Pricing, Competition and Policy 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. These routes were the setting for two recent competition cases, involving attempts by the largest carriers, Air New Zealand and Qantas, to obtain regulatory approval to cartelise their operations. The cases, which the airlines eventually lost, swung on the issue of whether the market shares of large legacy carrier incumbents over-estimate their ability to raise prices because of the competitive threat posed by fringe Low-Cost Carriers and airlines exercising 5th Freedom rights on the routes. The main findings of the paper are (i) that routes on which Qantas competes with Air New Zealand tend to have air fares around 20% lower than routes served only by Air NZ; (ii) The fringe carriers Emirates and Pacific Blue offer much lower fares across the Tasman, but yet cannot achieve substantial market shares, 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 significant air fare increases.

Keywords: Airline pricing; Cartels; Competition policy

JEL Classifications: L13; L41; L93

This research was supported by grants from the University of Auckland Research Committee and the NZ Institute for the Study of Competition and Regulation. Database assistance was provided by Cliff Kurniawan, Galilean Zhang and Callum MacLennan. Earlier versions have been presented at the Sauder Business School of the University of British Columbia, March 2005; the Annual Conference of the NZ Association of Economists, Christchurch, June 2005; the Annual Conference of the European Association for Research in Industrial Economics, Porto, September 2005; the Institute for the Study of Competition and Regulation, Wellington, June 2005, and at the Motu Research Seminar, Wellington, June 2006. Comments and suggestions from participants in these events are gratefully acknowledged.

February, 2007

1.0 Introduction

This paper uses new data to analyse airline pricing and competition across two of the three main Australasian aviation markets: domestic New Zealand, and the trans-Tasman routes that link Australia and NZ. Most previous econometric studies of airline pricing have used the US Department of Transportation DB1 database[1], and it is obviously valuable and interesting to widen our perspective with new data and different markets. But, in particular, the analysis and results reported in this paper can add to our insights in three quite important areas. First, the domestic NZ routes provide an unusually clean comparison of pricing behaviour in the two very-small number oligopoly cases of duopoly and monopoly. Second, the Tasman market is a laboratory for the study of competition between incumbent 'legacy' carriers and two quite different business models: low-cost carriers (LCCs) and long haul carriers exercising 5th Freedom rights.[2] And thirdly, these routes have been the setting for a series of intriguing competition cases, brought about by unsuccessful attempts on the part of the two incumbent legacy carriers, Air New Zealand and Qantas, to gain regulatory approval to cartelise their operations.

Given that these two airlines had combined market shares ranging from around 80% up to 100% over the routes on which they wished to join forces it may not seem surprising that their applications failed before the competition authorities. Rather, it might be surprising that the proposals were brought forward at all and that the airlines were willing to spend substantial sums of money prosecuting their case(s)

[1] The DB1 database provides a 10% sample of fares paid on domestic US routes over quarterly time periods. See, for example, Goolsbee and Syverson (2006).

[2] 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).

over a five year period.[3] Yet they did do so, and actually came quite close to succeeding, and the reasons for this will be a focus of the present paper.

The chronology of the competition cases runs as follows. In December 2002 Qantas and Air New Zealand jointly 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[4] all routes operated by either airline 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, given that all the affected routes involved operations in New Zealand. However, the 2004 rehearing (not appeal) before the Australian Competition Tribunal found in favour of the applicants in a Decision focused on the trans-Tasman routes deemed to be those of most concern to Australian interests, and, encouraged by this ruling, Qantas and Air New Zealand came back in April 2006 with a more restricted 'Tasman Networks Agreement' proposal, which again involved, in effect, the cartelisation of their operations, but now just those crossing the Tasman Sea. This plan was framed as a 'code share', and as such was put before the ACCC in Australia and the Ministry of Transport in New Zealand – not the NZ Commerce Commission, because under a special clause in the NZ Transport Act the Ministry was deemed to have jurisdiction over the matter. On November 3, 2007 the ACCC released a Draft Decision declining authorisation, for the usual reasons: that the plan would result in a substantial lessening of competition without sufficient

[3] A reasonable estimate would be that the two airlines between spent more than $US 40million, just on legal and consulting services, on presenting their two proposals.
[4] The Alliance, and the subsequent Tasman Networks Agreement, would have the two carriers jointly determining schedules, capacity and prices on the affected routes, whilst continuing to retain separate ownership of their planes, brands and other assets.

offsetting benefits.[5] The airlines withdrew their application on November 22, 2007, and at time of writing they continue to compete independently with each other on these and other routes.[6]

The essence of the airlines' case was that orthodox 'structural' measures (market shares) overestimate the market power of incumbents in air travel markets when these are subject to actual or potential competition from other airlines whose costs base allow them to undercut the incumbents on price.[7] On the Tasman routes, in particular, such competition would come from the LCC Pacific Blue, with lower overall costs, and also the 5th Freedom carrier Emirates, which, although a full-service 'legacy'-type airline, was able to price aggressively on the Tasman because revenue from these routes was only required to cover the marginal costs of supplying service.

This proposition was accepted by the Australian Competition Tribunal and was the basis of its decision in favour of the cartel: no significant lessening of competition to offset some efficiencies to be expected from the airlines rationalising their joint operations. The ACT in essence accepted the proposition put to them in Hearings by the airlines' experts, to the effect that competition for 'the marginal customer' was so keen that the cartel would be unable to profitably increase its fares

[5] Both Australian and New Zealand antitrust is based on benefit-cost analysis (net efficiencies), not on consumer or other interests (income distribution). A significant lessening of competition is not deemed undesirable because it transfers income from consumers to producers, but because it may result in allocative and other inefficiencies due to the restriction of output and/or lessening of incentives to produce at lowest cost. Such inefficiencies or detriments may be offset by benefits due to, for example, elimination of fixed costs made possible by the merger of two businesses.

[6] The Final Determinations on the Strategic Alliance proposal are referenced here as ACCC (2003) and NZCC (2003). The NZ High Court Decision is High Court (2004). The Australian Competition Tribunal Determination is ACT (2005). The determination on the Tasman Network Agreement is ACCC (2006). The NZ Ministry of Transport did not issue a decision or determination on the matter. All these documents, along with all the submissions, are downloadable from these organisations' websites.

[7] Note that these routes are unusually open to competition. 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

because any increase would result in loss of large numbers of these marginal customers to Pacific Blue and/or Emirates.

No direct empirical evidence was submitted in support of the marginal customer proposition[8], and nor was any such offered by those who opposed the cartel[9], and the first contribution of this paper is to close some of the empirical gap through econometric analysis of pricing of all carriers in two of the three markets affected by the original Strategic Alliance proposal.[10]

The new econometric results will also be put to use in developing the applied theory analysis of competition in these markets. In the hearings of the cartel case on the New Zealand side of the Tasman all parties made use of quantitative simulations, based on quite conventional Cournot-Nash oligopoly models, to predict whether loss of independent competition between the two largest carriers would significantly affect competition through higher prices. These models were empirically calibrated using assumptions and stylised facts about the airlines and the markets. Now we can sharpen the simulations by using econometrically justifiable values for key parameters

The paper proceeds as follows. The next section reviews econometric issues attached to the use of cross sectional data to infer the consequences of structural change in markets, and also reviews the economics of competition from low-cost carriers. 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

[8] In the Strategic Alliance case the airlines' consultants brought forward econometric analysis of pricing in US, European and Australian air travel markets. Perhaps moved by criticism of the lack of local content in their case, the airlines commissioned one of their experts, Dr Michael Tretheway, to conduct econometric analysis of time series air fare data for the Tasman routes, and presented this as part of their submissions in support of the "Code Share" proposal. The ACCC independently analysed the same data. The results will be noted below.

[9] The writer made independent submissions opposing both the 'Strategic Alliance' and the 'Tasman Networks Agreement'. I also appeared as an expert on behalf of Gullivers Pacific, a New Zealand-based corporate travel agency which submitted against the proposals.

[10] The third route affected was Auckland-LAX, then and now operated as a 'cosy duopoly' by Air New Zealand and Qantas, on behalf of their respective Star Alliance and Oneworld alliance partners.

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.

2.0 Econometric and Economic Issues

2.1 Impact of merger or cartel on pricing

The econometric analysis will be directed towards assessing the likely impact on prices of the, in effect, merger of Qantas and Air New Zealand's flight marketing operations, with particular interest in the extent to which this impact would be affected by competition from 5th Freedom and/or low cost carriers. A standard approach here would be to find some markets in which the two airlines compete with each other, and some other markets in which only one of them operates, as well as markets in which either or both face new competition from Emirates and/or Pacific Blue and look for evidence of significant price differentials associated with the different market structures, having controlled for any other relevant factors. In principle, the differences in structural competition could be observed over time, as a carrier enters or exits a route, and/or across different routes in a particular period of time.

In both cases, it is key that structure -- the number of competitors – be not endogenous to the dependent variable, price. If, for example, the Air New Zealand monopoly on a number of domestic NZ routes is sustained by prices set low specifically to deter Qantas from entering, then obviously those prices would underestimate the likely prices to be set by the two airlines operating together as a monopoly cartel.

Most previous econometric work on airline pricing has used US data, and most has not explicitly considered the endogeneity issue. For example, Borenstein's (1989) classic cross sectional study of the link between airfares and 'hub dominance' takes the number and market shares of carriers operating out of each airport as exogenous[11]. As for time series analyses: two papers looking at pricing before and after airline mergers (Kim and Singal, (1993); Morrison (1996)) take the merger event itself as a given.[12]

Of course, an untested assumption is not thereby necessarily wrong, and there may be little reason to expect airline route structures to be price-endogenous. Market size and costs of supply determine how many airlines can profitably operate on a route, and if this information is well known incumbents' pricing would not necessarily or even likely be aimed at influencing structure. An interesting recent paper by Goolsbee and Syverson (2006) is instructive here. These authors find that the probability of eventual entry onto a route by the LCC Southwest Airlines is sharply increased by its presence in both airports at either end of the route, and that incumbent carriers cut their fares on the route significantly when they become aware of the increased likelihood of Southwest's entry (ie, well before actual entry occurs). But this is not, as one might presume, manifestation of 'strategic' entry deterrence behaviour, but instead appears to be simply anticipation of the (inevitable) post-entry pricing equilibrium on the part of the incumbents, who may wish thereby to secure the loyalty of their business customers.[13] That is, there is a strong element of exogeneity

[11] Note that 'hubs' (and spokes) are not a market structure factor in Australasia, where the major airports of each country are more or less laid out along (one-dimensional) lines, not scattered over a (two-dimensional) grid, as in the US.

[12] Using studies of actual mergers to predict the outcome of a proposed merger is problematic, especially in the vigorous antitrust environment of the United States, because the sample of observed mergers excludes proposals that failed to go ahead because they were judged to be anti-competitive.

[13] Note that the price-cutting by incumbents implies that they have some excess margin to squeeze. Goolsbee and Syverson find that the price cuts tend only to occur in more concentrated routes.

about the changes in market structure, at least if we take as given the decisions by Southwest to set up operations in a particular airport.

Also relevant in this connection is the recent paper by Bitzan and Chi (2006), which is able to used lagged values as instruments for exogenous variables in a model of US airfares, and reports little difference between the 2SLS estimates using these instruments, and OLS.

The domestic New Zealand and trans-Tasman databases deployed in the present paper are panels, covering short periods of time over which no structural changes occurred and for which instrumental variables cannot be constructed. Can we reasonably take the cross sectional variability in the degree of competition on routes to be exogenous with respect to price? Consider the two sub-markets separately. Inside New Zealand, we have a sample of eight routes, four served only by Air New Zealand; four a duopoly with Qantas. On none of these routes did these carriers face any significant additional competition.[14] On the four duopoly routes there appears to be barely room for two carriers to operate profitably[15], and indeed Qantas has announced its exit, effective March 2007, from one of these (Wellington-Christchurch), citing 'competition and market demand'. There has been some talk from time to time of the Virgin LCC subsidiary Pacific Blue operating domestically in New Zealand[16], but it is very likely a reasonable assumption that price setting in these markets over the period studied was not influenced by the possibility of feedback effects on the probability of third-party entry.

[14] A small regional carrier, Origin Pacific, did at the time of the sample offer some service on some of these routes. This service does not appear to have been competitive with the larger carriers; nor, indeed, profitable -- Origin went out of business in 2006.

[15] Ansett, which was the domestic competitor to Air New Zealand under various corporate guises from 1987 to 2001 (when the stand-alone operation Ansett NZ went into liquidation) is believed to hardly ever have made a return on capital in the domestic NZ market.

[16] Most recently in January 2007, by the airline's volatile founder, Sir Richard Branson. Air NZ in this month rolled out an extensive program of fare decreases on its domestic NZ routes, for which it gave as one rationale the deterrence of new entry ('Fares cut to deter Branson', *NZ Herald*, January 20, 2007)

As for the four Air New Zealand monopoly routes, these are all 'regional', between a main centre and a smaller town or city (Dunedin, Wanaka, Napier), with traffic flows unlikely to support a second carrier. This is especially the case given that Qantas has no on-the-ground presence at any of these regional airports and would also have to set up a new fleet of smaller turboprop planes to service them economically.[17]

That is, it is reasonable to assume, in particular, that Air New Zealand's pricing on its monopoly routes is not constrained by the threat of competition, and so can be taken as indicative of the pricing behaviour that would be observed on current duopoly routes were these cartelised.

Turning to the Tasman routes, here the exogeneity issue is not quite so clear-cut. Given the geography of the region and the status of Air NZ and Qantas as their home countries' national carriers, there is little doubt that both of them will always serve all the routes linking the three major cities of each country, though this is evidently not so for the thinner routes involving Adelaide and Perth. The exercise of 5th Freedom rights by Emirates and other international carriers, to carry trans-Tasman passengers on sectors of journeys linking Australian and New Zealand with Dubai and other long-haul destinations, appears to be not very costly and is always taken up. So their presence can be taken as exogenous, too.

The possible problem is with the LCC Pacific Blue, set up as a subsidiary of Virgin Blue (which flies within Australia) to serve Tasman (and some Pacific Island) routes to and from New Zealand. Pacific Blue entered in 2004 from a base it set up, as far from Auckland as possible, in the second largest NZ city, Christchurch, where it was made very welcome by the city and airport. It has been notably cautious about

[17] The four routes on which Qantas flies are all between two airports from both of which the airline also flies across the Tasman to Australia, and are all flown with B737 jet aircraft. Qantas does also service one tourist route (Wellington-Rotorua) on which it does not fly internationally out of both airports (ie, not out of Rotorua).

expanding its route network, and in particular does not serve the largest market, Auckland-Sydney. Pacific Blue's decision to (thus far) avoid head-to-head competition with Air New Zealand, Qantas and Emirates in this important market may reflect some concern with a possible aggressive response from the incumbents if it should enter. But even if this were so, given the speed with which airfares can be adjusted there is no particular reason to expect that *current* fare structure to be affected.

Finally, note that the Australian Competition Tribunal determined that there is no significant likelihood of entry into the trans-Tasman market by any airline not currently operating there[18], and, indeed, an important part of the airlines' rationalisation of the so-called Code Share proposal was that Tasman routes are currently oversupplied with capacity, in terms of the number of seats that can be profitably offered.

2.2 Impact of Low Cost Carriers

There is no doubt that the innovation of the Low-Cost Carrier business model in the United States, in particular by its most successful exponent, Southwest Airlines, had a dramatic – even, traumatic -- effect on airline competition and pricing in that country. Studies by, for example, Dresner *et al.* (1996), Morrison (2001) and Goolsbee and Syverson (2006) convincingly document that the entry or likely entry by Southwest onto many U.S. routes has resulted in cuts in the prices charged by the incumbent 'legacy' carriers of up to 40%.

But, we can note now a number of differences in the situation now in the Australasian markets that might weaken the impact of Pacific Blue, compared to, say,

[18] 'We do not foresee a *de novo* committed long-term entrant in the trans-Tasman air passenger services market that could constrain the applicants as being a realistic likelihood over the period of authorisation, being the next five years.' (ACT 2005 para 416).

the historical impact of Southwest in the US. These differences are partly because conditions have changed, and partly because the situation has always been different in this part of the world.

First, and unsurprisingly, many legacy carriers have responded to the competitive threat of LCCs, 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 imposed 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 -- and 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 second reason to expect less of an impact from the LCC business model in this part of the world is that Air New Zealand and Qantas, which have always earned most of their revenue from international travel, are more cost competitive operators than are or 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.[19]

We can also note as possibly relevant some 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 Australia, in 2001. This is reviewed in the NZCC's Final Determination (2003 at paragraph 531). The airlines' consultants Professor Morrison and Dr Winston found that Qantas's fares tended to be about 6% lower in markets it had shared with Ansett, and 10% lower if it was competing with Virgin. Professor Hausman (as a consultant for parties opposed to the cartel) 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.

As noted above, the second "Code Share" proposal did bring forth some direct econometric analysis of the Tasman markets. The airlines supplied confidential data on their average fares on the nine major Tasman routes between 1999 and 2006 to the ACCC and to their own consultant Dr Tretheway. While it is understandable that the data would remain confidential, it is less obviously justifiable -- and certainly disappointing to the independent analyst -- that even the econometric results were also kept secret, with only summaries offered in the Public versions of ACCC (2006) and Tretheway (2006). The ACCC's report on their own econometric analysis is particularly terse (2006, paragraphs 9.50-9.56). The 'bottom line' appears to be that

[19] It is noteworthy that Virgin Blue has moved away from a pure LCC model in order to reduce the disadvantages it faces. It has introduced a Frequent Flier Program, has airport lounges, access to more spacious seating at a premium, boarding passes and connecting itineraries with the checked-through baggage.

the entry of Pacific Blue and/or Emirates was associated with airfare reductions by Air New Zealand and Qantas in the range 6-12%. While clearly falling short of *force majeure* status, these effects are larger than would be predicted by a conventional oligopoly model, and will be discussed below in Section 5.

3.0 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, though not on the direct trans-Tasman routes.

3.1 The sample

The data collected for this study cover 1001 different flights. For example, Qantas flight number 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.[20]

[20] 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.

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 Melbourne, Sydney and Brisbane on the one side of the Tasman, and Christchurch, Wellington and Auckland on the other side, plus Auckland/Adelaide, Auckland/Perth and Perth/Auckland.[21] These routes were observed for three Wednesdays: June 29, July 6 and July 13, in 2005. The Appendix lists all the routes and the airlines serving them.

In total, our database has information on 29 directional routes, with 104 flight numbers observed on up to eight different flight dates 2004/05[22], and 86 flight numbers observed on three different Wednesdays around July 2005.[23] The airlines whose flights are observed include, in addition to the major carriers Qantas and Air New Zealand[24], 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.[25]

3.2 Prices

[21] At this time there was no direct service from Adelaide to Auckland.
[22] Not all the domestic NZ flights were operated on all eight flight dates.
[23] The Auckland to Sydney flights were observed in both samples.
[24] But not Air NZ's subsidiary LCC, Freedom Air, which flies mainly out of smaller NZ cities.
[25] Table 1 shows that Aerolineas Argentinas, Garuda, Lan Chile and Royal Brunei each had less than 1% of the total trans-Tasman market in terms of seats. Thai had 1.8%, and has now exited the 5th Freedom market 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, and since some of their seats are of course filled by long-haul passengers. 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.

Key, of course, to this study are the new price data. As noted above, the relatively rich literature on pricing in US airline markets has been spawned by the fortuitous availability of an excellent database: the Department of Transportation's DB1 datasets covering random samples of 10% of all domestic airline tickets sold. There is, unfortunately, no similar database on prices paid available for the Australasian routes focused on here. But now, in the Internet age, it is possible for anyone to freely gather good data on prices *offered* -- from the airlines' own websites, either observed directly or indirectly through a travel agency site.[26] And the information on the Australasian sites is transparent, ever since the innovation by Air New Zealand 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 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

[26] 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).

weekly.[27] 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 the 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 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.

Price dispersion of airfares is an interesting topic in itself, but in the present paper we will focus on the mean or average price paid. We have as precedent most of the US studies using the DB1 databases[28], and as some theoretical justification the results of Hazledine (2006) to the effect that in a linear Cournot-Nash oligopoly setting, the average price charged in an n-firm oligopoly is not affected by the extent of price discrimination (number of different fares offered over time).

In the absence of information on the number of tickets sold at each price, the dependent variable for our model is constructed as a weighted mean of the 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 in kilometres to make different routes comparable. The weights are larger for the observations

[27] However it appears that fares are normally adjusted about once a week up until the last week, when they will be re-evaluated daily.
[28] Eg Goolsbee and Syverson (2006). Borenstein (1989) is an exception: he estimates pricing equations for the 20th, 50th (median) and 80th percentile fare paid.

closer to the flight date, dependent on the proportion of passengers travelling on business, since it is generally known that business travel tickets are mostly purchased within the last two weeks before flight date. Of course it would be better to have direct information on the weights, but I can report that the econometric results for models using the unweighted mean as the price variable do not differ substantially from the results to be reported below, so it seems that, as is often the case, the choice of weights seems to be not critical to the results.

Note that, even after aggregating the nine observations on each flight's fare, 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.

3.3 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, of which the most widely used is the Hirschman-Herfindahl index (HHI), defined in theory 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 actually 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 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. HHI measures based on both flights and on seats were computed, and turned out to give very similar results. We can 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.

The main exception is provided by the 5th Freedom carriers, with their large, wide-body aircraft. It is a quite important issue of course just how effective is the competitive constraint imposed by the availability of all these seats, and regression results will be reported with the HHI measured including and excluding the seat capacity of the minor 5th Freedom suppliers (that is, all of them bar Emirates, whose seats are always included).

The flight frequencies and resulting HHI numbers are shown in the Appendix. There were seven monopoly routes (HHI = 1): four in New Zealand, plus Auckland-Adelaide, Perth-Auckland and Auckland-Perth. 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)[29]. Christchurch-Melbourne and Auckland-Brisbane were two routes on which all four airlines provided service.

3.4 Flight costs

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).

The non-stop flight distance (DIST) is a readily available number and is very commonly used as the major or even only cost proxy in airline pricing studies. An obvious limitation on its accuracy is that flight distance on a given route is the same for all airlines supplying that route, but their actual costs may differ according to type of equipment used, wages paid, and other factors that are not necessarily uniform across carriers and routes. Therefore, we will also show results using, instead of distance, a direct measure of each airline's route flight costs (RCOST) built up from industry data on the cost per 'block hour' of each aircraft type, aggregated using seat capacity as weights in the cases where a particular airline operates more than one type of aircraft on a single route. This measure of costs has its own limitations, in particular on the relatively short domestic NZ routes where it may, for example, underestimate the costs of flying B737 jets on routes such as Wellington-Christchurch and Christchurch-Queenstown on which even turboprop aircraft spend less than one hour in the air. Bitzan and Chi (2006) report that the turboprop aircraft operated on

[29] The minor 5th Freedom carriers were also operating on the Auckland-Sydney or Auckland-Melbourne routes.

regional routes are cheaper to operate than jets of the same seat capacity, so that *a fortiori* they would be cheaper than larger B737 aircraft.

3.5 Other data

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[30] (though not, of course, for the domestic NZ routes). Here, the variable (UTIL) is calculated for the month of July 2005, which approximately matches the period over which the trans-Tasman prices were observed, and for November and December 2004 and 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. We will see results with and without the fringe 5th freedom carriers included in the measurement of utilisation rates.

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. 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 very short-haul domestic NZ flight leaving at a peak-period time for business travellers. 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.

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

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, PBLUE: each taking the value of one if the flight is operated by that airline

4.0 Econometric Model

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

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

Where X is the cost variable. For small values of the exponential coefficients, these can be read-off as percentage differences. The model is estimated on the EViews 5.1 package, using the EGLS option for estimating panel databases with random cross sectional coefficients. The cross sectional identifier is the flight number.

Results are shown on Table 2. The model is shown first estimated on the whole sample of 1001 weighted price observations, and then for the Tasman (346 observations) and domestic NZ (655 observations) sub-samples. Here we will examine the results variable by variable.

As usual in econometric airline pricing models, route distance (DIST) is extremely successful, and, interpreted as a cost variable, its coefficient in the full-sample regressions (columns 1-3) implies that doubling the length of a flight adds around 60% (1-0.4) 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, 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 0.6 seems plausible.

It should be noted that distance is used in the denominator of the dependent variable, which is defined as price per seat-kilometre, so that there will be some bias towards a spurious negative coefficient on the variable as a regressor. This bias may account for the size of the coefficient in absolute value increasing when the sample is partitioned -- ie, getting closer to -1 -- even though the t-statistics get smaller. Note that all the trans-Tasman routes are much longer than all the domestic NZ routes, so the partition inevitably loses variability of the DIST variable, which is the likely explanation of the loss of significance

Columns 4, 8 and 11 show the model with the distance variable replaced by our explicit measure of each airline's costs of serving each route. For the full sample, this variable performs as well statistically as the simple distance proxy for costs, but no better, and its coefficient is "too small" – we would expect, *ceteris paribus*, a coefficient close to 1, unless there is some theoretical reason why higher cost routes would have lower price-cost markups.[31] The RCOST variable is not a success for the

[31] Higher costs could push the airlines further up the demand curve, into the more elastic region where profit-maximising markups are indeed lower.

Tasman-only sample (column 8), most likely because there simply is not enough variance in route costs across the various trans-Tasman routes.

From a policy point of view, the most interesting variable is the HHI measure of structural competition. Columns 1 and 2 differ only in whether HHI includes or excludes flights offered by the minor 5th Freedom carriers on the Auckland-Sydney and Auckland-Melbourne routes. We see that there is a noticeable improvement in the t-statistic when these flights are excluded, which implies that, indeed, these airlines are not providing any significant competitive constraint to the pricing of the major carriers. Therefore, we will settle on the HHIflightX5 measure.[32]

We will consider the importance of structural competition together with the coefficients on the three airline dummy variables. These are all negative, significant and quite large, implying that each of these three carriers sets its lowest prices at a considerable discount to the fourth airline, Air New Zealand. Comparing columns 2 and 3, we see that, although other coefficients are not affected, that on HHI increases by about one third when the airline dummies are not used. This is not unexpected, given that routes with a lower HHI are those on which Air New Zealand faces competition from one or more of the other three airlines, and that the prices charged by these airlines tend to be lower. That is, in this market, the coefficient on HHI in a model without allowing for airline-specific pricing effects overestimates the effect of concentration on price.

Interestingly, comparing columns 2 and 4, we see that only the coefficient on the EMIRATES dummy is much smaller when differences in costs across airlines are allowed for (which of course the DIST variable does not do). That is, perhaps a quarter of the more than 30% price differential between Emirates and Air New

[32] There is no significant difference between using flights or seats as the basis for measuring supply.

Zealand can be associated with lower flying costs of the 5th Freedom carrier on the Tasman routes. Cost differentials are not a significant factor in explaining the lower prices charged by Qantas and by Pacific Blue.

Examining the airline dummies for the sub samples, we see that the Qantas price discounting relative to Air New Zealand is particularly marked on the domestic NZ routes. The differential is actually underestimated in real terms because Qantas offers frequent flier points and hot food with all its fares. Air New Zealand doesn't bundle these features into its lowest-price fare class.

Returning to the HHI, the results for the full sample suggest that its likely coefficient is in the range 0.3-0.4, which is fairly consistent with Cournot-Nash behaviour, as we will see in the next section. This range encompasses the estimated coefficient on HHI for the trans-Tasman sub-sample, but only when distance is used to control for flight costs (compare columns 6 and 8). When route costs are used, the size and significance of the concentration variable is completely wiped out. There seems to be an outlier effect from the small number of monopoly flights (between Auckland and Adelaide and Auckland and Perth), which are also the longest flights in terms of distance.[33]

The domestic NZ routes have a better balance between monopoly (Air New Zealand) and duopoly flights, and also of distances travelled. The model with DIST has a large and strongly significant HHI coefficient (column 10), which reduces sharply when the direct cost measure RCOST is used in place of distance (column 11). This is because the monopoly routes are such because they are 'thinner' in terms of market size, which results in Air New Zealand making greater use of smaller turboprop aircraft on these routes. Turboprop aircraft have higher block-hour

[33] When the column 6 model is estimated without the nine monopoly observations, the size and significance of the HHIflightsX5 coefficient disappear.

operating costs than Boeing 737 jets. The result here is consistent with the findings of Bitzen and Chu (2006) explaining the higher prices charged on smaller regional routes in the United States as a mix of market power and cost factors.

However, we should note that block-hour based measures will underestimate the cost of operating B737 aircraft on the very short (less than one hour flying time) routes such as Wellington-Christchurch and Christchurch-Queenstown on which Qantas competes with Air New Zealand.

To summarise the findings on competition and prices: it seems quite clear that prices are significantly lower on routes on which Air New Zealand and Qantas compete with each other than on routes where they don't. Some of the price difference should probably be attributed to higher costs of operating some monopoly routes. There is no evidence that additional competition on some Tasman routes from Pacific Blue and/or Emirates has an effect on market prices, apart from the lower prices charged by these airlines for their own seats. There is certainly no evidence in support of the Australian Competition Tribunal's key proposition that competition 'at the margin' would spread the low LCC and/or Emirates fares right across the market.

As for those lower prices of Pacific Blue and Emirates, these indicate, in conjunction with the rather small market shares achieved by these carriers, that in the minds of travellers the product offered is inferior to that supplied by Air New Zealand. The reason for 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. Such include: flight frequency, network connectivity at either or both ends of the Tasman flight, frequent flier

programs, links with global alliances, national carrier advantages on the ground (eg with tourism promotion), and perhaps national carrier loyalty on the part of many customers. These factors can also explain Air New Zealand's stronger position -- in terms of the prices it can charge -- relative to its main rival Qantas. The New Zealand carrier has a much better network, as well as home-team advantage, on its domestic routes, and it has a larger trans-Tasman customer base, since more New Zealanders travel between the two countries than do Australians, notwithstanding the disparity in population size between the two countries.

The other four variables used in these regressions demonstrate that differences and/or shifts in market demand have a significant impact on pricing. The coefficient on PEAKDUM implies that average fares on short-haul (within NZ) business peak-time flights are more than 70% higher than fares at other times, other things equal (exp0.55 =1.73). 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 three weeks the coefficient on the XMAS dummy implies they are able to earn a price premium of around 28%, despite the loss in business traveller traffic.[34]

For the Tasman market we can calculate monthly capacity utilisation, measured as the ratio of passengers carried to seats flown, at the route level (ie, not route and airline) using the Australian BTRE database. Columns 5 and 6 show the results, comparing alternative measures that do and do not include the passengers and seats of the minor 5th Freedom carriers: UTIL and UTILX5. We see that the latter performs better, consistent with the finding from columns 1 and 2 to the effect that the smaller 5th Freedom operators are really not a significant competitive factor in the market.

The coefficient on UTILX5 is large and significant. It implies, 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 the airlines serving that route by about 4.5% (and, of course, profitability by much more than that).

5.0 Applied Theory

In this section we will use the econometric results, along with other data, to calibrate a quantitative oligopoly model of a representative Tasman route, and then calculate the implications of this for the 'What if?' question of interest to regulators faced with proposals that would eliminate some competition between the largest airlines. A key issue will be the extent of the competitive threat to the large legacy carriers posed by the fringe operators, Pacific Blue and Emirates. The basic idea here is to establish what "theory" or model, based on rational profit-seeking behaviour, can make sense

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

of the "facts" as observed or econometrically estimated, and then to ask this model to predict how the facts or market outcomes would differ if the nature of competition between the airlines were to change.

5.1 Cournot conjectures

We build a linear Cournot-Nash quantity-setting oligopoly model with differentiated products (Hazledine *et al*, 2003; Hazledine, 2003; 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 for their clients Air New Zealand and Qantas. 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* (2003) 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, 2003) 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 was certainly a cornerstone of the airlines' 2006 "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.

5.2 Product substitutability

Although the econometric results suggest that each of the four main airlines servicing trans-Tasman routes is to some extent differentiated from each of the others in terms of the products offered, it is a reasonable and computationally very useful simplification to model outputs of the two legacy carriers Qantas and Air New Zealand as being perfectly substitutable with each other, but differentiated from the product of either Pacific Blue or Emirates. And, our model will have just one of these two carriers in competition with Qantas and Air New Zealand. This is actually 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 will continue to ignore the other 5th Freedom carriers, whose market shares were very small, as noted above.

5.3 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):

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

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

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 the 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 legacy firm *i* is taken as linear in output:

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

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 for costs.

Legacy firm *i's* profit function is:

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

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

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

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

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)):

$$a - 2bq_i - bq_j - kq_F - c_i = 0 \quad \text{(legacy carrier } i\text{)} \qquad (6)$$

$$a - 2bq_j - bq_i - kq_F - c_j = 0 \quad \text{(legacy carrier } j\text{)} \qquad (7)$$

$$\alpha - 2\beta q_F - kq_i - kq_j - c_F = 0 \quad \text{(fringe carrier)} \qquad (8)$$

5.4 Calibration of the model

Equations (6), (7) and (8) can be solved for the Nash Equilibrium in quantities and thus prices. Then, we need to replace the algebraic symbols by actual or estimated numerical values for a representative trans-Tasman route. Beginning with outputs, we take from Table 1 and the Appendix the stylised fact that on a typical market Air New Zealand, Qantas and either Emirates or Pacific Blue have market shares of around 40%, 40% and 20%.[35] 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[36], 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

[35] 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.

[36] 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).

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 legacy levels[37], 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.[38] 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.

5.5 Simulation analysis

[37] 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%.

[38] 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.

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 of Table 3 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 quite close to what the full sample econometric results found to be the consequences of Qantas not serving a market, so that Air New Zealand was left with a monopoly.[39] 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. This is the difference between 20% (column 3/4) and 18% (column 2/1).

[39] Monopolising a symmetric duopoly changes the HHI by 0.5 (=1.0-0.5). The coefficients of HHI from regressions 2 and 4 (with the different cost measures) are around 0.35. The exponential of 0.5x0.35 is 1.19, implying a 19% price increase from monopolisation.

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). 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. The small impact of the fringe on legacy fares may be surprising, and it indeed appears to be less than the 'actual' impact of the entry of Pacific Blue and Emirates in 2003-04, which from their analysis of the 1999-2006 times series data the ACCC (2006) report to have been associated with a 6-12% decrease in Qantas and Air New Zealand fares, as noted above in Section 2.2.

The larger fare impact is consistent with the increase in the total number of seats available in the market, due not just to the new carriers, but also to a 6% increase between 2004 and 2005 in the number of seats supplied by Air New Zealand (ACCC, 2006, p28, para 5.26). More seats supplied require a lower price to clear the market. But then this at once forces the question: *why* did the incumbents increase capacity, rather than (to an extent) pull seats off the market, as our Cournot-Nash model predicts they rationally should do when a new competitor enters?

Earlier research into behaviour on the trans-Tasman routes (Hazledine *et al*, 2003) has revealed episodes of aggressively competitive behaviour by Air New Zealand and Qantas, each of whom seems to feel a sense of 'ownership' about the Tasman market. Such may have been a factor in the reactions to Pacific Blue and/or Emirates. If so, then the standard model will likely *under*-estimate the impact on price of elimination of competition between the large incumbents, because they would be coming to the collusive outcome from an even lower starting price structure. Be this as it may, analysts should be aware of the possible limitations of the, in effect, single-

period equilibrium approach to oligopoly modelling in real-world situations in which the participants may have longer-term or "strategic" justifications for their behaviour.

6.0 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 significantly 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 neither has achieved more than single-digit market shares overall. This outcome 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.

The policy implications are most relevant for the trans-Tasman routes, which were the key markets at stake in the various hearings of proposals by the legacy carrier incumbents Air New Zealand and Qantas to in effect cartelise their operations. Without wishing to overstate the case, the combined empirical and applied theoretical results developed in this paper do at the very least demonstrate just how difficult it is within a conventional oligopoly modelling framework to support propositions that

competition from the 'fringe' carriers Pacific Blue and/or Emirates would effectively constrain a legacy carrier cartel from significantly raising air fares across the Tasman. In an important sense this difficulty is the greater given that the fringe carriers are currently actually operating in the market. Were their presence only potential, it might be possible to make impressive claims for the effectiveness of their competitive constraint on the incumbents. It would be hard to prove such claims, but it might be hard to disprove them too. But both Pacific Blue and Emirates actually have entered the Tasman market, and thus have had to "reveal their true colours". And on the basis of their actual performance -- specifically, quite small market shares achieved despite substantially lower prices charged -- we have not been here able to justify the rather rose-tinted view of competition in the marketplace put forward by the proponents of the cartel.

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Table 1: 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
100%	0.4%	36.0%	8.5%	10.0%	0.3%	0.6%	6.6%	35.0%	0.8%	1.8%

TABLE 2: REGRESSION RESULTS: dependent variable log(PWAVK)

	1	2	3	4	5	6	7	8	9	10	11
	All routes				Tasman routes				NZ routes		
constant	5.577	5.481	5.454	3.974	7.078	6.348	6.876	2.473	5.792	5.896	3.986
t-statistic	*30.7*	*31.0*	*28.4*	*39.6*	*7.5*	*6.9*	*6.8*	*6.2*	*20.1*	*22.3*	*33.2*
log(DIST)	-0.399	-0.394	-0.410		-0.661	-0.586	-0.678		-0.486	-0.478	
t-statistic	*-18.1*	*-18.8*	*-18.1*		*-5.2*	*-4.8*	*-5.1*		*-11.1*	*-12.0*	
log(RCOST)				0.628				0.208			0.548
t-statistic				*19.0*				*1.3*			*12.8*
HHIflights	0.280										
t-statistic	*3.8*										
HHIflightX5		0.368	0.496	0.348	0.322	0.399	0.607	0.012	0.668	0.511	0.227
t-statistic		*4.6*	*6.0*	*4.4*	*2.1*	*2.7*	*3.8*	*0.1*	*5.8*	*4.6*	*2.1*
PEAKDUM	0.550	0.546	0.554	0.582					0.543	0.538	0.548
t-statistic	*13.4*	*13.4*	*13.2*	*14.3*					*12.9*	*13.1*	*13.5*
SOLDDUM	0.175	0.174	0.170	0.158	0.082	0.070	0.072	0.056	0.215	0.216	0.213
t-statistic	*7.5*	*7.5*	*7.3*	*6.9*	*2.5*	*2.1*	*2.1*	*1.6*	*7.4*	*7.5*	*7.4*
XMAS	0.246	0.245	0.248	0.260	0.401	0.372	0.385	0.399	0.215	0.214	0.215
t-statistic	*14.3*	*14.2*	*14.3*	*15.1*	*9.4*	*8.6*	*8.6*	*9.1*	*11.6*	*11.6*	*11.6*
UTIL					0.799						
t-statistic					*5.2*						
UTILX5						0.889	0.936	0.860			
t-statistic						*5.7*	*5.5*	*5.0*			
QANTAS	-0.163	-0.158		-0.176	-0.099	-0.093		-0.076		-0.222	-0.229
t-statistic	*-4.9*	*-4.8*		*-5.5*	*-3.2*	*-3.2*		*-2.3*		*-4.0*	*-4.3*
PBLUE	-0.233	-0.210		-0.213	-0.290	-0.269		-0.298			
t-statistic	*-2.5*	*-2.3*		*-2.3*	*-4.1*	*-4.0*		*-3.9*			
EMIRATES	-0.319	-0.306		-0.240	-0.250	-0.255		-0.246			
t-statistic	*-4.2*	*-4.1*		*-3.2*	*-4.4*	*-4.7*		*-3.6*			
weighted R2	0.559	0.564	0.542	0.564	0.431	0.412	0.461	0.450	0.577	0.594	0.603
unweighted R2	0.780	0.784	0.764	0.785	0.444	0.452	0.381	0.417	0.579	0.616	0.633
number obs'ns	1001	1001	1001	1001	346	346	346	346	655	655	655

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: NUMBER OF DAILY FLIGHTS & HIRSCHMAN-HERFINDAHL INDEX

		daily flight frequency				
Route	total flights	AirNZ	Qantas	Emirates	PacificBlue	HHI
Auckland-Adelaide	1		1			1.000
Auckland-Brisbane[1]	6	3	1.5	1	0.5	0.316
Auckland-Melbourne[1]	6	3	2	1		0.345
Auckland-Perth[1]	1	1				1.000
Auckland-Sydney[1]	12	5	6	1		0.414
Christchurch-Brisbane[1]	3	1	1		1	0.344
Christchurch-Melbourne[1]	3.5	1	1	1	0.5	0.285
Christchurch-Sydney[1]	4.7	2	2		0.7	0.451
Wellington-Brisbane[1]	2	1	0.5		0.5	0.372
Wellington-Melbourne[1]	2	1	1			0.505
Wellington-Sydney[1]	4	2	2			0.501
Auckland-Dunedin	11	11				1.000
Auckland-Napier	11	11				1.000
Auckland-Queenstown	10	6	4			0.520
Auckland-Wanaka	1	1				1.000
Auckland-Wellington	25	18	7			0.597
Christchurch-Queenstown	8	6	2			0.625
Christchurch-Wanaka	1	1				1.000
Wellington-Christchurch	16	14	2			0.781

1: these routes have the shown number of flights operating in each direction in the database
2. HHI is the HHIfilghtX5 measure used in the econometric model