, with logs taken of the dependent variable, Pavk (average price per flight per kilometre) and of the flight distance, DIST. All other variables are entered linearly, so that the underlying specification is:

(1) $$P_{avk} = DIST^a \exp[bx_1 + cx_2 + dx_3 + \ldots]$$

For small values of the exponential coefficients, these can be read-off as percentage differences.

Results are shown on Table 1. The first four columns are for the full sample. Look at the third column. The overall R^2 is 0.80, which is high for a cross section model. An important contributor to the fit is the distance variable, of which the estimated coefficient has a double-digit t-statistic. Interpreted as a cost variable, this coefficient implies that doubling the length of a flight adds a bit more than 50% (1-0.45 = 0.55) to total flight costs. This seems broadly in line with the literature on aviation cost functions. Most recently, Swan and Adler (2006), using very detailed proprietary information on the components of direct flight costs, find that these increase with flight length over 'short haul' (1000-5000 kms) flights with an elasticity of 0.75. Their costs exclude various costs which are not distance dependent, such as marketing and sales costs, administrative overheads and certain airport charges, and which, they report, account for around 40% of total airline costs. If the airlines include most but not all of these costs (eg, they may not allocate head-office and back-office costs to flights) in their cost accounting for individual flights then an elasticity of around 0.5 seems plausible.

Of particular interest, of course, is the size and significance of the estimated coefficient on the Hirschman-Herfindahl index of structural competition. In the Column 3 regression this takes the value 0.52 and has a quite impressive t-statistic of 5.4 . However, this may be an over-estimate of the variable's *ceteris paribus* impact on market prices, as we shall see.

The coefficient on PEAKDUM implies that average fares on short-haul business peak-time flights are more than 60% higher than fares at other times, other things equal (exp0.49 = 1.63). Since these average fares are calculated from observations beginning eight weeks from flight date, it seems clear that the airlines build their expectations of higher willingness to pay into their yield management schedules well before most business travellers would actually purchase a ticket. The purpose may be to discourage leisure travellers from taking seats on these flights, in order to leave plenty of capacity available for the lucrative last-minute travellers.

The airlines appear also to be able to predict which flights are likely to be sold-out, and build in a price premium in advance. Note that if causation went the other way, then the coefficient on SOLDDUM would be negative – sold-out flights would be those for which fares were set 'too low'.

The airlines also are well prepared for the Christmas holiday season, during which weeks the coefficient on the XMAS dummy implies they are able to earn a price premium of around 30%, despite the loss in business traveller traffic.[19]

Trans-Tasman flights have fares about 20% (exp0.19) higher than domestic NZ fares, other things held constant. This result may be picking up cost differences that aren't captured in the coefficient of the DIST variable, the size of which increases in absolute value when the TASMAN dummy is introduced into the model. Note that the shortest trans-Tasman flight (Christchurch-Sydney: 2127 kms) is still twice as long as the longest domestic NZ flight (Auckland-Dunedin: 1062 kms), so it would not be surprising if a single DIST coefficient did not perfectly span the cost functions of both these markets.

Now consider column 4, which augments the column 3 specification with dummy variables for the airlines. Note first that the coefficients of all the variables except the Hirschman-Herfindahl index do not change. The HHI coefficient shrinks somewhat in size and significance. The likely reason for this becomes clear when we examine the coefficients on the airline dummy variables. It is striking that Air New Zealand appears to be able to charge a quite substantial and significant price premium over all three of its competitors. The prices earned by Emirates and Pacific Blue are especially low, but even Qantas is pricing below its main competitor, overall.

[19] Air New Zealand does adjust its schedule in the holiday season, discontinuing some flights which may depend on business traffic.

So, some of the column 3 regression linkage between the HHI and pricing seems to be due to the fact that those markets with more competition have in them one or more of the carriers that also tend to generally charge lower prices than Air New Zealand (which is present on all routes except the single-flight Auckland-Adelaide run). If so, then it is the column 4 coefficient on HHI which should be taken as the estimate of this variable's impact on market pricing, holding other factors constant. It is still large enough to imply that a monopoly market will see average fares 20% higher than a symmetric duopoly.[20] This is a difference which is consistent with a standard Cournot-Nash model of oligopoly pricing, as we will see in the next section.

Now we estimate separate models for each of the two broad markets, looking first at the trans-Tasman routes, for which we have available 325 observations, mostly observed in June/July 2005, though with Auckland/Sydney also picked up through November-January 2004.

Note in column 5 that the overall explanatory power of the regression is quite a lot lower than for the full database, and that this goes along with a drastic fall in the significance of the DIST variable. Since there really is not very much variation in the distances of trans-Tasman flights, it is probably not surprising or disturbing that the coefficient of the distance variable would be difficult to pin down in this sample

Of more concern is the deflation of significance of the HHI coefficient. While we no longer have the variation in this variable generated by the four domestic NZ Air New Zealand monopoly routes, there is still a good mix of duopoly and triopoly routes (and two with all four airlines competing), and it is surprising that the regression model shows really no effect of this on market pricing behaviour. We return to this below.

Column 6 adds the route seat utilisation variable UTIL, which is only available for the trans-Tasman routes. This turns out to be a very useful regressor, with an estimated coefficient implying, for example, that a five percentage point improvement in overall capacity utilisation on a route from 70% to 75%, would tend to increase the prices charged by airlines serving that route by about 4% (and, of course, profitability by much more than that).

Now, in column 7 we bring back the airline dummies. The Qantas dummy coefficient is smaller than for the full sample, suggesting that this airline's lowest Tasman fares are around 10% less than the competing Air New Zealand fares.[21] Emirates' and Pacific Blue's Tasman fares (and of course neither airline flies inside NZ) are about 30% below Air NZ's on each route, other things equal – a substantially lower yield per seat.

Finally, I experimented with dropping the only monopoly Tasman route with flights in both directions, Auckland-Perth – which of course is also by far the longest route at

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[20] The HHI takes the value 0.5 for a symmetric duopoly and 1.0 for monopoly. So, the difference in price is exp(0.37*1)/exp(0.37*0.5) which is 1.20.

[21] Interestingly, Qantas's overall fare structure across the Tasman is apparently higher than Air New Zealand's (*NZ Herald* May 27, 2006, interview with Air NZ CEO Rob Fyfe). If the econometric numbers here have validity beyond the months they were estimated for, then it must be true that Qantas does a lot better than Air New Zealand at the high-yield business class end of the market, which is not represented in the lowest fares observed for this study.

more than 5000 kms. The size and significance of the distance variable actually increases, which was a surprise -- evidently a different cost model is needed for this near-long haul route. Other variables are not affected, but the HHI is completely wiped out.

Columns 9-11 repeat the specification search for the domestic NZ routes. The model is comfortable with this sample, and there are no surprises. Note in column 11 that the coefficient on the QANTAS dummy variable is twice its value for the Tasman routes – Qantas has actually admitted to losing money on its domestic NZ flights[22], and here we can see part of the reason why it does (low utilisation rates may be another factor).

In summary: despite the fairly considerable amount of inter-temporal price discrimination that now goes on in the weeks before an aircraft takes off, there is considerable information in an estimate of the average (lowest) fare charged for each flight, as predicted by Hazledine (2006). Basically, the whole intertemporal price distribution shifts up and down in response to differences in the factors that standard price theory predicts should matter: the number of competitors, costs, and the pressure of demand against capacity, which varies systematically across routes, and also at different times of the year and times of the day.

The evidence is strongest for the full sample and for the larger of the two sub-samples – the domestic NZ flights. The trans-Tasman routes have little variability in distance and not much variability in the Hirschman-Herfindahl Index of seller concentration, so that it probably is not a cause of concern that this sample does not yield precise coefficient estimates. However it may be a little surprising that there is no discernible effect on market pricing of the competition provided to Air New Zealand and Qantas by the fringe carriers Pacific Blue and Emirates, apart from the much lower fares paid by those customers who actually do travel on these two airlines. That is, there is no evidence here that fringe competition affects the prices charged by the two major carriers, for whom what matters is just the competition between them.

This may be explained by noting just how few travellers actually do take advantage of the low Pacific Blue and Emirates fares, which implies that the fringe carriers' product is perceived as inferior to that of the incumbents by a majority of customers. The source of this is not likely to be differences in the in-the-air service offerings (of which Emirates' may well be the best), but rather in the various local advantages of Air New Zealand and Qantas, that are particularly attractive to the New Zealanders and Australians who make up most of their trans-Tasman customers, as well as to many tourist and business travellers. These include: flight frequency, network connectivity at either or both ends of the Tasman flight, frequent flier programs, national carrier advantages on the ground (eg with tourism promotion), and perhaps national carrier loyalty on the part of many customers.

[22] Why isn't this then predatory behaviour? Qantas claims that it is worth losing money in NZ to get feed for its Tasman routes. However given that (a) the airlines claim to not make any money across the Tasman, either and (b) with the exception of its limited service to Rotorua, all Qantas's NZ network cities are also directly linked to Australia by the airline, the feed argument seems even weaker than it may usually be as a rationalisation of aggressively low pricing.

5. Applied Theory

In this section we find out whether the found 'facts' of the airline markets make sense in theory, and then what this theory predicts would be the impact of arrangements that eliminated competition between Qantas and Air New Zealand, focussing on the trans-Tasman routes where they face competition from the fringe carriers Pacific Blue and Emirates.

Specifically, we will use some of the econometric results (the airline price dummy coefficients), along with other data, to calibrate a quantitative oligopoly model of a representative Tasman route and then check the implications of this against the central econometric findings of (a) a strong impact on prices of competition between Qantas and Air New Zealand and (b) the lack of evidence of any additional effect of competition from either Pacific Blue or Emirates, in order to answer the key 'What if?' question of interest to regulators faced with proposals that would eliminate some competition between the largest airlines.

Cournot conjectures

We build a linear Cournot-Nash quantity-setting oligopoly model with differentiated products (Hazledine *et al*, 2003; Hazledine, 2004; Fu *et al*, 2006). The theory underpinning this is the standard solution concept of small-number Nash Equilibrium, that observed market outcomes can be explained as the mutually consistent result of competent attempts by individual and independent firms to maximise their profits given the actions of the other firms.

It is quite common practice to impose the structure of non-cooperative oligopoly theory on market behaviour in airlines and other mature industries. Brander and Zhang (1990) found econometric evidence of Cournot-Nash outcomes in various US airline duopoly markets, and NECG (2002) adopted the assumption of Cournot-Nash in their modeling of the Australasian routes. Haugh and Hazledine (1999) found that the price-cost margins of Air New Zealand and Qantas in 1995 were consistent with Cournot, which in terms of the model means that each firm has a zero conjectural variation parameter – they take the other's output as fixed when choosing their own optimal output level. But then in 1996 after the entry of the upstart low-cost airline Kiwi International, their behaviour suddenly became markedly more competitive (CV parameter negative and approaching –1), which Haugh and Hazledine interpreted as possible evidence of predatory behaviour by the incumbents aimed (successfully) at driving Kiwi from the market.

Hazledine *et al* (2001) updated the analysis of the incumbents' behaviour in the trans-Tasman market to 1999. They found that although the airlines returned to near-Cournot behaviour after dealing with Kiwi, they then became increasingly aggressive towards each other as they joined different global alliances (Oneworld and Star Alliance) and abandoned code-sharing arrangements, such that by 1999 the implied CV parameter was –0.57 .

During the various hearings in 2003 and 2004 on the proposed Qantas/Air NZ 'strategic alliance' (cartel) it seemed to be common ground that competition on most Tasman routes was particularly intense and in my own modeling (Hazledine, 2004) I represented this by modeling the current market with a CV parameter of -0.5 for Air New Zealand and Qantas. However, price competition may have eased since then, and/or the real profitability problem on these routes may be driven by excess capacity (too many fixed costs), not by too-low profit margins on variable costs. The reduction of claimed excess capacity on Tasman routes is certainly a cornerstone of the airlines' current 'code share' proposal. In any case, we will here model conjectures as Cournot for all airlines: we will be able to test this assumption against the econometric results.

Product substitutability

As a useful simplification, we assume that the outputs of the two legacy carriers Qantas and Air New Zealand are perfectly substitutable with each other, but differentiated from the product of either Pacific Blue or Emirates, and the model will have just one of these two carriers in competition with Qantas and Air New Zealand. This is a quite reasonable representation of the typical trans-Tasman market: of the seven of the nine main trans-Tasman routes on which Air New Zealand and Qantas did face some competition in July 2005, only two (Christchurch-Melbourne and Auckland-Brisbane) were operated by all four carriers. We also ignore the other 5th Freedom carriers, whose market shares were very small, as Table 2 reveals.[23]

Linear differentiated products Cournot-Nash model

The model can then be written down as follows. We write the price-dependent demand curves for the products of legacy carriers (L) and any fringe carrier (F):

$$(1) \qquad P_L = a - bQ_L - kq_F$$

$$(2) \qquad P_F = \alpha - \beta q_F - kQ_L$$

where: $Q_L = q_i + q_j$,

using i and j to subscript the two legacy carriers (Air New Zealand and Qantas). Fu *et al.* (2006) show that these demand curves can be derived from a representative consumer model, in which the utility function is quadratic (and strictly concave). The cross-quantity coefficient k measures the extent of horizontal product differentiation. If $k = 0$, then legacy airline product is completely independent of fringe output in the marketplace -- they are not at all substitutes, because changes in fringe output q_F have no impact at all on P_L . If, at the other extreme, $k = b$, then the products are perfect substitutes.

Total cost of, say, legacy firm i is taken as linear in output:

$$(3) \qquad C_i = f_i + c_i q_i ,$$

[23] The largest of these 5th Freedom carriers in terms of market share, Thai, has since exited the route, following its introduction of direct Auckland-Bangkok services. Note that the actual passenger market shares of all the 5th Freedom carriers, including Emirates, are well below their nominal capacity share as measured by seats flown, since these carriers do not usually achieve very high load factors across the Tasman. Note also that 'ignoring' these very small players does not mean assuming that they do not exist – rather that their output is implicitly netted out of the market demand curves.

where f_i is firm *i's* fixed costs, and c_i is its marginal cost. Firm j and the fringe firm(s) have similar specifications.

Legacy firm *i's* profit function is:

(4) $\pi_i = q_i P_i - C_i$

$= q_i [a - bQ_L - kq_F] - f_i - c_i q_i$

Differentiating with respect to firm *i's* output and equating to zero gives the first order condition for profit-maximisation:

(5) $d\pi_i/dq_i = a - bq_i\, dQ_L/dq_i - bQ_L - eq_i\, dq_F/dq_i - eq_F - c_i = 0$,

For the Cournot conjectures case, $dQ_L/dq_i = 1$ and $dq_F/dq_i = 0$, so the first order conditions for firm i and, similarly, firms j and F are (using (2)):

(6) $a - 2bq_i - bq_j - kq_F - c_i = 0$ (legacy carrier *i*)

(7) $a - 2bq_j - bq_i - kq_F - c_j = 0$ (legacy carrier *j)*

(8) $\alpha - 2\beta q_F - kq_i - kq_j - c_F = 0$ (fringe carrier)

Calibration of the model

Equations (6), (7) and (8) can be solved for the Nash Equilibrium in quantities and thus prices. Here, we assume that the 'actual' (*circa* 2005/6) observed situation is such a Nash Equilibrium, and use this and some other stylised facts and assumptions to specify the model empirically for a 'typical' trans-Tasman route. Specifically, we take from Table 2 the stylised fact that on one of these markets Air New Zealand, Qantas and either Emirates or Pacific Blue have market shares of 40%, 40% and 20%.[24] We calibrate total output to be 1000 and set the actual legacy carrier price at 1.0. We follow the airlines' consultants NECG in using the figure of -1.3 for the own-price elasticity of demand for legacy carrier output[25], and make the fairly standard (though not often directly estimated) assumption that the cross-quantity coefficient is one half of the own-quantity coefficient in the legacy demand curve (1). This enables us to solve for the parameters a, b and k of the legacy carrier demand curve.

With homogeneous legacy outputs and equal market shares, we must have $c_i = c_j$ and we can now solve (6) for this. Then, we assume that fringe marginal costs are 80% of

[24] Noting that most of Freedom Air's passengers are carried on minor routes implies that Air NZ and Qantas have approximately equal market shares on the nine major routes, which in all but one case, as reported above, is not also served by both Pacific Blue and Emirates. We do not explicitly allow for the very small market presence of the other 5th Freedom carriers.

[25] This is the figure used by NECG (2003) in their modelling in support of the original cartel proposal. It is a passenger share-weighted average of estimates of the price elasticities of demand of business (-0.65) and leisure (-1.6) travellers. As such this number is quite consistent with the findings of the meta analysis of econometric elasticity estimates by Gillen *et al* (2003).

legacy levels[26], which, along with the value for k which we already have, leaves us with equation (8) in two unknown parameters, α and β. We do not have any reliable independent estimates of the own-price elasticity of demand for Pacific Blue and/or Emirates' trans-Tasman services. So, to solve, we make use of a key piece of information from the econometric results, namely that the market price charged by fringe firms is about 25% lower on average than the average price charged by Air New Zealand and Qantas. The actual algorithm used to find the parameters consistent with this price difference involves asking the question; "At what fringe price, given unchanged legacy output, would sales of fringe output be zero?", and trying out different values for the answer to this question until we find the one that replicates the actual fringe price discount. The answer turns out to be 1.0 – that is, if the fringe carrier set a price equal to the actual current legacy price, and if the legacy carriers maintained their actual current (2006) outputs, no-one would choose to travel with the fringe.[27] This gives us our value for α, which then can be plugged in to (8) along with the other known parameters and outputs to get β.

Simulation analysis

Now we have a fully calibrated model which can be put to work to answer policy-relevant questions; in particular, of course, what would happen if Air New Zealand and Qantas were to coordinate their output and pricing, acting together as a cartel. Analytically, this involves deleting one of the first order conditions and one of the legacy carrier's outputs, so we end up with an asymmetric duopoly of the cartel and the fringe carrier. The results are shown in column 2 of Table 3. We see that even with independent competition from the fringe airline the cartel would increase their prices by about 18%. The fringe does take advantage of the situation by increasing its own output by 20%, but it also takes some of the fruits of less intense competition in the form of higher profit margins, raising its own prices by over 6%, so that overall the average price paid by consumers in this market would increase by around 15%.

To put this result in perspective, columns 3, 4 and 5 show the simple symmetric homogeneous oligopoly cases, with all airlines' costs set at the actual 2006 legacy level (0.615) and the market demand curve given by equation (1) with fringe output set to zero. Then, monopolising a previously duopolistic market results in a price increase of almost exactly 20%, which is indeed just what the econometric results found to be the consequences of Qantas not serving a market, so that Air New Zealand was left with a monopoly. This tell us two things: first that the Cournot-Nash model seems consistent with the econometric findings, and second that, even with its market share set, perhaps generously, at 20%, competition from a fringe airline is unable to reduce the cartel's price increase by more than a couple of percentage points (that is, the difference between 20% and 18%).

[26] NECG (2002, p111) determined that the cost differential of supplying a no-frills LCC flight with respect to a full-service offering from a legacy carrier was around 20% in this market. They also determined or assumed that the cost differential with respect to Air New Zealand's then new domestic 'NZ Express' service would be 12.5%.

[27] That is, specifying the intercept of the fringe demand curve (2), $\alpha - kQ_L = 1.0$ at the actual 2006 value of Q_L gives a value for α . Of course, in reality linearity of the demand curve would probably not hold exactly at this extreme.

Note too, comparing columns 4 and 1, that in 2006 the presence of fringe competition only reduced legacy carrier prices by about 3% (1.032 – 1.000), which may explain why the econometric analysis was unable to discern a significant effect of the fringe on Air New Zealand and Qantas prices on the Tasman routes. Were there a third carrier competing on equal terms with Air NZ and Qantas, then prices would be nearly 10% lower (compare columns 4 and 5) in the (symmetric) triopoly case.

6. Conclusion

The lowest price paid for a kilometre of air travel across the Tasman Sea and within New Zealand differs widely across different routes. Much of the difference is due to differences in distance-related costs, but we find also a substantial and significant role for demand and market structure factors. In particular, air fares on routes competed for by both Qantas and Air New Zealand tended to be about 20% lower, other things equal, than fares for routes on which Air New Zealand was the sole provider of service.

On the trans-Tasman routes, Air NZ and Qantas face additional competition from the Low-Cost Carrier Pacific Blue and from the 5th Freedom airline Emirates. Despite the much lower (around 25%) fares offered by these airlines they have not achieved more than single-digit market shares overall, and there is little econometric evidence that their presence in the market has influenced the pricing of Air New Zealand and Qantas. This perhaps surprising finding can be understood in terms of a model of oligopolistic interaction which shows that the degree of product differentiation between the large carriers Air NZ and Qantas on the one hand, and the fringe airlines Pacific Blue and/or Emirates on the other, is such that the competitive pressure exerted by the fringe is rather small.

These results are consistent with the results of other studies of airline competition (and, of course studies of other industries), to the effect that, when a market is dominated by a very small number of suppliers, the extent of competition between those suppliers is significant for pricing. As such, they may be taken as further evidence against the proposals, past and present, that Qantas and Air New Zealand be permitted to cease competing independently with each other.

Certainly, it would be very hard to argue that air travel prices on domestic New Zealand routes are not significantly affected by whether or not Qantas competes with Air New Zealand on them. But we should note that these two airlines compete with each other on all nine of the major trans-Tasman city-pair routes, so that we do not have *direct* comparisons between monopoly (+ fringe) and duopoly (+fringe) market structures in this sector. Also, all the Tasman routes are much longer than all the domestic NZ routes, and we do not here have a direct measure of costs – only distance as a proxy, so we cannot be sure that the whole price structure across the Tasman (ie, prices relative to costs) differs from pricing on the New Zealand routes.

Future research should look to construct a direct measure of costs, and to finding samples of prices and market structures that overlap in terms of route distance – in particular, it would be informative to observe monopoly (or monopoly + fringe) routes of around the same length as the typical trans-Tasman run.

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Table 1: Regression Results. Dependent Variable Log(Pavk)
Regression method: Panel Least Squares with ar(1) correction. Panel grouped by route

Sample	Tasman and NZ routes				All Tasman routes			Tasman; no Perth	Domestic NZ routes		
	1	2	3	4	5	6	7	8	9	10	11
Number of observations	972	972	972	972	325	325	325	321	645	645	645
Constant	5.52 (25.5)	5.24 (25.9)	5.61 (22.6)	5.70 (24.6)	7.16 (5.5)	6.22 (4.5)	4.90 (4.3)	6.79 (4.5)	5.62 (18.2)	5.52 (18.4)	5.62 (20.0)
Log(DIST)	-0.41 (-16.0)	-0.38 (15.6)	-0.45 (-11.9)	-0.44 (-12.5)	-0.62 (-3.6)	-0.58 (-3.6)	-0.38 (-2.5)	-0.62 (-3.2)	-0.44 (-9.5)	-0.44 (-9.7)	-0.43 (-10.3)
HHI	0.46 (4.9)	0.41 (4.7)	0.52 (5.4)	0.38 (4.1)	0.40 (1.8)	0.56 (2.8)	0.23 (1.2)	-0.06 (-0.3)	0.57 (4.6)	0.56 (4.7)	0.42 (3.5)
PEAKDUM	0.35 (7.2)	0.48 (10.4)	0.49 (10.6)	0.48 (10.9)					0.35 (7.3)	0.48 (10.5)	0.48 (10.7)
SOLDDUM	0.18 (7.4)	0.15 (6.7)	0.15 (6.7)	0.15 (7.0)	0.07 (1.8)	0.05 (1.4)	0.05 (1.5)	0.05 (1.4)	0.23 (8.0)	0.19 (7.6)	0.20 (7.7)
XMAS		0.26 (12.8)	0.27 (13.0)	0.27 (13.2)	0.46 (8.9)	0.39 (7.7)	0.37 (7.9)	0.36 (7.8)		0.23 (11.2)	0.23 (11.2)
TASMAN			0.19 (2.5)	0.22 (3.2)							
UTIL						0.79 (4.9)	0.84 (5.7)	0.80 (5.5)			
QANTAS				-0.18 (-5.5)			-0.10 (-3.3)	-0.09 (-3.1)			-0.20 (-3.9)
EMIRATES				-0.39 (-6.1)			-0.32 (-5.8)	-0.31 (-5.7)			
PACIFIC BLUE				-0.28 (-3.4)			-0.31 (-4.4)	-0.30 (-4.3)			
R^2, D-W	0.769 2.05	0.803 2.10	0.804 2.10	0.815 2.07	0.356 2.03	0.400 2.03	0.478 2.03	0.485 2.01	0.653 2.06	0.711 2.09	0.717 2.07

Table 2: Total trans-Tasman passengers carried (000s) and market shares, year ending August 2005 (source BTRE website)

total all airlines	Aero-lineas Argen-tinas	Air New Zealand	Emirates	Free-dom Air	Garuda	Lan Chile	Pacific Blue	Qantas	Royal Brunei	Thai
4869.2	20.6	1754.5	413.7	486.1	13.4	29.9	319.6	1705.0	37.9	88.5
	0.4%	36.0%	8.5%	10.0%	0.3%	0.6%	6.6%	35.0%	0.8%	1.8%

Table 3: Modelling a Representative trans-Tasman Route

	1	2	3	4	5
	Actual 2006 (Cournot-Nash Triopoly)	Cournot Duopoly with cartel & Fringe	Monopoly	Symmetric Cournot Duopoly	Symmetric Cournot Triopoly
Market output	1000	830	650	867	975
Legacy price	1.0	1.183	1.240	1.032	0.930
Total legacy output	800	590			
Air NZ output	400	295			
Qantas output	400	295			
Fringe price	0.746	0.797			
Fringe output	200	240			
HHI Index	0.360	0.336	1.000	0.500	0.333
Legacy costs	0.615	0.615	0.615	0.615	0.615
Fringe costs	0.492	0.492			

Appendix: List of routes, flight frequencies and Hirschman-Herfindahl Index

		daily flight frequency				
Route	total flights	AirNZ	Qantas	Emirates	PacificBlue	HHI
Auckland-Dunedin	12	12				10000
Auckland-Napier	11	11				10000
Auckland-Queenstown	10	6	4			5200
Auckland-Wanaka	1	1				10000
Auckland-Wellington	25	18	7			5970
Wellington-Christchurch	16	14	2			7810
Christchurch-Queenstown	8	6	2			6250
Christchurch-Wanaka	1	1				10000
Auckland-Adelaide	1		1			10000
Auckland-Brisbane	6	3	1.5	1	0.5	3472
Auckland-Melbourne	6	3	2	1		3889
Auckland-Perth	1	1				10000
Auckland-Sydney	12	5	6	1		4306
Brisbane-Auckland	6	3	1.5	1	0.5	3472
Brisbane-Christchurch	3	1	1		1	3333
Brisbane-Wellington	2	1	0.5		0.5	3750
Christchurch-Brisbane	3	1	1		1	3333
Christchurch-Melbourne	3.5	1	1	1	0.5	2653
Christchurch-Sydney	4.7	2	2		0.7	3843
Melbourne-Auckland	6	3	2	1		3889
Melbourne-Christchurch	3.5	1	1	1	0.5	2653
Melbourne-Wellington	2	1	1			5000
Perth-Auckland	1	1				10000
Sydney-Auckland	12	5	6	1		4306
Sydney-Christchurch	4.7	2	2		0.7	3843
Sydney-Wellington	4	2	2			5000
Wellington-Brisbane	2	1	0.5		0.5	3750
Wellington-Melbourne	2	1	1			5000
Wellington-Sydney	4	2	2			5000

Non-integer values indicate that flight frequency is not seven days/week