Competition Policy for the Trans-Tasman Air Travel Market: The 2005 ACT Decision and its Implications

by

Tim Hazledine

Department of Economics
The University of Auckland
t.hazledine@auckland.ac.nz

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ABSTRACT
Qantas and Air New Zealand are seeking regulatory authorisation for a Tasman Networks Agreement that would in effect cartelise their trans-Tasman operations. They cite in support Reasons given by the Australian Competition Tribunal in its authorisation of their previous application to form a 'Strategic Alliance'. The ACT determined that a cartel-like arrangement between these airlines would not substantially lessen competition across the Tasman because of competition from Pacific Blue and Emirates, despite the latter's very small current market share on these routes. This paper examines the ACT's reasons and finds them lacking in economic logic, as well as being inconsistent with the facts of airline market competition in Australasia. The paper suggests that the ACT is not an appropriate forum for hearing civil matters such as this, and proposes an alternative process based rather on the present procedures adopted by the competition commissions of Australia and New Zealand

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1. Introduction

In April, 2006, Qantas and Air New Zealand sought regulatory approval for a near-merger of their flying activities across the Tasman Sea. This proposed 'Tasman Networks Agreement' is the latest in a series of interesting and unusual competition and policy events in the Australasian aviation industry that go back at least to the 1996 'single aviation market' agreement (SAM) between the Australian and New Zealand governments (Hooper and Findlay, 1998).[1]

Perhaps most notable was the controversial 2002 proposal, by the same two airlines, that they be permitted to form a 'strategic alliance', which in effect would have cartelised all the markets served by both of them (as well as some currently served only by Air New Zealand). This proposal was firmly rebuffed by both the ACCC and the NZ Commerce Commission (2003), and the decision of the latter was upheld in the NZ High Court (2004). In Australia, however, the airlines' case was taken on to the Australian Competition Tribunal – as a re-hearing, not an appeal – and there it succeeded.[2]

The essence of the ACT's Decision (2005) was two-pronged: first, that the only market currently or potentially served by Air New Zealand that is of significant concern to Australians is the trans-Tasman market, and, second, that permitting the applicants to operate their cartel on that market would not result in a substantial lessening of competition, notwithstanding their combined market share totalling 80% or more.

Their success before the ACT – even though this was not sufficient to negate the effective veto of the NZ High Court[3] -- no doubt encouraged the two airlines to develop their current proposal, which is limited to trans-Tasman routes. And, understandably, their submission in support to the ACCC[4] (TNA, 2006) draws heavily on the substance of the ACT Decision. There is some risk to this, though, as it must now put the spotlight on the Tribunal's reasons and reasoning. Do these stand up to serious scrutiny?

The purpose of this paper is to explain and evaluate the ACT determination that competition in the Tasman market would be not significantly lessened by eliminating competition between the two largest suppliers of air travel services on those routes. It is interesting and important to do this for at least two reasons: the Decision is a matter of current policy concern because it is being recycled by the airlines in support of

[1] The SAM was expanded into an ASA (Air Services Agreeement) between Australia and NZ taking effect in 2000 and formally ratified in 2002 (ACT 2004, at para 79).
[2] The author of this paper was involved at all stages of this case: first with an independent submission to the ACCC and the NZCC (Hazledine, 2003), then in collaboration with the NZ Institute of Economic Research on behalf of Gullivers Pacific Travel in submission to the Hearing held by the NZCC, and then for Gullivers in submission and testimony before the ACT and the NZ High Court. I opposed the cartel proposal.
[3] For obvious reasons, authorisations of arrangements that might affect commerce between Australia and New Zealand normally need approval from both sides of the Tasman.
[4] And to the Minister of Transport in New Zealand. Owing to an oddity in the NZ Aviation Act (1990), deemed 'code-shares' are to be approved by the Minister of Transport and are exempt from the provisions of the Commerce Act under which the NZCC operates.

their TNA proposal, and the Decision, if valid, could have quite far-reaching implications for the appraisal of competition concerns in other markets apparently dominated by a pair of large suppliers. The paper will not consider in any depth the ACCC, NZCC and NZ High Court determinations, partly because there simply isn't space here to do them justice, but also because their carefully considered finding, with respect to the Tasman market, that a cartel-like arrangement between two suppliers holding a combined market share of 80% or more would be likely to substantially lessen competition is an unsurprising, mainstream judgement. It is the ACT decision to the contrary that is striking, and therefore of special interest and relevance.

The next section fills in the background of air travel competition across the Tasman over the past decade. Section 3 reviews and criticises the ACT finding. Section 4 summarises some new empirical evidence on pricing in Tasman and domestic NZ markets in support of the critique. Sections 5 and 6 explore implications: for the use of economics and economists in public benefit competition cases, and for the airlines' current proposal.

2. Background

Air New Zealand and Qantas dominate the Tasman in terms of their combined market share, which has exceeded 90%, but they have been having profitability problems on these routes for the past decade, and it is quite important in the present context to determine the extent to which their current difficulties are the result of their own actions, or are being caused by newcomers to the market, as they claim in their TNA submission.

After decades operating as the cosiest of duopolies -- two government-owned airlines sharing a regulated joint monopoly – the incumbents were subject to the usual shake-ups of the 1980s and early 1990s liberalisation era, each being privatised and being required to compete, first just with each other, and then, at least potentially, with other locally owned operators permitted to enter the market under the SAM. Also, they were to face very peripheral competition from a shifting fringe of '5th Freedom' carriers, these being international airlines basically in the business of flying long-haul routes to and from Australasia, who are permitted under the two countries' aviation policies to carry trans-Tasman customers when their routings include stops in both countries.

The first real shock came in August 1995, when a small charter operator, Kiwi International Airlines, began flying scheduled services to Brisbane and Sydney from its home base in Hamilton, as well as from Dunedin and Palmerston North. These three regional cities had not previously been served by scheduled direct trans-Tasman services. Haugh and Hazledine (1999) document the rather brutal response by the big incumbents. First, Air New Zealand set up a 'fighting brand' low-cost carrier (LCC), Freedom Air, operating out of the same cities and thus bracketing the Kiwi network. Then, when this failed to push out the upstart, Qantas, quickly followed by Air New Zealand, initiated a price war. Kiwi International went into liquidation in September 1996, just over a year after entering the market.

Although the incumbents soon raised their fares after Kiwi disappeared, life on the Tasman market has never quite returned to the 'normal' state of affairs (Cournot-Nash

duopoly) which Haugh and Hazledine identified prior to the disturbance. Instead, in May 1997, Qantas and Air New Zealand abandoned the code-sharing arrangement under which around 40% of their Tasman customers had travelled[5], joined different global airline alliances, and put on more flights to maintain the attractiveness of their schedules without the code-share – with this additional supply naturally putting downward pressure on prices. Hazledine *et al* (2001) estimate that by the end of 1999 prices were low enough to imply behaviour substantially more competitive than Cournot-Nash, with a 'conjectural variations parameter' around -0.5. [6]

We do not have documentation of the course of prices after 1999, but right from the first submission made by the airlines' economic consultants in support of the 'Strategic Alliance' proposal (NECG, 2002) it was close to common ground for proponents and opponents of the airlines' case that price competition across the Tasman was unusually fierce, such that it has been difficult or even impossible for the incumbents to earn decent profits on these routes.

What is not common ground, of course, is the extent to which this over-vigorous competition is due to entry into parts of the market by the 5th Freedom carrier Emirates in August 2003, and then the Low-Cost Carrier Pacific Blue (an operating wing of Virgin Blue) in late January, 2004, rather then being just a continuation of the hostilities between Air New Zealand and Qantas that can be documented back to 1997.

Also contentious is the degree to which hostilities may in fact have abated somewhat over the past two years – that is, since the ACT Hearings in May 2004. The incumbents claim that market life on the Tasman routes is at least as tough as ever; others -- notably Wellington International Airport Ltd in its submission to the ACCC (WIAL 2006) – find signs of significant easing of competitive pressure. These are matters to be dealt with below.

3. The ACT Determination

On May 16, 2005, the Australian Competition Tribunal released the 'Reasons' for the Determination in favour of the cartel that it had announced more than seven months previously. Although these Reasons (ACT 2005) run to 141 single-spaced pages, and consider many issues, it is fair to say that the case swung on the determination that competition in the trans-Tasman market would not be significantly harmed by the cartel. This is because: (1) the ACT's interpretation of Australian competition policy is that it is focussed -- as in NZ – on the national interest (rather than on competition *per se*, or efficiency (Hazledine, 2004)), and the Tasman was judged the only affected market where the interests of large numbers of Australian nationals were at

[5] This code-share was (I believe) a 'block space' arrangement, meaning that each airline purchased blocks of seats on the other's aircraft, and then did their best to fill those seats through independent pricing and marketing of the flight. This is quite different from the augmented code-share proposed under the TNA.

[6] This parameter, which is often used by Industrial Organisation economists to summarise the intensity of price competition in market, takes the value 0 for Cournot-Nash oligopoly (independent behaviour) and -1 for the extreme case of a fully (perfectly) competitive duopoly, in which the sellers have managed to compete away all of their profits.

stake[7]; and (2) with other considerations found to be not substantially important, the allocative loss from a substantial lessening of competition was the major threat to the national interest.

I will argue that the Reasons depend on three economic propositions, about:

- Behaviour of customers
- Behaviour of existing firms
- Behaviour of potential firms

The Propositions are:

A: ***Demand at the firm level is highly price-elastic:*** 'The competition for the customer at the margin does not stay with that customer, but those fares necessary to attract the marginal customers will be available to all buyers in the market' (ACT 2005 para 429; repeated in TNA 2006 section 6.10)

B: ***Short/medium term supply is highly price-elastic:*** 'a 10% fare increase would divert so many passengers away from the Alliance [to expanding Pacific Blue and/or Emirates] that such an elevation in fares would be unsustainable' (ACT 2005 para 353).

C: ***Long term supply is inelastic:*** '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 first two propositions are key. I will argue that both are clearly wrong: Proposition A on the basis of fact; Proposition B on the basis of theory (and fact). Proposition C, on entry, may be wrong, perhaps depending on interpretation. It is probably not crucial to the case and I will deal with it first.

Entry unlikely

Proposition C might seem to contradict the frequent assertions in the Reasons that there are no substantial 'barriers to entry *[sic]* and expansion' in the Tasman market (eg, ACT 2005, para 420), but it could instead be reasonably interpreted as meaning that, although entry is not barred, no new firm (or new to this market) would *wish* to enter, given the effective competitive constraint on prices that will be maintained according to Propositions A and B.

In fact it seems that entry into international aviation markets is, from a supply side point of view (ie absent regulatory obstacles) exceptionally easy, in part because the main item of capital equipment is, literally, extremely mobile. There are probably at least fifty established scheduled airlines operating around the Pacific Rim, any of

[7] The NZ authorities, under the same criteria, were also concerned with the impact of the cartel on the domestic NZ market, and on the Auckland-US route(s). Each of these markets is of a roughly similar size to the Tasman market in terms of revenues for Air New Zealand.

whom would have little operational difficulty in setting up Tasman services. However, there *are* regulatory obstacles – unless they used 5th Freedom rights, the new carrier would have to somehow set up an Australian or NZ controlled subsidiary.

In any case, the applicants did not press the point of ease of entry. This may have been because they wished to claim substantial barriers to Air New Zealand re-entering in some way the domestic Australian market, absent the cartel. This is a large market, especially important, of course, to Australians.[8] To put it into perspective, in 2004 airlines carried seven times as many passengers within Australia than across the Tasman, and total revenue-passenger kilometres (RPKs) were nearly four times larger.[9]

The Tribunal deals with the Australian market in thirteen brisk paragraphs, covering just about two pages (ACT 2005, paras 529-541). Yet here there are some interesting revelations. Apparently (para 535) Air New Zealand's directors believed that Qantas's motivation for entering into the cartel agreement was to prevent entry into its domestic market by or through Air New Zealand! It is also reported that (Air New Zealand) 'Board papers relied upon by the [ACCC] evidence *[verb]* the continuing "strategic imperative" for Air New Zealand or another Star Alliance member to enter the Australian domestic market' (ACT 2005, para 539).

It is certainly true that the continent of Australia is a noticeable gap in the Star Alliance network. The proposed cartel had provision for Air NZ/Qantas code-sharing in Australia, which of course would be sensible if the rest of the arrangement were approved. However, in the counterfactual, there must be a significant probability of either entry by Air New Zealand, or -- perhaps more likely -- a code-share between Air NZ and Virgin Blue. The latter would likely have a favourable impact on competition. The current market situation in Australia is of asymmetric duopoly, with Qantas having about twice the market share of Virgin. Virgin's position would be strengthened by getting trans-Tasman feed to and from Air New Zealand. Strengthening the smaller member of an asymmetric duopoly can be expected to result in more competition and lower prices.

The Tribunal would not agree. It did not even believe that *de novo* entry would affect competition in this large market. On the basis of Virgin's business model and the launch of Qantas's LCC Jetstar it was 'satisfied… that the Australian domestic market is competitive *[sic]* and that entry by a third-party carrier would, thus, be unlikely to further enhance competition' (2005, para 540).

The current TNA proposal is restricted to the Tasman. However, it might be judged that having Air NZ and Qantas cooperating to such an extent on these routes would make it less likely that Air NZ will pursue a domestic Australia (and, likely, domestic NZ) code-share with Virgin Blue.

[8] The domestic Australian market did not even warrant a mention in the NZ High Court Determination, despite the substantial diaspora of expatriate Kiwis living in and presumably travelling around Australia.

[9] Data taken from the BTRE website report about 33 million domestic passengers in 2004, compared with 4.7 million travelling across the Tasman. Domestic RPKs were 40 billion. Tasman RPKs are not given but can be calculated to be around 11 billion by multiplying the number of passengers by the average trip length, which is about 2400kms.

Short term demand and supply highly elastic

What I have termed Proposition A states that airline customers are highly price sensitive, so that should the cartel put up prices customers will readily look for another supplier. Proposition B states that alternative supply will be readily forthcoming, from eagerly expanding Pacific Blue and Emirates.

Note first that both these propositions need to hold to validate the Tribunal's decision. If A does not hold because the fringe firms do not offer a product closely substitutable to that of the two FSA carriers, then the latter, having eliminated the competition between themselves (where cross price elasticities are undoubtedly substantial) would be able to raise price without losing lots of customers, however eager the fringe might be (Proposition B) to serve those customers. And even if A did hold, this would not be sufficient to constrain the cartel, should the fringe choose to follow the cartel's price increase rather than aggressively seek to take their market share (B not holding).

The Tribunal was able to maintain and even integrate these propositions to its own satisfaction by means of the concept of the 'marginal customer', or, equivalently here, 'competition for customers at the margin.' This was apparently introduced at the Hearings by the airlines' expert Professor Ordover, in response to a question from the Tribunal.[10] The concept would exercise an almost bewitching effect upon them. From the point of its introduction into the Reasons at paragraph 350 through to paragraph 465 it appears twenty four times. By paragraph 445 the marginal passenger has become 'all-important', and with this hyperbole the case is in effect won for the applicants, even though the Reasons go on for another three hundred paragraphs or so – the cartel would not dare raise price one penny if this would lose it an 'all-important' customer.

It is worth quoting the paragraph in full, because it provides a reasonably succinct statement of the Tribunal's final position and has been recited approvingly by the airlines in their TNA application (2006, para 4.3):

> ' [I]n the absence of barriers to expansion for Virgin Blue and Emirates, and given the capacity available to Virgin Blue and Emirates, we expect that the Alliance will be promptly and competitively constrained should it seek to raise fares. Such a fare increase would likely be welcomed by the two newer carriers, as it would provide them with the opportunity to increase their market shares without having to lower their own fares, advertise more heavily, or otherwise engage in expensive brand and product differentiation. We do not expect that the Alliance would be so commercially inept as to present Virgin Blue and Emirates with such a golden opportunity to expand at its expense. Commercial self-interest will demand that the Alliance compete heavily for the all-important marginal passenger, and this natural interplay of

[10] It does not appear anywhere in Prof Ordover's lengthy written submission (Ordover 2004).

> responsiveness to market forces of supply and demand will not be likely to produce any anti-competitive detriment' (ACT 2005, para 445).

We need to 'unpack' the economic reasoning underpinning this paragraph. First, the idea, which I have termed Proposition A, that customers are very willing to switch from Air New Zealand/Qantas to Pacific Blue and/or Emirates, if the prices differ just a little. Basically, this is saying that air travel is a highly homogeneous (undifferentiated) product like, say, cement: sellers offer close substitutes.

Now, it is not inherently or theoretically implausible that this be so: it is a question of fact. In the next section I marshall some facts about prices and their implications for demand substitutability. I find that there is substantial variation over time and across airlines and routes in the lowest prices charged to Tasman travellers, and that in particular, Air NZ and Qantas are able to charge a substantial premium over Pacific Blue and Emirates, who yet, despite their much lower prices, are unable to raise their individual market shares above single digits, nor to achieve satisfactory load factors on their flights.

That is, the claim made by the applicants in the cartel case (and repeated by them in their TNA submission) that the small market shares of the fringe carriers in fact substantially understates their true market presence seems quite wrong. If anything, the small fringe share overstates the competitive constraint they impose on the large incumbents through demand-side substitutability.

This is enough to invalidate the ACT Decision and with it the TNA proposal, unless substantial benefits could be found to offset the likely lessening of competition. However, the matter should not be left there, because there is the possibility (probability?) that the ACT Decision will be called on again in support of apparently problematic mergers or arrangements, and these perhaps in industries such as cement in which Proposition A does hold tolerably well. That is, we need to deal also with Proposition B.

Suppose the industry *is* cement, or similar. That is, the product is homogeneous and well-informed consumers will not support any persistent price differences. And suppose that there are no barriers to the expansion of the existing sellers – marginal costs are constant with respect to output. And suppose we have four firms in the market: two large with market shares of 40% each; two small fringe firms with 10% each. Now, will it be true in such a situation that the marginal customer will be all-important, in the sense of being able to constrain a cartel of the largest firms from raising price? *No it will not be true.* It is not true because, when the cartel gets its act together and pulls some output off the market to push the price up, the most profitable response by the fringe is to (partially) go along with this. In general, in homogeneous oligopoly, the best response by any firm to a reduction in output by the others is partly free-ride off this by increasing its own output, but not by so much that the price increase is wiped out. *All the firms will welcome an increase in the market price when this is caused as a result of a lessening of competition between a subset of them.*

That is, the best response by the fringe to the cartel's restriction of output is a trade-off: enjoy some of the benefits in the form of higher profit margins (higher prices),

and some through higher market share.[11] Unfortunately, the Australian Competition Tribunal in this matter totally failed to appreciate the basic and indispensable economic concept of the trade-off. They asserted that, because the fringe *could* expand (which I for one didn't really doubt, at least with respect to Pacific Blue), then they *would* choose to do to the full extent so as to wipe-out any price increase. But they won't.

To summarise, the ACT's analysis of the importance of the 'marginal customer' might well warrant the epithet "half-baked". The Tribunal has considered the customer at the margin but ignored the customers within the margin. Yet a cartel deciding whether to shed a customer (at the margin) trades-off the loss of their business against the gain in profit margins earned on infra-marginal customers. And an outside firm deciding whether to take on a marginal customer shed by the cartel trades-off the additional business against the loss in profits on their infra-marginal customers if by so doing it prevents market price from increasing.

The merger paradox

In the interest of completeness, I will note here the 'merger paradox', first identified by Salant, Switzer and Reynolds (1983). These authors proved that, in a symmetric homogeneous oligopoly, the free-rider problem implies a puzzle: in any merger of two independent sellers in a market with three or more firms, the combined profits of the merged entity (if this then behaves as just another single independent competitor) will fall below their joint pre-merger profits, despite the higher market price, because the market share they do lose to the other firms outweighs this. So why then *do* firms merge?

As a matter of fact many -- perhaps most -- mergers do disappoint in terms of post-merger profitability, perhaps because they are driven by other motives -- hubris and/or desire for power (and bonuses) on the part of the managers responsible.

However, in terms of making sense of it within standard oligopoly theory, we have a number of possibilities. The merged firms could realise cost reductions (or could believe they would do so when negotiating the merger). Behaviour in the industry might become more collusive with one fewer competitor. The product may not be homogeneous.

In the airlines situation the merger paradox result does not apply, because the market is not a symmetric oligopoly. Rather, as we know, the merging or cartelising firms currently have around 80% of the total market, and the next two largest firms have around or less than 10% each. To the oligopoly analyst these numbers tell us something. Relative size must itself make sense as the outcome of rational profit-seeking behaviour. In the case of homogeneous oligopoly what it must mean is that the small firms have higher costs, so that they cannot profitably produce for a larger

[11] In the case of homogenous product oligopoly, with other simplifications such as linear demand and constant marginal costs, it can easily be shown that the outcome of the trade-off is, in a sense, 50:50. What is called the 'best response function' or the 'Cournot reaction function' tell us that for every unit of output that is taken off the market by other firms, a particular firm should increase its own output by one half of a unit – leaving, of course, a net reduction in total industry output and thus an increase in the market price.

share of the market. It can easily be shown that the two largest firms in a homogeneous linear oligopoly with the cost differences implied by these pre-merger market shares would find it profitable to merge.

In the trans-Tasman air travel market the small market share of the fringe is not likely to be cost-driven. It is believed that Pacific Blue has lower costs than either Air New Zealand or Qantas, and it is claimed that Emirates is acting as though it has lower costs, by ignoring certain fixed costs when setting its Tasman fares. What does here explain the asymmetry in shares is product heterogeneity: the product is not homogeneous, and in particular the product offered by the fringe is 'inferior' in the sense that a majority of customers, given equality of price, would choose to travel on Air New Zealand or Qantas (because a majority do choose to do so, even though prices on the large carriers tend to be higher, as we find in the next section).

Thus, it is very hard to come up with a plausible economic model in which it is rational for Pacific Blue (and/or Emirates) to gobble up market share if Air New Zealand and Qantas increase prices, but somehow is not rational for them to expand in the absence of the cartel or TNA.

4. Evidence

One of the remarkable features of the 'Strategic Alliance' (cartel) case is that the airlines 'invested' at least AUD 40million fighting it[12], of which quite a lot probably went to economists, but none was spent analysing actual empirical data on what goes on in the affected markets, including the Tasman.[13] Yet, as argued in the previous section, the case crucially hangs on the empirical questions of the extent of price dispersion and on the appropriate oligopoly model to use in these circumstances. Here I report empirical analysis undertaken since the ACT Hearing

The Tribunal asserted that:

> 'because airlines cannot easily discriminate between passengers at the margin and committed passengers, the low fares offered by Virgin [Pacific] Blue and Emirates in their attempts to gain market share at the expense of the Alliance will flow through to all passengers in the market who wish to take advantage of them' (ACT 2005, para 444).

Is it true that airlines cannot price discriminate, that Pacific Blue and Emirates charge low fares and that their fares flow through to Air New Zealand and Qantas passengers? The answers, in short, are: No, Yes and No. The evidence comes from a set of observations on the lowest fares offered on airlines' websites, analysed in Hazledine (2006). This covers more than 10,000 observations of fares for 1001 flights on 29 routes, of which 8 were domestic NZ and 21 trans-Tasman. The NZ flights and Auckland-Sydney were observed for flight dates on eight successive Wednesdays from November 2004 through to early January 2005. The Tasman flights (including, again, Auckland-Sydney) were observed for flight dates on three Wednesdays in late

[12] Press interview by Qantas Chair Margaret Jackson, reported in *NZ Herald*, March 11, 2006.
[13] There was much quantitative analysis using 'merger simulation models' (see King, 2005), but such models are in essence consumers, not producers of empirical data: they answer "what if?" type questions with models calibrated to fit the already known or estimated 'facts' of market behaviour.

June and July 2005. Lowest fares offered for each flight/date were observed weekly from eight weeks before flight day, and daily or near-daily in the last week before take-off.

It is interesting to look at these data, to observe the patterns of prices over time. Figures 1 to 4 show bar graphs for each trans-Tasman airline of their average lowest fares expressed in each case as a ratio of the fare observed the day before the actual flight date (which usually is the highest fare offered). We can make two inferences from these bar graphs:

- There is substantial inter-temporal price discrimination practiced by Air NZ and Qantas
- There seems to be a difference in the pricing behaviour of Air NZ/Qantas and of Pacific Blue/Emirates

For the two largest carriers, Tasman fares tend to increase over the eight weeks, with an acceleration in the last two weeks before flight date. The last lowest price offered is around 30-40% higher than the lowest price available eight weeks out, on average. Pacific Blue has a much flatter price distribution, as one might expect from a LCC with a relatively simple fare structure. As for Emirates, it too has a relatively flat distribution of prices, though with a slight trough: it seems the best time to purchase a ticket from this airline is three weeks before flight date. These numbers do not support the ACT's statement about the fringe carriers' prices 'flowing through to all passengers in the market'.

Further evidence comes from calculating the average price per kilometre for each flight (that is, the average of the eight observations on lowest price as used to build up the bar graphs of Figures 1 to 4), and using (the logarithm of) these numbers as the dependent variable in a regression model. Hazledine (2006) gives detail on the procedure and results, which are here summarised in Table 1, on which t-statistics are given after the coefficient estimates.

Table 1: Regression results

	All routes	Tasman only
Number of observations Available for estimation	972	325
Constant	5.70 (24.6)	4.90 (4.3)
Log(DIST)	-0.44 (-12.5)	-0.38 (-2.5)
HHI	0.38 (4.1)	0.23 (1.2)
PEAKDUM	0.48 (10.9)	-
SOLDDUM	0.15 (7.0)	0.05 (1.5)
XMAS	0.27 (13.2)	0.37 (7.9)
TASMAN	0.22 (3.2)	-
UTIL	-	0.84 (5.7)
QANTAS	-0.18 (-5.5)	-0.10 (-3.3)
EMIRATES	-0.40 (-6.1)	-0.32 (-5.8)
PACIFIC BLUE	-0.28 (-3.4)	-0.31 (-4.4)
R^2, D-W	0.815, 2.07	0.478, 2.03

Here we show the best regression model for two data sets: the full sample of Tasman and domestic routes, and the subset of just Tasman routes. The explanatory variables are flight distance (DIST -- a major determinant of average cost differences), the often-used Hirschman-Herfindahl Index (HHI) summary statistic of the size distribution or concentration of firms in a market (with firm size measured here by frequency of flights offered on a route), the rate of utilisation of seats on a route (UTIL -- available only for the Tasman routes), and some dummy variables, including one for each of the main airlines.

The relevant results, in summary, are:

- Routes where Air NZ has a monopoly have prices, other things equal, around 20% higher than duopoly routes
- On the Tasman, where differences in market concentration as measured by the HHI are largely due to the presence or not of competition from Pacific Blue and/or Emirates (because Air NZ and Qantas are both present on nearly all these routes), the additional competition does not have a statistically discernible effect on market price, except that
- The airline dummy variables reveal that, holding other factors, including concentration, constant, the lowest fares offered by Qantas are somewhat lower than those of Air NZ, and the fares offered by Pacific Blue and by Emirates are substantially (around 30%) lower.

That is, the empirical evidence shows that the substantially lower fares offered by the fringe (which despite these low fares has been unable to achieve sizeable market shares) do not flow through to the legacy carriers Qantas and, especially, Air New Zealand, whose pricing seems to have a degree of insulation from competition from the fringe.

5. Economics, economists and the ACT

Assessment of the likely impact of a proposed change in the competitive arrangements between sellers in a market is a matter of economic judgement. In the airlines cartel case the Tribunal seems to have seriously misjudged the economics of the matter. If so, what went wrong? In this section I will suggest that the structure itself of the Tribunal's processes is inherently unsuited to the assessment of civil matters requiring unbiased but necessarily imprecise economic judgement, such that, at best, we should expect a high variance in the quality of their decisions. I focus on the role of economists in the case, both as 'experts' hired by interested parties, and sitting on the Tribunal itself. I will attempt a constructive proposal as to how these matters could better be handled.

The Tribunal's process has three substantive stages. First, written submissions are invited and received. This is similar to the process followed by the ACCC and the NZCC (and the NZ High Court), and is not problematic. Second, there is a court

hearing, at which industry witnesses and experts are led and then cross examined by counsel, under the supervision of the presiding judge of the Tribunal. Third, the members of the Tribunal (three in this case) retire to form their judgement, in private.

It is the second and third stages of the process where things can and in this case did go wrong, and which are, I will suggest, inherently unsuited to the assessment of civil economic matters. The problem is not that economics and economists were not involved in all stages of the Tribunal's process, it is how the economics was handled, at and after the Court room proceedings

The economist as expert

All the experts called upon in the ACT airlines hearing were professional economists, and I believe it is correct to say that the submissions and testimony of the economists were key to the case, notwithstanding the quite considerable quantity of informative written and oral material received from airline and travel industry insiders. At the Hearings stage the Tribunal dealt with the experts in what seemed (to me, anyway) a surprisingly ad hoc and even improvisatory manner, and the Tribunal admits in its Reasons to problems arising from this.

Experts are charged with assisting the court, and with being non-partisan, but of course they are themselves charging their clients substantial fees, and there must be a strong mutual expectation that the clients will get value for their money. The ACT attempted, after the fact, to unravel the inherent difficulties of the expert's situation with the following advice:

> The role of expert witnesses appearing before the Tribunal is to instruct on areas of specialist knowledge in a manner that is ultimately designed to inform rather than to advocate a particular view. Obviously, parties will call upon experts whose opinions support their view of the case. However, it is not appropriate for an expert witness to act as an advocate for the instructing party at all costs, and professional witnesses should be willing to concede points which, whilst not advancing the case of the party engaging them, they believe to be open as a fair and reasonable assessment on *[sic]* the material before them. (ACT 2005, paragraph 216)

This seems reasonable, but the point in practice may be that the set of points to be conceded that are both materially relevant to the case yet not advancing the client's interest may often be, as economists say, an 'empty box'. Peters and Casey (2005) quote from the transcript of the NZ High Court Appeal the words of the 'shrewd' Rodney Hansen, judge presiding:

> One of the difficulties for a simple judge listening to experts as distinguished and erudite as those I have heard from over the last few days is that, while purporting to disagree with one another, you each make perfect sense until I hear from the other one. (from p.848 of the transcripts, High Court, 2004)

The ACT Determination was blunter, singling out particular experts for criticism, in particular charging two – Henry Ergas and me -- with 'partiality and an inability to

express an objective expert opinion'. In my opinion, the problems the Tribunal had in getting objective expertise were rather more widespread.

The Tribunal did make a number of attempts to improve the quality of the information and advice it was getting from the economists. None were very successful. First, it had us meet by ourselves to draft a communiqué listing matters of common ground. The list proved to be rather short -- just a couple of pages, as I recall, and the Tribunal found it disappointingly bland, offering agreement only on 'relatively inconsequential' matters.

So then the Tribunal countered by presenting us with a list of remarkably specific questions, on which we each were to cogitate overnight and respond to in the Hearing. These questions mostly asked us to predict the impact of an 'assumed' precisely specified increase in the number of seats supplied by either Virgin Blue or Emirates. It is noteworthy that, two years further on, the assumed increases in capacity have not in general come to pass, but in any case it is doubtful that the Tribunal got much edification from the economists' answers (paragraphs 348-349; 403-404, and 406-407).

Finally, the Tribunal experimented *ad lib* with a system, quickly abandoned, wherein experts were cross-examined by other experts. I believe it fair to say that even those experts whose testimony was most effective before the Tribunal found these arrangements unsatisfactory, and I think they were right.

The basic problem of hired experts being reluctant to bite the hand that feeds them is surely endemic to the situation, never to be 'solved' completely. But it is worth asking whether the difficulties are exacerbated by the particular structure and process of courtroom proceedings. In both the NZ High Court and the Tribunal, these proceedings often seemed to be dominated by the adversarial antics of counsel, whose brief, as everyone knows, is not to add to the enlightenment of the world, but to win the case for their client. Whilst this system may be suited to matters of criminal justice and of litigation, it may not bring out the best in experts asked to assist in making reasonable decisions on administrative matters depending on the likely effect on competition in a market of a proposed merger or practice.

The economist as judge

In both the NZ High Court appeal and the Australian Competition Tribunal hearing, the highly distinguished presiding judges were assisted by professional economists acting as 'lay' members of the court or tribunal.[14] I can have no doubt that the judges' deliberations in these cases were greatly assisted by the input of their economist colleagues, both of whom have huge experience in competition policy matters. However, there are two possible problems.

The first, and probably lesser difficulty, is that long experience is not the unmixed blessing for professional economists as it no doubt is for learned judges. Economics is a progressive science, bent on continually improving the extent and accuracy of our insights into the functioning of the market system. This means, first, that precedents -- so valuable in the law -- are in economics rather perishable, such that the value of

[14] Ms Kerrin Vautier was the lay member of the High Court, and Professor David Round appeared on the Tribunal. The ACT panel also included Mr G F Latta, a businessman.

knowledge of them tends to depreciate over time, and, second, that senior economists quite often -- even, alas, mostly – are not skilled in the latest analytical methods, which in economics have tended to become more and more mathematically complex. In the airlines case, the use of quantitative oligopoly models – also known as merger simulation models -- was problematic for the High Court and for the Tribunal: however, neither of the economist-judges – both of whom entered the profession at a time when it was still possible to embark on a distinguished career as an economist without first earning the doctorate -- is expert in the use of such models, and the rather grumpy paragraphs in the judgements criticising quantitative oligopoly analysis may somewhat reflect this.[15]

The use (and mis-use) of merger simulation models in this case is important enough to warrant a paper of its own.[16] It is important in particular because such models may in the end have determined the outcome of the case: their predictions of the impact of the cartel on competition were important and perhaps key to the NZCC's determination against the cartel, and this determination was upheld on appeal, notwithstanding the High Court's discomfort with the quantitative approach.

The second problem is this: economics is *hard*. With or without hi-tech mathematical tools, the path to achieving a satisfactory economic analysis of a complex market situation is seldom smooth and straightforward. There will be false starts, dead ends, pitfalls, wrong turnings, errors of judgement and sins of commission and omission along the way. Even the most brilliant economist is unlikely to get there on their own: the process needs consultation, comments, criticism, and even competition, in the sense of the tabling of alternative analyses of the problem.

But all this is unavailable to judges and tribunals once their hearings have closed. The judges must draft their decisions in secretive solitude. Such may be less of a problem for the NZ High Court, which formally is hearing an appeal – ie, based on points of law. But in the Australian system the ACT deals with the case *de novo*, with the entire burden of economic analysis thrown on a single economist member who is, after the Hearing, unable to even mention the case to any of his or her colleagues, much less expose his thinking to criticisms and suggestions. It should not be surprising if decisions so reached are not robust to criticism.

After studying the ACT decision, I would suggest that what the applicants' experts succeeded most cleverly in doing during the Hearing was to make the economic issues seem *simple* – too simple, of course, in my opinion. Using the intuitively appealing concepts of 'workable contestability' and 'the marginal customer' they managed to persuade the Tribunal that two airlines with very small shares of the trans-Tasman market -- Virgin Blue and Emirates – could and would totally dominate the pricing decisions of the two airlines Qantas and Air New Zealand which together have a market share exceeding 80%, such that a cartel between the latter would not materially lessen competition.

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[15] See the NZ High Court decision at paragraph 269, and the ACT decision at paragraph 347. I should note that these models have also been criticised from the other direction, as being not sufficiently technical in their use of sophisticated econometrics and dynamic game theory. See King (2005).

[16] Peters and Casey (2005) deal nicely with some of the methodological issues raised by economists and their models.

Of course, the other experts, including me, had their chances before the Tribunal to refute this proposition, and clearly failed to do so. Fair enough, but I can still doubt whether the underpinnings of the judgement, which may actually have gone further than the Hearings in depending in particular on the half-baked notion of the *all important* [sic] marginal customer, would have survived a robust exchange of independent economic advice, were such available to the Tribunal during its post-hearing deliberations.

An alternative professional/inquisitorial process

There are four general types of competition matters which may at times be of regulatory/judicial concern:

- Matters of guilt or innocence (eg price-fixing)
- Matters of rights and wrongs (assessment of damages)
- Matters of due process (appeal against earlier decisions on points of law)
- Matters of public benefit or detriment (authorisations of mergers or cartels)

The Tribunal/Court system may well be the best available forum for dealing with the first three types of matters. It seems, however, on the basis of the arguments above, to be not well suited to the economic assessment of the likely net benefits of a proposed arrangement such as a merger or, as in this case, cartel.

So is there a better way of handling merger or cartel authorisations, in particular to extract more value from the experts and to firm up the economic foundations of judgements? I suggest that there is, and that something quite like it was in fact deployed at the first stage of the airlines case, when the matter was before the competition commissions of Australia and New Zealand.

The NZCC, having received the application with supporting documentation, called for written submissions. It considered all these materials and carried out its own internal analysis, assisted by outside experts. The upshot, after no doubt vigorous debate within and between its staff and the commissioners, who included amongst them two economists and a QC, was a Draft Determination, on which further comment and submissions were invited. Following the receipt and distribution of these, the NZCC held a Hearing, at which interested parties presented their views.

Experts and others presenting at the Hearing were questioned by the Commissioners, and, at the Chair's discretion, by the NZCC's own economists. Notably, counsel for the parties were not permitted to lead or cross-examine the experts, to their sometimes visible frustration. No doubt telling blows were not landed and witty ripostes remained unuttered as a result, but it is my view, which may be incorrect, that the relatively civil and professional atmosphere of the NZCC Hearing was more conducive to the accumulation of reasoned analysis than was the often confrontational and hostile setting of the ACT courtroom.

In any case, following their hearing the Commissioners retired again to consider the matter internally, with the eventual (actually, quite speedy, in comparison to the ACT) outcome of its Final Determination, which in due course survived appeal to the NZ High Court. The ACCC went through a similar process of draft and final

determinations, but did not hold a hearing, I believe because parties were satisfied that one hearing, before the NZCC, was sufficient.

What I will now suggest is that what could be called the 'professional/inquisitorial' method of the Commissions is better suited to handling authorisations than the 'judicial/adversarial' process of the Tribunal and the High Court. Nor is it satisfactory to have both systems in operation, as at present. If the Commission is more likely to come up with a sound decision than the Tribunal, what is gained by letting the latter 'review' -- actually, re-hear – the issue? The chain of decision making will be only as strong as its weakest link.

That is, why subject decisions on authorisations to any special appeal or review process? Why not make them regulatory matters? These Commissions, and others like them, already have the power to regulate natural monopolies: why not have them regulate unnatural monopolies as well? Of course, 'mistakes' will be made, but given (i) that both the NZCC and the ACCC are impartial and honest bodies[17], with good processes and competencies already in place, and (ii) the not insignificant consideration of the legal and other transaction costs of appeals and litigation, and (iii) that mistakes in these non-criminal matters do not have awful consequences for individuals (eg, wrongful imprisonment), it seems quite plausible that the likely net benefits of such a system would exceed those of the present arrangements.

What about the role of the experts? Of course interested parties cannot be prevented from hiring economists and others to bolster their case, but perhaps incentives would better be aligned in the cause of creating light not heat if the parties were to be tithed, with a matching dollar for each dollar they spend on their consultants going to the Commission to hire its own experts to act *qua amicus curiae*.

6. Two Years On: the Tasman Networks Agreement proposal

On April 13, 2006, being just about two years since they had made their final written submissions to the Australian Competition Tribunal and the NZ High Court in support of their 'Strategic Alliance' proposal, Qantas and Air New Zealand came back to the ACCC with their application for authorisation to enter into a 'Tasman Networks Agreement' (TNA, 2006). This was summarised as follows on the ACCC website:

> *The TNA involves the coordination of activities between the Applicants in respect of any flight operated on their 'trans-Tasman Network' in the areas of scheduling and planning of flights (including the allocation of capacity), pricing of passenger services, code sharing, processing of passengers and baggage, and coordinating of minimum inflight offering and cargo services (as determined from time to time).*

In economic terms, then, the proposal was for another cartel, though this restricted to the Tasman routes. In summary support of the TNA, the airlines claimed that:

[17] Ross Jones (2002, p430) claims, I believe reasonably, that it 'would be acknowledged by even the [ACCC's] most strident critics that the Commission has not been captured by the industries which it regulates'. Note that regulatory capture is inherently less likely to be a problem in one-off authorisation situations, compared to the ongoing dealings involved with a statutory 'industry' regulator.

> 'The Tasman is an intensely competitive market….[t]he lower cost airlines – Emirates… and Virgin Blue – effectively set fare levels on the Tasman, with intense competition occurring for price sensitive travellers (or "marginal" passengers). Competition for marginal passengers is not confined to those customers and extends to all passengers. The fare levels set to attract the marginal passenger are available throughout the market.' (TNA, 2006, paras 1.4, 1.5)

Quotes and near-quotes like this from the ACT Decision appear throughout the TNA application and are the core of the airlines' argument that eliminating independent competition between them would not result in significantly higher air fares. But as we have seen above, the 'marginal passenger' fares are not available throughout the market. Emirates and Pacific Blue's fares are actually substantially lower than those available from Air New Zealand and Qantas, on average (largely due to the latters' greater use of inter-temporal price discrimination), such that even without including those business and other travellers who voluntarily purchase higher price tickets (with fewer restrictions), the majority of travellers across the Tasman choose to fly on Air NZ and Qantas and to pay more to do so than they would on Emirates or Pacific Blue. Such is actually explicitly recognised later in the Application in the following passage:

> 'Emirates leverages its marginal cost advantage to sell approximately 87% of its seats in its low priced lead-in and tactical fare classes. In contrast, Qantas and Air NZ, without the ability to deploy aircraft on a marginally costed basis, sell approximately [RESTRICTION OF PUBLICATION CLAIMED] of their seats in lead-in and tactical fare classes…Not only does Emirates offer such a high proportion of total fares at its lead-in and tactical fares…' (TNA, 2006, paragraph 9.24)

This does not rule out the entire *distribution* of prices being lower as a result of competition between the carriers, and indeed we would expect this to be so, though as Hazledine (2006) finds, it is hard to build a model – given the low market shares of Emirates and Pacific Blue, despite their lower prices – in which the bulk of this competition is not driven by independent competition between Qantas and Air NZ, which, as noted above, has often been quite fierce on the Tasman routes over the past decade.

There is some evidence that price competition between the large carriers has eased somewhat since the ACT decision. Wellington International Airport Ltd, in their submission on the TNA (WIAL 2006, paragraphs 20, 42, 102) claim that prices have increased significantly, though they show no supporting data for this.[18] I can report that the lowest prices offered on the Auckland-Sydney route by Qantas and Air New Zealand, exclusive of increases in the fuel cost surcharge, were a bit more than 10% higher in May 2006 than in November 2004, eighteen months earlier. Given that May is a month of unusually low capacity utilisation for the airlines, and that prices tend to be lower at such times, this is consistent with significant real price increases over this

[18] I have not seen these numbers but I believe they come from observations of fares for ex-Wellington flights offered on airline websites.

period. It would be good to have regular monitoring of prices charged on these and other routes.

If, then, pricing pressure has been relaxed somewhat since 2004, why are the airlines still so keen to form a cartel? It may be that one of the applicants is more keen than the other, but in any case both claim that there is now a severe problem of excess capacity on most of the Tasman routes, which could be relieved if they were to be allowed to coordinate reductions in seats flown while offering code sharing facilities on the remaining flights to avoid damaging their networks.

In their submissions in support of the 2002 Strategic Alliance proposal, the airlines predicted a fearsome 'war of attrition' on the Tasman if they were not permitted to cartelise their activities, with Qantas in particular aggressively adding unnecessary capacity to the routes. This proposition was not taken very seriously by the authorities (with the possible exception of the ACT), and it has clearly not (yet) come to pass, in the two years of 'counterfactual' that we have already experienced.

However, the addition of capacity from Pacific Blue and Emirates may have caused Air NZ and Qantas some difficulties, despite the quite strong recent growth in the Tasman market, on which total passenger numbers have increased by more than 7% annually, on average, since January 2001 (see Appendix). BTRE data do show a gradual but fairly steady decline in seat utilisation rates since 2001 for Qantas and Air NZ (Appendix), though this could be due to increases in fares. Note that with around 46 daily return flights across the Tasman on the nine main routes, of which Air NZ and Qantas have about one third each, a continuation of 7% annual market growth with no change in their schedules would be for each of them the equivalent of removing the capacity of one daily return flight each year from their schedule (ie, 365 actual return trips) in a static market.

Of course, there are alternatives to the TNA. Are there not opportunities for setting up code sharing arrangements (not necessarily restricted to being between Air NZ and Qantas) which could enable reductions in capacity without compromising independent competition on marketing and pricing? And why can't they just adjust capacity unilaterally, as independent competitors normally do and as they have done in the past? The airlines anticipated this question, and respond as follows:

> 'The consequences of a network carrier unilaterally removing capacity from a market, such as the Tasman, would be to cede competitive advantage to the competing airline's network while effectively marginalising its own network … consumers (particularly business passengers) are more likely to choose the network airline that offers more destinations and frequencies.' (Qantas and Air NZ 2006, paragraphs 3.8, 3.9)

To the extent that this statement holds true, it provides corroboration for the findings of this paper and of Hazledine (2006), to the effect that the fringe airlines Pacific Blue and Emirates do not appear to offer strong competition for the network carriers on the Tasman. The real problem faced by Air NZ and Qantas is each other, as it has been in the past. Whether this can justify unusual regulatory relief in the form of an officially sanctioned cartel is another matter.

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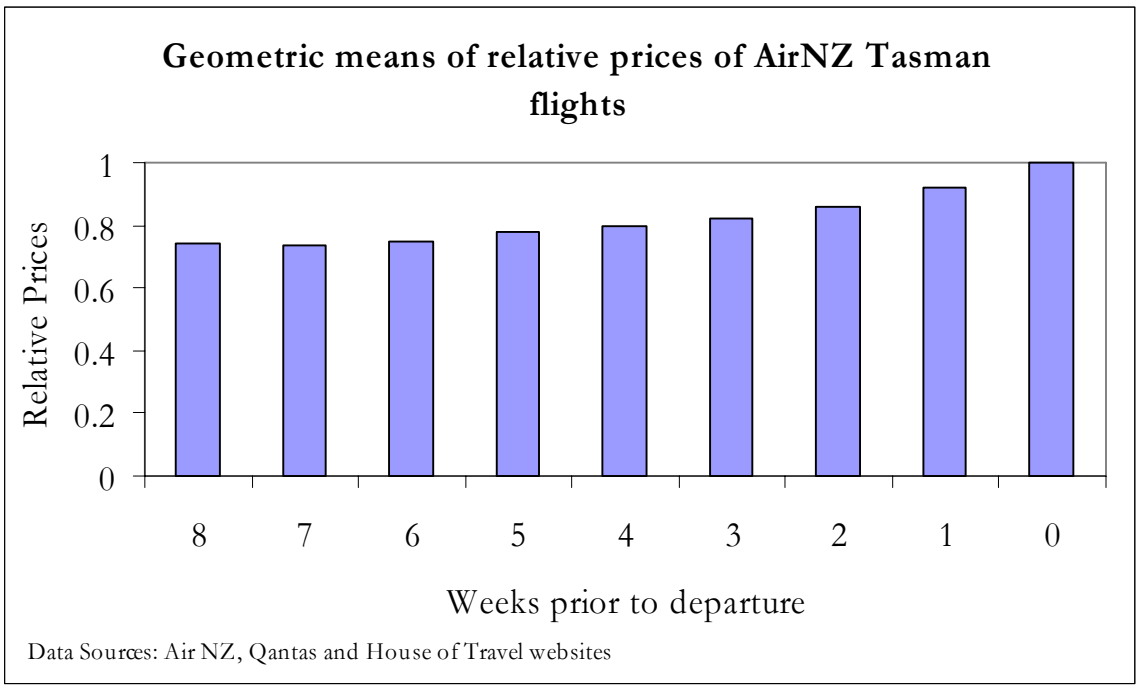
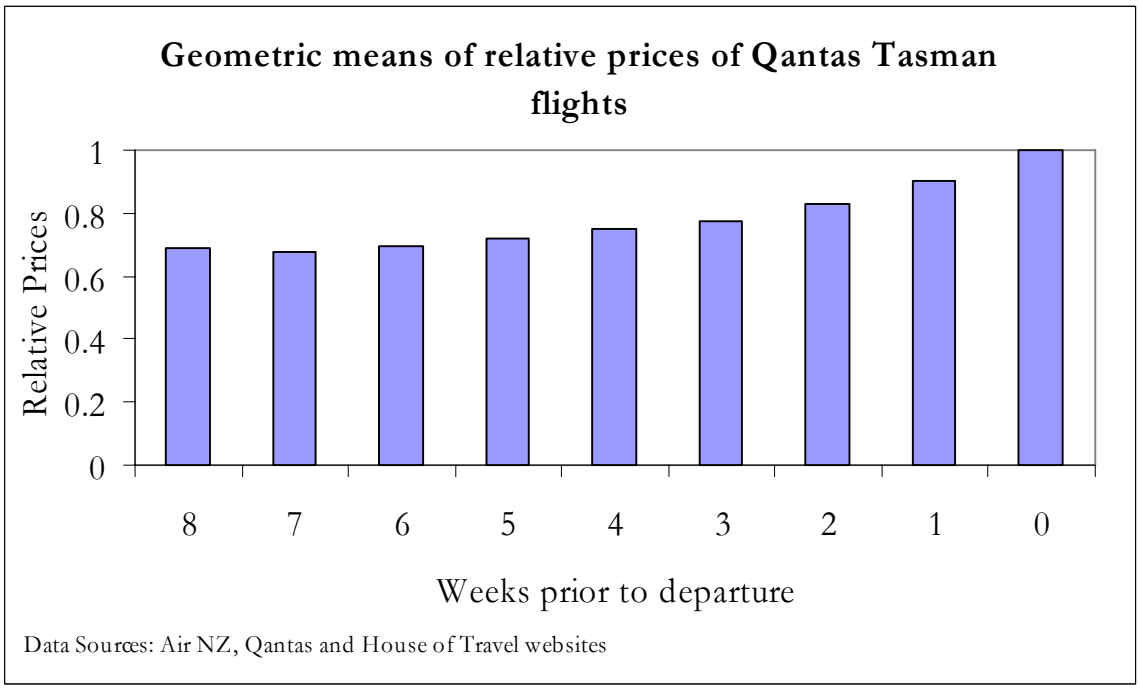
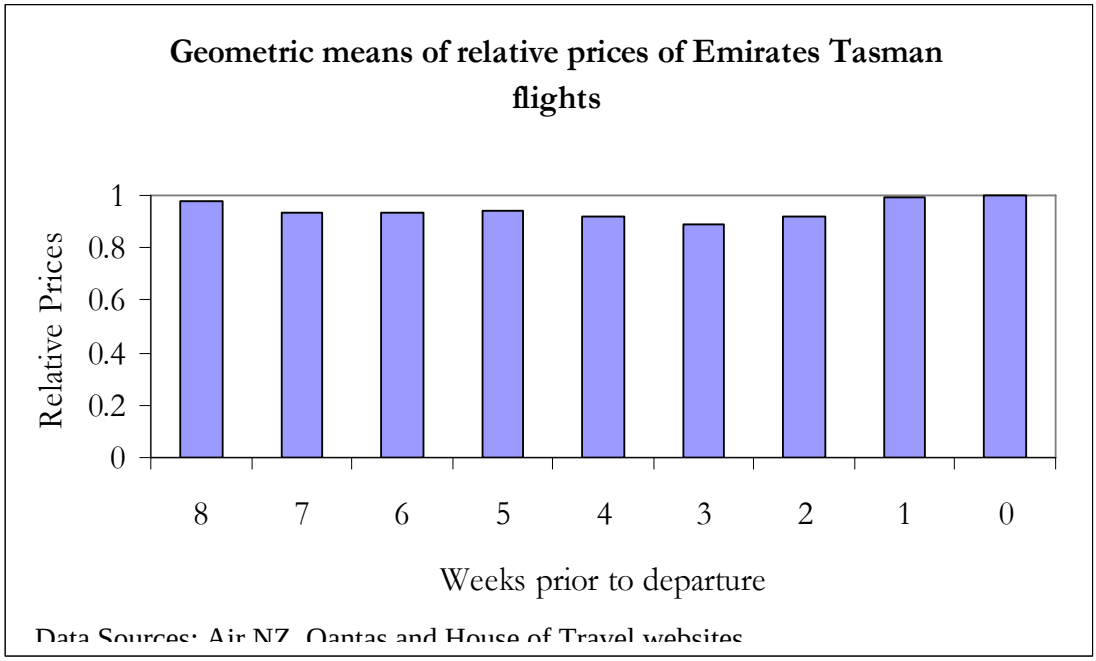
Figures 1-4 follow:

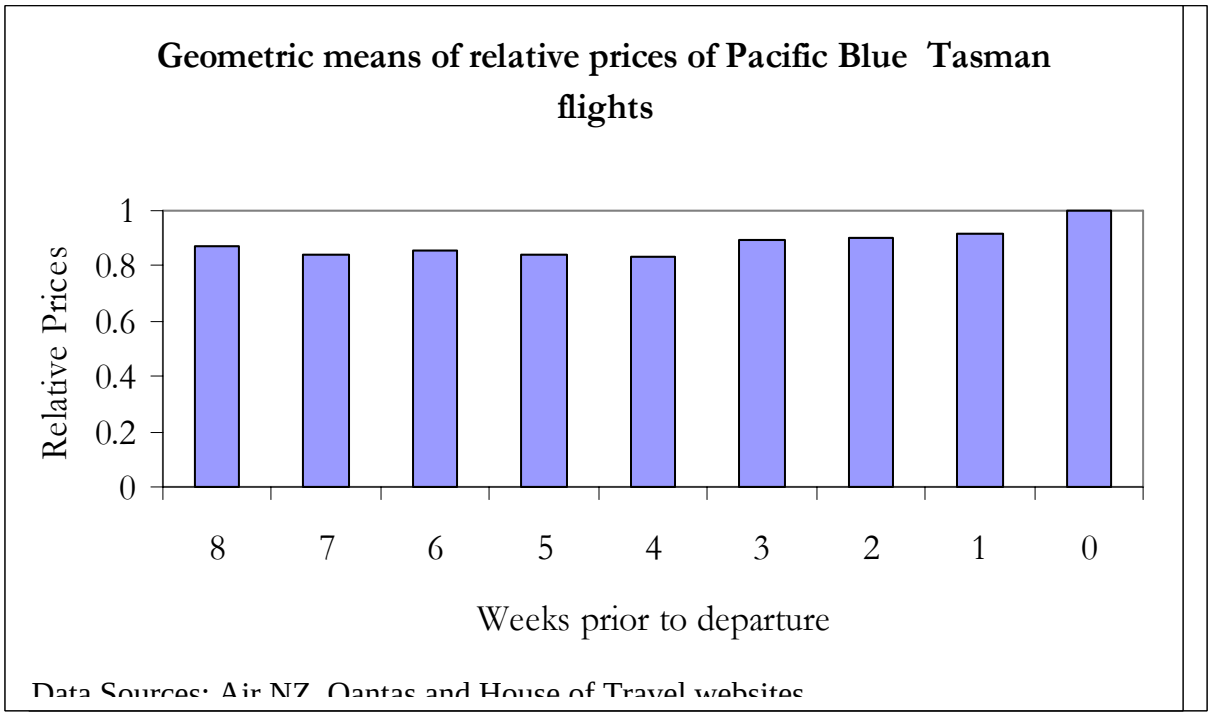


Data Sources: Air NZ, Qantas and House of Travel websites

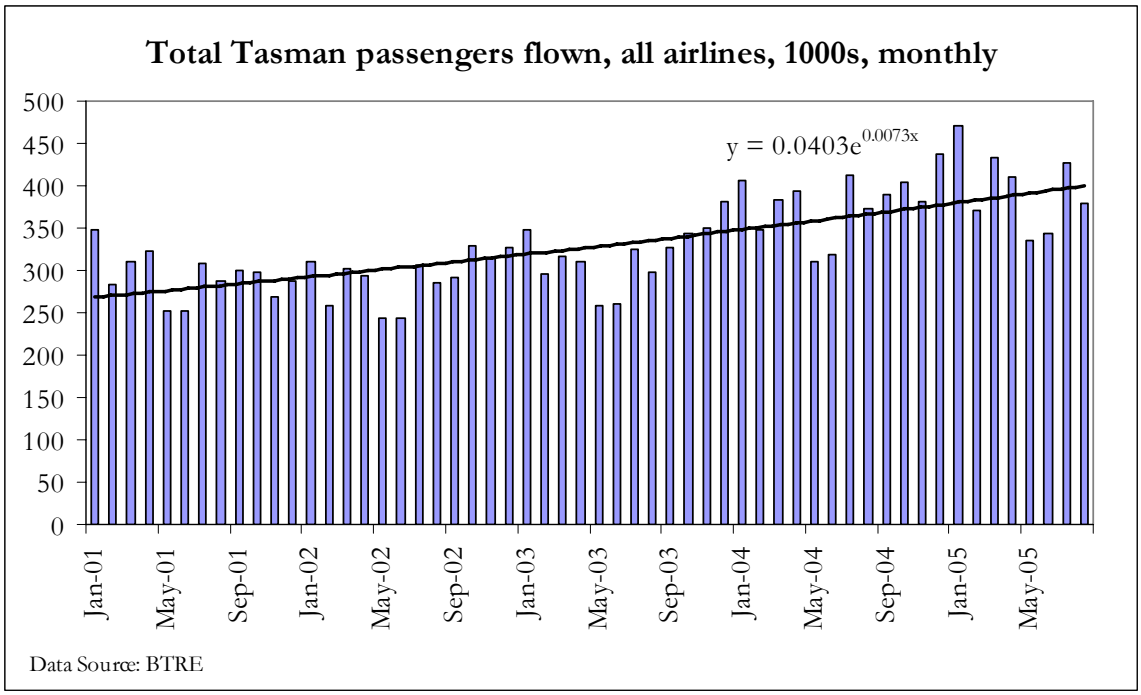


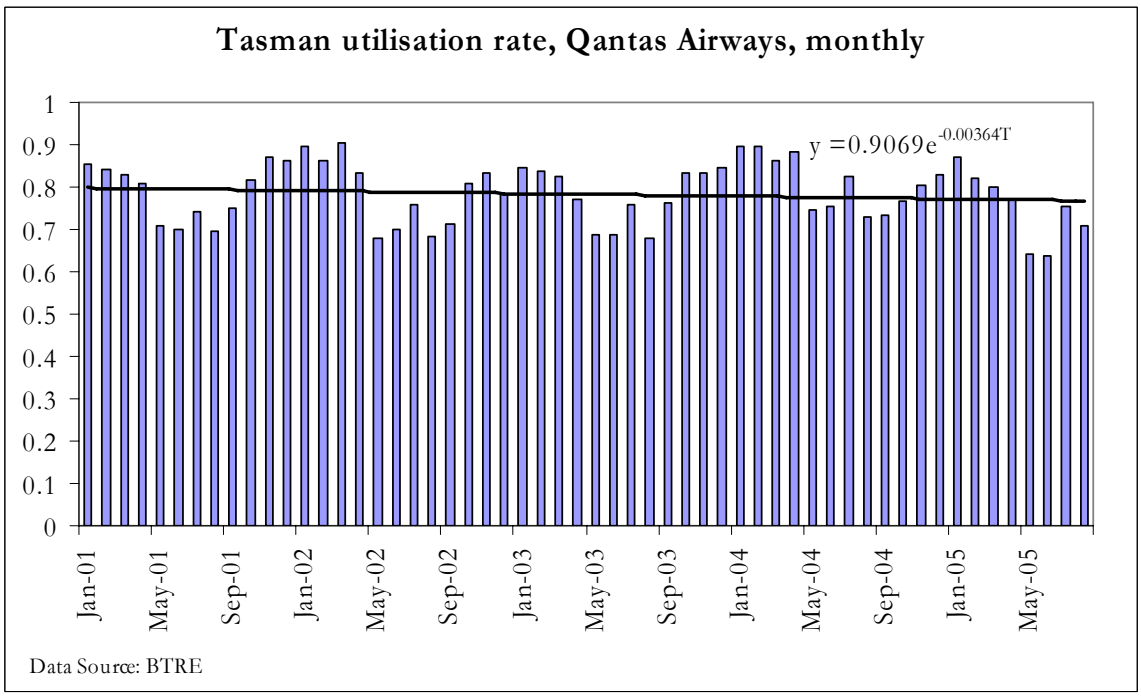
Data Sources: Air NZ, Qantas and House of Travel websites


Geometric means of relative prices of Emirates Tasman flights
Relative Prices
1
0.8
0.6
0.4
0.2
0
8
7
6
5
4
3
2
1
0
Weeks prior to departure
Data Sources: Air NZ, Qantas and House of Travel websites

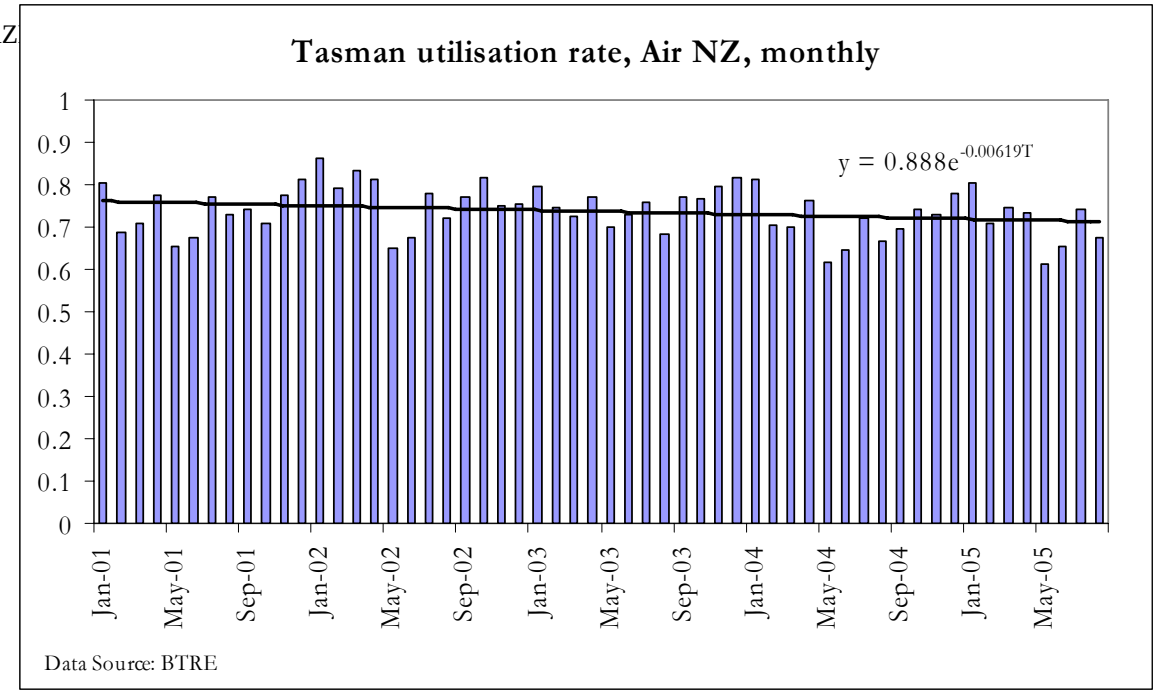

Geometric means of relative prices of Pacific Blue Tasman flights
Relative Prices
1
0.8
0.6
0.4
0.2
0
8
7
6
5
4
3
2
1
0
Weeks prior to departure
Data Sources: Air NZ, Qantas and House of Travel websites

Appendix


Total Tasman passengers flown, all airlines, 1000s, monthly
y = 0.0403e^0.0073x
500
450
400
350
300
250
200
150
100
50
0
Jan-01
May-01
Sep-01
Jan-02
May-02
Sep-02
Jan-03
May-03
Sep-03
Jan-04
May-04
Sep-04
Jan-05
May-05
Data Source: BTRE


Tasman utilisation rate, Qantas Airways, monthly
y =0.9069e^-0.00364T
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-01
May-01
Sep-01
Jan-02
May-02
Sep-02
Jan-03
May-03
Sep-03
Jan-04
May-04
Sep-04
Jan-05
May-05
Data Source: BTRE

HAZ


Tasman utilisation rate, Air NZ, monthly
y = 0.888e-0.00619T
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-01
May-01
Sep-01
Jan-02
May-02
Sep-02
Jan-03
May-03
Sep-03
Jan-04
May-04
Sep-04
Jan-05
May-05
Data Source: BTRE

Pricing and Competition in Australasian Air Travel Markets

Tim Hazledine
Dept of Economics
The University of Auckland
t.hazledine@auckland.ac.nz

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JEL numbers: D43 L93 L41

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.

[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:

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

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

[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

The New Price Discrimination and Pricing in Airline Markets: Implications for Competition and Antitrust*

by

David Gillen
Sauder School of Business
2053 Main Mall
University of British Columbia
Vancouver, BC Canada V6T 1Z2
(604) 822 8352
david.gillen@sauder.ubc.ca

and

Tim Hazledine
Department of Economics
University of Auckland Business School
Commerce A Building
3A, Symonds Street
Auckland, New Zealand
64 9 - 373 7599 Ext: 87435
t.hazledine@auckland.ac.nz

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Abstract

The passenger air travel industry has recently been impacted by two major innovations: the rise of Low-Cost Carriers (LCCs) offering cheap, no-frills, one-way fares, and the widespread adoption of Internet-based direct Business-to-Consumer ticket sale systems. This paper explores the implications of these innovations using price data for over 1700 flights on forty Canadian and trans-border routes observed in May 2006.

We find (a) that there is extensive price discrimination based on date of purchase of ticket and other factors; (b) that average prices paid are nevertheless still significantly determined by the number and size distribution of airlines supplying a route; (c) that established 'legacy' carriers can still charge a substantial price premium over LCCs; and (d) that the internet fare systems may have made it easier for legacy carriers to coordinate the typically substantial increases in their fares over the last two weeks before flight date. We note the implications for antitrust policy in these markets

1. Introduction

The passenger air travel market has recently been impacted by two major innovations: first, in the 1990s, the rise of 'Low-cost Carrier' (LCC) airlines offering cheap one-way point to point tickets, and then, in the new millennium, the emergence and enthusiastic adoption by consumers of on-line internet booking systems. It has been suggested that the impact on the established or 'legacy' carriers has been dramatic – even that their business model has been 'broken' (Tretheway, 2004) as a consequence of the spread of these innovations.

Specifically, the transparency of Internet booking systems would result in only the lowest fare offerings being sustainable in the market, and the simplicity and efficiency of LCCs would mean that it would be their fares that would be the lowest. This would seem to have two important implications in practice for the legacy carriers. First, they would not be able to sustain the elaborate price discrimination practices whereby they had been able to extract different prices from different customers and prevent fareclass arbitrage by means of 'fences' placed around their cheapest fares – notably, the advance purchase return ticket with a Saturday night stayover requirement, which was cleverly designed to deter high-value business travellers but not the leisure travel segment of the market. And, second, because the new, flat, fare structure would be determined by the presence of LCCs in a market, the traditional relationship between market structure and price would be broken: it wouldn't matter much whether a route was serviced by three or two or even just one legacy carrier, and indeed the monopoly might even be more attractive because it would be able to reap efficiencies of scale and scope economies.

In this paper we analyse more than 20,000 observations of airfares offered in May 2006 on forty North American routes: twenty two within Canada, and eighteen trans-border routes between Canada and the United States. The impact of the internet and the LCCs is immediately apparent: the old restricted return fare product has completely disappeared from the market – all thirteen of the airlines in our database offer one-way internet fares, which can be purchased either directly off the airline's website, or from a travel agency which collects all the available fares and displays them so as to make it immediately obvious to the consumer where the best deal is coming from.

And yet the outcomes of the new competition do not at all support the 'broken model' predictions. We find that the legacy carriers use the new system to generate substantial inter-temporal price discrimination, with prices offered for a specific flight often being two or three times higher in the week before the flight than the fares available eight weeks before (where our observations begin). We observe this pattern of fare increases even in markets served also by LCCs, whose prices throughout -- and especially in the last week -- are significantly lower than those of the legacy carriers. We find that structural competition still matters: the legacy carriers' fares are lower, on average, if there are more of them operating on a route. And we find evidence that the very transparency of Internet-based fare systems may actually have made it easier for legacy carriers to coordinate their pricing, in particular to take advantage of the generally higher willingness to pay of business travellers making their purchase decision close to the day of the flight.

The paper is set out as follows in section 2 we provide the motivation for and background to our research and section 3 is a summary of previous studies in airline pricing. Section 4 describes our data and defines the variables subsequently used in the econometric modelling Section 5 presents a graphical illustration of prices in a sample of the markets. Section 6 discusses the regression results and their interpretation while section 7 offers a summary and some conclusions.

2. Motivation and Background

The focus of this paper is the link between market structure and the new price discrimination. Standard economic pricing theory is in terms of single-pricing and nearly all econometric tests use average price data, as though only a single price is charged for any particular product or service. Such analyses predict that sellers use their market power to raise price by restricting output, and that the extent a group of sellers can do this depends, among other factors, on their numbers: more sellers means lower price.

Such predictions are the basis of the policy treatment of proposed mergers, which are often turned down by the antitrust authorities if it is deemed, according to the orthodox theory, that the merged firm's market share would be such as to make significant restrictions of output (and consequential allocative inefficiencies) likely. Such in essence was the basis of the decisions of the NZ Commerce Commission and the Australian Competition and Consumer Commission ruling against the 2002 application by Air New Zealand and Qantas to form a 'strategic alliance' (in essence, a cartel) covering all of the markets on which they currently compete.

A similar type of model was used in assessing the [then] proposed Air France-KLM merger and this was approved, on the basis that the likely price effects would not be significant.

There are some who argue that in such cases that keen competition at the low-price end of the market (induced by the actual or potential presence of the LCCs), coupled with the price discrimination practices of the legacy carriers have basically rendered obsolete the traditional basis of antitrust economics – that is, of price increases from restricting output. Even a dominant firm that could price discriminate effectively would not wish to restrict output, because it would pay them to supply marginal or low-valuation customers so long as this segment of the market could be 'fenced off' from higher value demand. Thus, the formation of a cartel would not necessarily lead to allocative inefficiencies, and possibly not even to increases in the average fares paid in these markets.

Empirical work on domestic NZ and trans-Tasman routes (Hazledine, 2006a) finds evidence that the extent of actual competition on routes (number and size of competing carriers) does still significantly affect the average fare paid, and, perhaps especially, the lowest price at which seats are offered. However, the output restrictions required to affect price increases may indeed be less than is predicted in standard single-price oligopoly models. For the present paper we develop these results and extend the tests to the domestic Canadian market, where an FSA (Air Canada) faces competition from an LCC (WestJet), and to the Canada/US transborder market where differing routes have differing levels of competition in terms of both numbers and types of carriers. We then consider the implications for antitrust as applied to horizontal mergers or alliances between competing airlines. We find this important for two reasons. First, North America has a number of carriers in Chapter 11 protection and it seems only a matter of time before further mergers will be proposed. Second, and pertinent to the Air New Zealand-Qantas proposal, Canada is often described as being similar to the Australian-New Zealand market.

3. Previous studies of airline pricing

There is an interesting econometric literature on the relationship between airline (average) fares and differences or changes in market structures, mostly using U.S. data. There have been three main focuses of attention: on the link between number of competitors and prices; on the existence of "hub premiums" earned by airlines dominating an airport used as a hub for connecting flights; and on the competitive impact of low-cost carriers or LCCs. Many of these studies are surveyed by Tretheway and Kincaid (2005).

Kim and Singal (1993) examined the impact of the fourteen U.S. airline mergers (national and/or regional carriers) that took place over the 1985-88 period, comparing routes affected by mergers with a control group of unaffected routes. They found that over the period from the initiation of merger talks through merger completion, the merging firms increased fares on average by 9.44% relative to unaffected routes, and any competitors on the affected routes raised their prices by even more -- 12.17%, on average. Hurdle *et al* (1989) compared 850 non-stop city-pair routes in the U.S. and report an average price differential between routes supplied by one carrier and routes supplied by two carriers of about 20%. Borenstein (1990) focused on the 1986 Northwest Airlines/Republic merger and

found average fare increases of 6.7% and 22.5% on routes served pre-merger by both airlines, depending on whether there was or was not at least one other competitor also serving the route. The same author (1991) found average fare differences between monopoly and duopoly, and between duopoly and triopoly, of 8% in each case. Oum, Zhang and Zhang (1993) predict a 17% price increase moving from duopoly to monopoly routes.

Morrison and Winston (1990) report that the number of effective airlines in a particular market over the 1982-88 period affected the fare charged with an elasticity of 0.12 -- that is, a route served by two carriers has fares twelve percent lower than a route served by just one airline.

Tretheway, in his 2004 submission to the Australian Competition Tribunal, reports an econometric model of air ticket prices estimated on a panel dataset covering ten years (1990-2000) of data on 1000 U.S. routes.[1] Tretheway's main interest is in the impact of LCC competition on prices, but his results do cover situations in which only 'FSA's (full-service airlines, also known as 'legacy carriers') serve routes, and these imply that a route with just one FSA has fares as much as 33% higher than a duopoly FSA route, which in turn sets prices on average 8% higher than on a route competed for by three FSAs.[2]

However, in later work, not surveyed by Tretheway and Kincaid, Goolsbee and Syverson (2005) find that an increase in the probability of Southwest entering a route[3] 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.

Morrison and Winston (2000) estimated the hub premium using DB1A data from 1996. They compared the average fare at eleven concentrated airports with the average fare across all airports in the US. They found a hub premium estimate of 22%. They next controlled for Southwest by simply by removing airports served by Southwest and found fares at the concentrated airports were found to be 6% lower than the remaining airports; fares at airports served by

1 This paper is reported here as Tretheway and Kincaid (2005)

2 Tretheway's regressions were carried out for him by Steven Morrison and Clifford Winston, who have themselves published a number of studies of U.S. airline pricing. Morrison and Winston also carried out on behalf of Air New Zealand and Qantas an analysis of airfares in Australia over the period 1999-2002, during which Ansett Australia exited and Virgin Blue entered the domestic market. This analysis was subjected to some criticisms from another consultant, Professor Jerry Hausman, which led to the NZ Commerce Commission carrying out its own econometric analysis of the data (2003, Appendix IV). The results of this imply that the presence of Ansett as a competitor to Qantas on a route reduced the latter's fares by about 6.8% on average.

3 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.

Southwest were approximately 39% lower than fares at airports not served by Southwest, averaging across al airports.

In another study, Morrison and Winston (1995) found that average fares for travel to and from the 12 concentrated airports were actually 6% *lower* on average than those for trips to and from other domestic airports if those served by Southwest were excluded from the latter group. They noted that if airports served by Southwest were excluded from *both* the concentrated and the remaining unconcentrated hub airports, average fares between the two groups differed by only about 1% after adjusting for differences in passengers' trip lengths and use of frequent-flyer award tickets.

More recently Hofer et al. (2004) examine whether LCCs affect network carriers' ability to benefit from market concentration and power and whether LCCs earn hub premiums. Their conclusion is that airport market power and market concentration are positively correlated with average fares and that the presence of an LCC in a market leads to lower fares.

Overall, the body of econometric air fare analyses, nearly all of it based on the U.S. domestic market and using data generated under the old system of price discrimination based on imposing restrictions on discounted fares, gives strong support to the prediction of oligopoly theory that actual competition should matter to prices in a market.

4. The Database

Sample

The basic unit of observation is the 'flight', which is a particular journey (flight number or pair of numbers) between two cities marketed by a particular airline on a particular date. In most cases the passengers on a flight are travelling in an aircraft operated by the airline or carrier which sold them the ticket, but some flights are code-shares, such that the aircraft carries passengers with boarding cards with differing flight numbers in the name of two or more airlines.

There are 1748 such flights in total, flown on one of four Wednesdays in May 2006, from May 10 through May 31. Thus there are 437 different flight numbers. These flight numbers cover 40 city-pair routes – 18 trans-border (ie between Canada and the United States) and 22 within Canada. Ten of the trans-border routes are only observed ex-Canada, and four are observed flying both ways. In total, thirteen airlines are observed.[4]

The sample does not include all domestic Canadian and trans-border flights. Apart from the exclusion of most 'return' itineraries, the sample was limited by the following choices:

4 The airlines that fly these routes are: Air Canada, Alaska, America West, American Airlines, CanJet, Continental, Delta, Harmony, Northwest, Skyservice, United, US Air, and WestJet. Note that in September 2006 CanJet announced its exit from scheduled passenger services.

- The extremely busy (many flights) Ottawa-Toronto-Montreal 'triangle' routes were not included, in the interests of keeping the job manageable
- No itinerary with more than one stop was included, nor any 1-stop itinerary taking more than twice the journey time of a non-stop flight[5]

The sample includes flights to and/or from the ten largest cities in Canada, and two other cities. The trans-border sample is a selection of short- and medium haul flights between four Canadian and ten American cities.

Prices

For each of the 1748 flights we observed[6] the lowest available ticket price, beginning on the Wednesday eight weeks before flight date, and thereafter weekly until the final week before take-off, during which price was observed daily (Thursday, Friday, Saturday, Monday, Tuesday). We thus have up to thirteen observations[7] on the lowest available prices at which tickets for the flight could have been purchased -- a total of 20,494 non-blank data entries. In our econometric work we make use of the eight weekly (Wednesday) observations on prices plus the last price offered, which is usually that shown on the day before the flight date. We have no information on the quantity of seats sold at each observed price and nor on any other prices that might have been offered before or within our eight week observation period. That is, our pricing data are sampled from the actual distribution of prices purchased.

To get comparability across routes, prices are divided by the non-stop flight distance, in kilometres. The price variables used here are:

Pavk: average price (cents/km) of the eight weekly price observations and the price the day before flight date (ie, this is the unweighted average of nine price numbers).

P8k: price eight weeks from flight date

P0k: price the day before flight date

Pmink: lowest of the nine prices

Pmaxk: highest of the nine prices

Capacity and Concentration

We have no information on numbers of seats sold on each flight. We can ascertain, from the websites, the aircraft type and the number of seats available on the aircraft used on the flight. As a true supply-side variable, untainted by the effects of price charged – unlike the actual number of seats sold – seats available is arguably a

5 Airline websites are often padded out with large numbers of rather lengthy and inconvenient itineraries, often at higher prices than are on offer for non-stop flights leaving at a similar time (and arriving of course much sooner). 119 of the journeys included had one-stop itineraries.

6 The Expedia.ca website was the source of the price quotes.

7 Fewer than thirteen if the flight was sold out before flight date. The prices included all taxes and 'charges' that the airlines usually do not include in their initial advertised prices.

better measure for use in construction of market structure variables than sales.[8]

However, even on non-stop flights, the total number of seats on the aircraft cannot usually be used as the economic capacity or supply. This is because flights connect with other flights, so that some passengers have an origin and/or destination differing from the take-off or landing point of the particular flight. Also, some flights are operated as codeshares, with seats marketed independently by more than one airline. For these flights we allocated the seats available using what seemed to us to be reasonable rules of thumb. For example for the Air Canada one-stop route from Montreal to Calgary via Toronto, of which the first leg is flown by a 37-seat Dash 8 and the second by an Airbus A320 with 140 seats in total, we assigned just 10 seats to the Montreal-Calgary 'flight', and the remainder to the Calgary-Toronto nonstop. We reasoned that most of the passengers on the first leg would leave the flight at Toronto, either because that was their final destination, or to pick up other onward connections (to Vancouver, or Winnipeg, for example).

Our market structure variables are measured at the route level. For each of the 40 routes we calculated the following:

HHI: Hirschman-Herfindahl Index of seller concentration, defined as the sum of the squared market shares of all the carriers selling seats on the routes, with each airline's market share measured as the sum of all its available seats divided by the total of all airlines' available seats. So, for example, an airline with two daily flights on a route, flown by 140-seat Airbus A320s, would have a market share equal to 280 divided by the total number of available seats offered on all flights by all airlines supplying this route.

DOMINATED: This is a dummy variable set equal to 1 for a route on which the largest airline offers more than 50% of the available seats, with no other carrier offering more than 25% of the seats. On twenty of the forty routes, one carrier was deemed to be dominant by this criterion.

Costs

In most airline pricing studies route distance is used as a proxy for costs. This is clearly an important determinant of flying costs, and is always a highly successful variable in econometric models, but it does suppress any variation in costs due to other factors, such as aircraft type, wage costs and overall operating efficiency. Therefore, in this study we built up our cost variable directly. This is not a simple matter. Apart from the data requirements, important conceptual and economic issues are raised. In particular, the appropriate measure of costs depends on the time horizon -- what contribution to 'fixed' costs is expected when airlines set fares – and also the extent that airlines expect each flight to pay its way, or, instead, price on a broader basis, such as the average costs for the route, or even for their entire networks. We do not bring firm priors to these issues, and our approach will be to let the data reveal the dimensions of costs that enter airlines' pricing and yield management decisions.

We have three different ways of building up a costs variable. Two of these apply formulations developed in a recent article by Swan and

8 With the qualification that a seat in business class is not really the same as a seat in economy. Here we just add the total number of economy and business class seats, with no weighting of the latter.

Adler (2006). The third is a 'block hour' measure based on Form 41 costs collected by the USDoT/FAA and reported in *Aviation Daily*.

Swan and Adler report two methods for constructing costs. First is what they term a 'planar-form cost function' based on engineering data ,which specifies that aircraft trip costs are determined by seat numbers (S) and route distance (D). For single-aisle operations from 1000-5000 km, the relationship is:

$$C = (D+722)*(S+104)*\$0.019$$

And for longer haul twin-aisle operations:

$$C = (D+2200)*(S+211)*\$0.0115$$

The latter function has more application to long haul trans-ocean flying, whereas our data covers markets which are essentially domestic flying; our longest route is 5335 km and the average non-stop flight length is 1683 km. These formulae are designed to incorporate only aircraft trip costs, which Swan and Adler state are around 50-60% of total costs, with general administrative costs around 30% and commissions and sales expenses the remainder. Note that the constants added in these expressions to both D and S ensure that there will be increasing returns to both these factors: doubling distance for a given number of seats, or doubling aircraft seat capacity for a given distance, will in both cases less than double the total costs of making the trip, so the costs per seat kilometre will fall.

The other cost formula provided by Swan and Adler is a Cobb-Douglas cost function estimated as a log-linear regression on the same information as they used in constructing the planer cost functions. The two specifications estimated for narrow body and wide body operations, respectively, with cost per seat kilometre as the dependent variable, are:

$$c = 2.44S^{-0.40} D^{-0.25}$$

and

$$c = 0.64S^{-0.345}D^{-0.088}$$

Note that in these equations the impact of distance on costs is captured through a distance elasticity, and varies between -.09 to -.25. This 'cost taper' results from lower fuel burn at higher altitudes and spreading the costs of getting to altitude over more km.

Our third method builds up flight costs from available measures of 'block hour' operating costs. The cost associated with operating aircraft on a route; referred to as flying operations cost (FOC) can be measured by the cost per block hour multiplied by the number of block hours required for the route:

$$FOC_s = B_s \bullet H_s \bullet f(Y_s)$$

where B_s is cost per block hour for the aircraft used, H_s are the block hours required for segment S, and $f(Y_s)$ is flight frequency which depends on number of passengers on segment, Y_s . a route can have one or more segments and we examine a flight so frequency is 1. Obviously, the cost per block hour for a given aircraft and given segment will depend upon the labour prices of the carrier as well as other input prices. [9] However, the other input

9. The aircraft cost can be measured by adding the cost per block hour multiplied by the number of block hours required for the flight segment and a portion of the indirect airline costs which are attributable to flight frequency. Note that the

prices such as fuel, maintenance and capital costs will not vary significantly across carriers for that segment.

We constructed this cost measure using information submitted by carriers to the USDOT and assembled as 'Form 41' data. These data are available by aircraft type by carrier by activity -- for example, costs per block hour are available for United, Southwest, American and USAir flying a Boeing 737-400 series. The data are also available on a cost per available seat mile (CASM) basis broken out for crew cost, fuel/oil, aircraft cost, insurance, taxes and maintenance burden. The cost of operating an aircraft type by carriers using that aircraft were reported by carrier, and an average across carriers for an aircraft type is also reported. We had available all costs for all aircraft types used in our data set.

The cost variable was measured as the block hour operating costs for the aircraft used times the block hours for a flight (available when collecting price data). These were divided by the seat km of the flight and expressed as 'cost per seat km'. These represented flight costs.

These costs can differ for the same airline flying the same route if it uses different aircraft type. Accordingly, we also calculated a route-based operating cost measure for each airline and route, which was a capacity-weighted average of the individual flight costs. We will let the econometrics tell us which measure is the more appropriate.

There are additional non-operating costs attached to a flight. These include marketing and transaction costs, passenger and baggage ground-handling costs, and airport fees. We have little direct information on these costs, but we do know that they are incurred on a per passenger basis, so that excluding them from our costs measure would bias upwards the relative costs of longer flights. Therefore, we proceeded on a "top down" basis, as follows. We calculated the total of operating costs for each airline, based on the block hour-based per flight costs we had already computed aggregated over all the flights observed, applied the Swan and Adler rule of thumb that these costs are around 20% of flight operating costs, divided by the total number of seats offered on all flights by the airline, to get marketing etc costs per seat, and then for each flight divided this number by flight distance and added to our flight operating cost measure to arrive at our total costs per seat kilometre measure.

We thus have twelve possible measures of the cost per seat kilometre for a specific flight by a specific airline. There are the three different methods for constructing the operating cost variable, each of which can be measured at the flight or route level, and to which can be added or not the top-down estimate of marketing and ground costs.

We found that neither of the Swan/Adler measures performed well econometrically. This may be because our routes are clustered near

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block-hour costs need to be adjusted upward by the amount of interest cost on the capital tied up in aircraft. It appears that the cost per block hour available in Form 41 data includes only the aircraft rentals paid for leased aircraft, and does not appear to include the interest cost on the owned aircraft. This however may not be a significant problem given that most airlines lease aircraft.

or below the bottom end of the flight distance range specified by Swan and Adler -- 1000-5000 kilometres.[10] The nonlinearity built in to the Swan/Adler formulas could overestimate flight costs for these shorter flights. Also we observe both single and double aisle aircraft flying transcontinental routes, but the shorter distance Swan/Adler formula is designed just for single-aisle aircraft.

We therefore used the measure that we developed ourselves from the block hour data as the basis of our cost variable. Perhaps surprisingly, we found that adding our, admittedly quite crude estimate of marketing etc costs to the operating cost data improved the explanatory power of the variable, and we also found that prices were better explained by operating costs measured at the route, not the flight level.

Other variables

SOLDOUT: This is a dummy variable set equal to 1 if the flight appeared to have sold-out at any time in the last week before the flight date, as evidenced by its disappearance from the website offerings

LEISURE: This is an informed 'quesstimate' of the percentage of passengers on a route who are 'leisure' as opposed to 'business' travellers. Leisure travel includes tourism and the 'VFR' (visiting friends and relatives) category. This was constructed using as a basis the industry rule of thumb that, overall, about 70% of passengers are leisure travellers, and then modifying this up or down depending on the known characteristics of the route. For example, the value of LEISURE for the Toronto-Tampa route is set at 90, and for the Toronto-New York route at 40.

PEAKDUM: This is a dummy variable assigned the value 1 for some early morning short-haul flights between large cities. It did not show any significance in the econometric analysis.

LCC: The airlines America West, CanJet, Harmony and Skyservice are all 'Low Cost Carriers' and the dummy LCC is set at 1 for them. We will also show results with WestJet categorised as an LCC

STOPS: set equal to 1 for one-stop flights.

Table 1 provides the summary statistics for each variable used in the regression analysis.

Table 1

	Pavk	Pmink	P8k	Pmaxk	P0k	ROCOSTB	HHI	DOMINATED
Mean	0.1992	0.1466	0.1559	0.3339	0.3275	0.1315	5,171	0.2943
Standard deviation	0.1274	0.0865	0.0933	0.2664	0.2662	0.0855	1,891	0.4558
Maximum	0.8772	0.5427	0.8400	1.5138	1.5138	0.6318	10,000	1
Minimum	0.0338	0.0167	0.0167	0.0406	0.0292	0.0418	2,176	0
	SOLDOUT	LEISURE	WEEK1	WEEK2	WEEK3	LCC	STOPS	PeakDum
Mean	0.2012	65.11	0.25	0.25	0.25	0.1819	0.2189	0.1125
Standard deviation	0.4010	14.39	0.4331	0.4331	0.4331	0.3858	0.4136	0.3160
Maximum	1	90	1	1	1	1	1	1
Minimum	0	35	0	0	0	0	0	0

5. Pricing Behaviour

Asymmetric information is an intrinsic and inescapable fact in nearly all pricing situations: customers know more about their maximum willingness to pay [WTP] for a given good or service than does the seller. This is still true of course in air travel markets, but

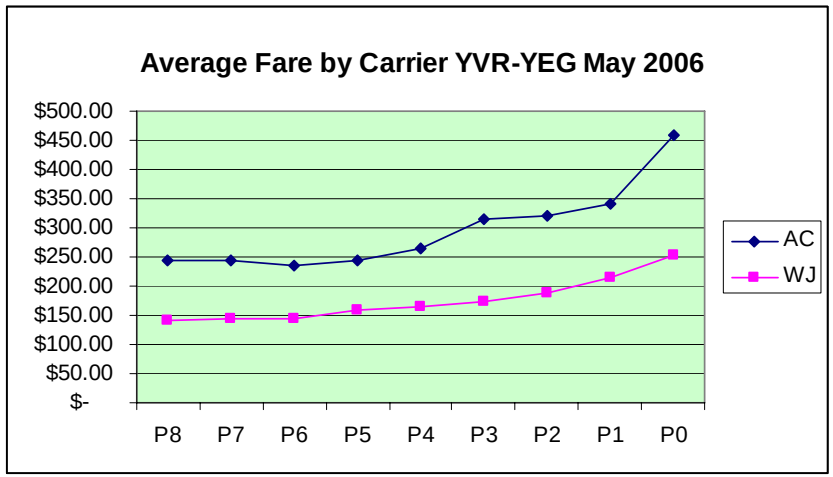
10 Fifteen of our 40 flights are actually less than 1000kms in distance.

what distinguishes the passenger airline industry from just about all others is the extent to which the sellers -- the airlines -- have been able to devise methods of separating potential travellers by their WTP, and charging them accordingly.

In this section we use our price data to illustrate what is now the most important tool used for sorting passengers by their willingness to pay, which is simply the practice, using what the airlines call 'yield management', of increasing the lowest fare offered for a particular flight as the day of that flight approaches. This exploits the different WTP of leisure and business travellers. Generally leisure passengers will be more price sensitive (lower WTP) and are willing to plan and book well ahead of the departure date. Business passengers on the other hand tend to face continuously changing schedules requiring flexibility and so are unwilling to commit to an itinerary well in advance, but are willing to pay a high price when they do choose to travel

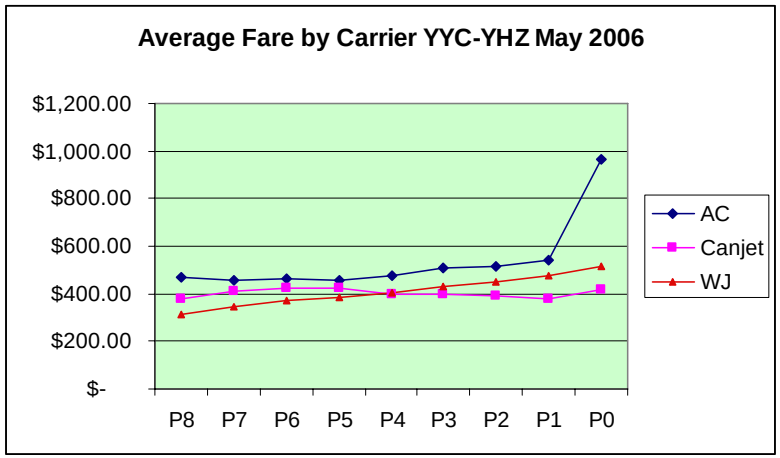
Figure 1 shows the YVR-YEG (Vancouver-Edmonton) route, which has a somewhat higher than average proportion of business travellers. The route is served by two airlines, the legacy carrier Air Canada (AC) and a LCC, WestJet (WJ). We can see both carriers start to increase prices five weeks out, at P5, and that the average price increases steadily, but with AC at a higher level throughout than WJ. So, both carriers are using intertemporal price discrimination, but the legacy carrier more so than the LCC.

Figure 1



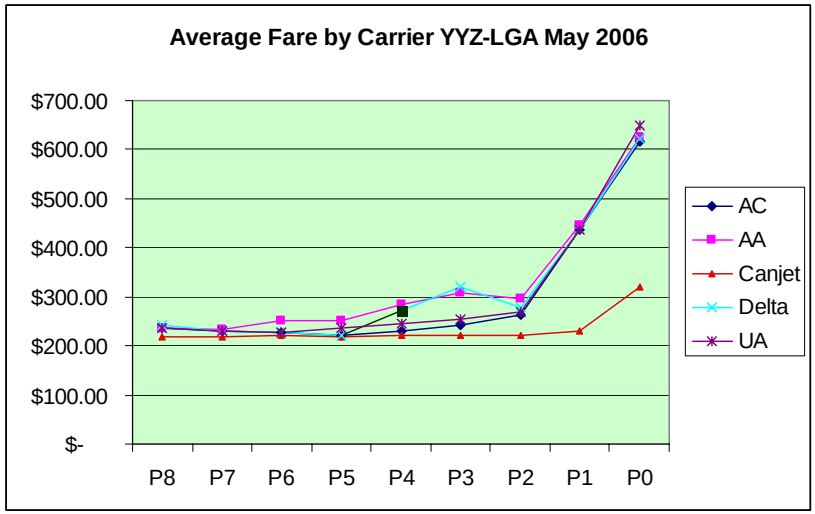
In contrast, on Figure 2 showing the Vancouver-Halifax (YVR-YHZ) route, we had three carriers -- two LCCs (WJ and Canjet) and Air Canada. This is a relatively long haul route, at approximately 4600 km. The carriers behave in strikingly different ways. WJ gradually increases prices by a small amount, Canjet keeps prices relatively constant and AC increases prices very little in the first 6 weeks but two weeks before the flight increases prices significantly. So we have one LCC which does not price discriminate at all, one which does to a small degree and a legacy carrier which discriminates to some degree over 6 weeks and significantly in the last two weeks.

Figure 2



Compare this behaviour with Figure 3 which illustrates prices in a transborder market – a market in which the route joins a city in Canada with a city in the US. The route shown is Toronto-New York (YYZ-LGA), as served by 4 legacy carriers -- AC, AA (American airlines), Delta and UA (United Airlines) -- and one LCC, Canjet. This can be regarded as a predominately business market. Prices are relatively constant until 2 weeks prior to the flight with the LCC is charging the lowest price. At 2 weeks before the flight every carrier except Canjet raises prices significantly, as then does Canjet one week out. The prices rise significantly and in an apparently coordinated way.

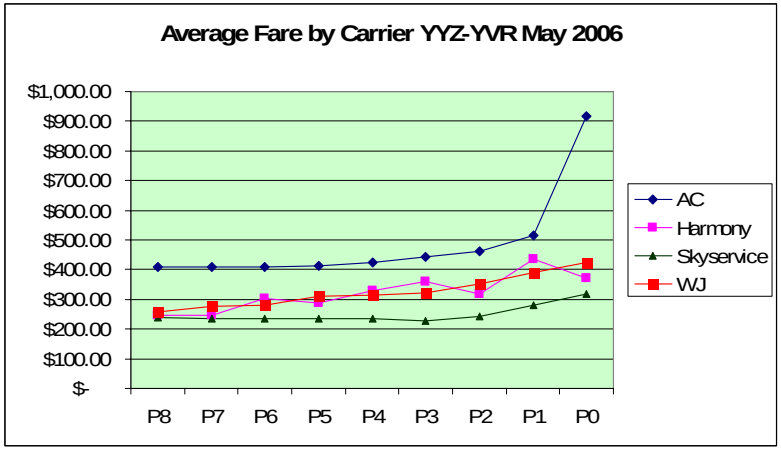
Figure 3



In Figure 4 we show the high volume domestic route Toronto-Vancouver, which is fairly typical route with respect to the relative proportions of business and leisure passengers. There are four carriers: a legacy carrier, AC, a low cost carrier, WJ and two scheduled charter operators which would also be low cost.[11] The legacy carrier sets prices 60 percent or more higher than other carriers. All carriers increase their prices by a small amount over weeks eight through two before flight date, but only the legacy carrier increases prices significantly within two weeks of take-off.

Figure 4

11 A schedule-charter operator flies some scheduled routes at low frequency and also flies charters to leisure destinations.



Our final illustration is Figure 5, showing another transborder route (Los Angeles-Vancouver), which is served by five legacy carriers plus the US based LCC, America West. Here the pricing behaviour is quite different. Each carrier appears to set its own, different, price level -- eight weeks out from the flight date prices range from $180 to $300. The price distributions are relatively flat in some cases and volatile in others: on average there is very little price discrimination before the last two weeks before the flight. The LCC is not even the low price supplier. Some prices go up two weeks out but others fall and the increases are not nearly as marked in other markets.

Figure 5

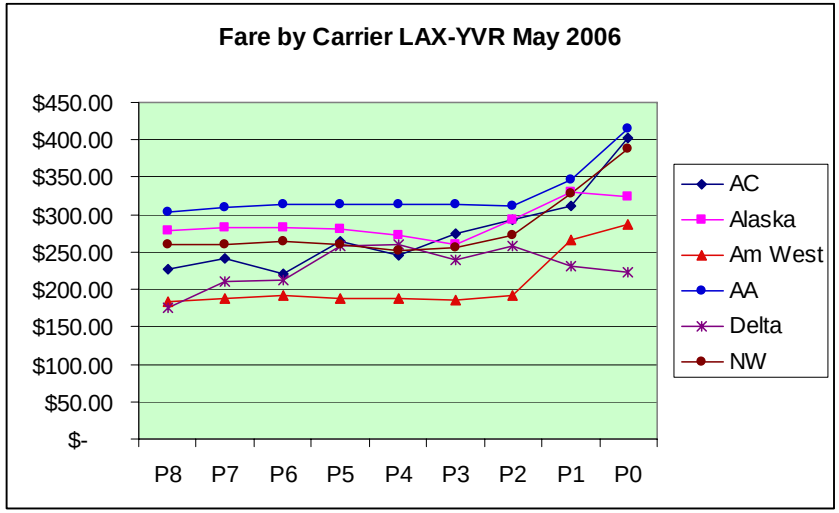


Figure 1 through 5 illustrate pricing activity in markets with differing numbers of carriers, as well as differences in route length, market type, domestic versus transborder and mix of carriers. These data show quite marked differences in prices charged for flights on the same route and the same day – differences both across carriers and over time on each carrier. The data also reveal some striking apparent coordination of price increases as the flight date approaches. The next section explores these pricing patterns systematically.

6. Econometric Results

The graphics shown in the previous section reveal substantial and differing patterns of intertemporal price discrimination across the Canadian and trans-border routes. In this section we seek to explain these patterns in terms of supply, demand and market structure factors. We are particularly interested in whether the prediction of standard (one-price) oligopoly theory that price is affected by the extent of structural competition in a market, as evidenced by the number and relative size of sellers, holds true when 'price' is demonstrably an average of prices paid which can differ, for the same flight, by a factor of two or three depending on when the ticket was purchased. We are also interested in the competitive impact of Low-Cost Carriers, and on whether we can explain the pattern of price discrimination; in particular, whether this is affected by market structure, as predicted by theory.

We have a panel of data, with 437 itineraries or flights each observed four times on consecutive Wednesdays in May 2006, giving a total of 1748 observations. To estimate our models we use EViews 5.1 Panel EGLS with cross sectional random effects, with the flight as the cross sectional identifier.

Results are shown on Table 2. Here we have two sets of six regression outputs. The two sets differ only in their treatment of the Canadian airline WestJet. The upper group of six has WestJet classified as a Low Cost Carrier, as indeed it claims to be. The lower six regressions all have WestJet not classified as an LCC.[12]

Average price regressions

The first two regression models in each group have the log of the average lowest price per kilometre as the dependent variable. We are testing the proposition that average price (in essence, the first order summary statistic of the price distribution) is a meaningful number even in the context of the very substantial intertemporal price discrimination revealed by our data. Hazledine (2006) finds in the context of the linear homogeneous Cournot-Nash model that average price charged is actually unaffected in theory by the extent of price discrimination (number of different prices offered) -- here we can test this prediction.

These regressions introduce the set of explanatory variables that we use throughout. Looking first at the first column of results, we note the following:

- Our cost measure is a highly significant determinant of the average level of prices
- The HHI market concentration index is a moderately significant determinant of average prices, as predicted by oligopoly theory

12 The new term for business model followed now by Westjet is 'Value Focused Carrier' (VFC), meaning a carrier which follows the LCC strategy with respect to costing but has added services for additional price.

- Flights which are sold out before the flight date have higher average prices, suggesting that selling-out is a demand-shift phenomenon, not a movement down demand curves induced by lower prices
- Flights with a higher proportion of leisure (non-business) passengers may have lower prices, although this finding is not robust to the classification of WestJet
- There was a monotonic ramping up of prices as the month of May proceeded towards the summer holiday travel season, with flights on the last day of the month tending to be more than 9% more expensive than flights just twenty one days earlier
- One-stop flights yielded fares at least 15% lower than non-stops. This is a striking result, because the costs of flying one-stops must in general be higher than a non-stop routing, so that supply-side factors would push for a higher, not lower price.[13] It seems likely that what we have found is a manifestation of a price discrimination practice, with highly time-insensitive travellers taking up these cheap itineraries whose inconvenience[14] deters the high-value time-sensitive business customer.
- It is clear, as it was in the graphs of section 5, that LCCs charge lower prices than legacy carriers: but it seems that WestJet is a more expensive LCC than CanJet, America West and the others. Without WestJet, the coefficient on the LCC dummy variable is about -0.3; with WestJet also classified as an LCC, the coefficient rises to just -0.08
- The classification of WestJet also affects the significance of the HHI, which is greater when WestJet is assigned to be an LCC. The reason for this is probably that most of the relatively highly concentrated duopoly routes are those inside Canada on which Air Canada and WestJet compete, and on which WestJet does systematically charge lower prices than Air Canada, especially in the last week before travel. Treating WestJet as an LCC allows some of this price differential to be absorbed into the LCC dummy coefficient, leaving more effect to be accounted for by the HHI structural measure.

In the second column we allow the coefficient of HHI to differ according to whether the route is deemed to have a 'dominant' carrier, as defined (without any experimentation but not unreasonably) as an airline offering more than half of the seats on a route on which no other airline offers more than one quarter. Statistically, this is a highly successful specification, but its economic implication was a surprise. Bearing in mind the literature on 'hub premia' and 'city presence' effects, we had expected prices to be higher for a dominant carrier, ceteris paribus, and indeed first specified the dummy variable 'DOMINANT', taking the value 1 for the airline, not for the route. When the coefficient came out as negative we investigated further, and found that the characteristic being picked up is more likely a route, not an airline characteristic – a model with the dummy variable DOMINATED fit the data better.

13 The RCOSTB unit cost variable does not account for additional costs of operating a one-stop itinerary. It has the same value for all the flights on a particular route of a particular airline.

14 As well as taking longer, many one-stop itineraries operate in non-peak hours.

The implications of the result can be seen as follows. Suppose we have two routes. One is supplied by two equal-sized airlines, and so has a HHI value of 0.5. The other has a 'dominant' carrier offering 2/3 thirds of the total seats, competing with two smaller carriers, each supplying 1/6 of the market. The HHI for the second route is also 0.5, but according to our regression model, prices would be about thirteen percent higher on the symmetrical duopoly route.[15] That is, on these routes, there is more effective price competition between three firms than between two, even if in the triopoly case two of the three suppliers are much smaller than the leading firm. A possible explanation is that two similar-sized duopolists find it easier to tacitly collude to avoid over-enthusiastic price competition. This may help explain why WestJet -- which operates mostly in duopoly situations with Air Canada – has prices systematically higher than the other LCCs.

Low price regressions

The third and fourth of the six columns of results on Table 2 explore the determinants of the lowest prices charged by the airlines.[16] We use two measures of low price: Pmink, which is the lowest of the nine prices observed over the eight weeks before flight date, and P8k, which is the first price observed, eight weeks before flight date. In 57% of cases (998 out of 1748) these numbers are the same, but in the other instances the lowest fare was observed less than eight weeks before flight date.

Which is the most appropriate low-price measure? Sudden (and usually temporary) breaks in the pattern of monotonically increasing prices over time seem likely to be mostly due to unforeseen shifts in the demand curve (eg because of a cancellation of a tour group booking), not to price discrimination, which is about movements along the demand curve. If then, our focus is on the characteristics of (inter-temporal) price discrimination, then we might wish to focus on the P8k variable, being the price at the low-price end of the intertemporal distribution. On the other hand, Pmink is indeed an actual price offered in the market, and as the lowest such price is of some interest in itself, whether or not price discrimination is involved.

In the event, the two different price measures do not produce radically different regression models. It appears that market structure is an important determinant of fares even at the low-end of the demand curve, and that the legacy carrier price premium over LCCs is also observed at this end of the distribution.

We will compare these results with those in the fifth and sixth columns, which model the highest observed price (Pmaxk) and the last observed price, the day before flight (P0k). In 92% of cases these two numbers are the same, and so it is not surprising that we get quite similar regression models. These show interesting differences from the low-price models, and we focus

15 Exp(0.5*0.25) = 1.133

16 These are the 'lowest of the low' -- all our price observations are the lowest price offered for a flight on the day the flight is observed.

on the comparisons between these, and with the average price (Pavk) results. We can note that:

- The market structure variables HHI and HHI*DOMINATED play a significant role throughout the yield management process, with possibly little difference in the proportional impact of structure on high and low prices.
- The generally higher yields from SOLDOUT flights appear to be garnered in the middle of the price distribution, since although average prices are around 3% higher on sold-out flights, there is no discernible positive effect on either lowest or highest prices
- If LEISURE does have an effect on yields (it only consistently appears to do so in the regression model with WestJet classified as an LCC) this is apparent throughout the price distribution, not – as one might expect -- just at the high price end, which is when we expect most business travellers to purchase their tickets. Eight weeks out from flight date we believe that nearly all purchasers of tickets will be 'leisure' travellers, whatever the eventual composition of the passenger load when the plane takes off. Our results suggest that the airlines price their 'leisure' tickets higher if they know the flight will eventually have a higher business traveller composition, probably to ensure that seats for the latter will still be available in the last one or two weeks.
- The seasonal effect on prices, which went up on average through the month of May, seems to be largely worked through prices nearer the beginning of the distribution, presumably because it is the demand from leisure travellers (not business) that is increasing as the summer approaches
- However WestJet is categorised, the LCC price effect is much larger the day before the flight than eight weeks before. After inspecting the graphs shown in section 5 we can see that it could hardly be otherwise, since it is in the last week or perhaps two before flight date that the legacy carriers' prices increase sharply, with this being not generally matched by the LCCs, from whom a relatively inexpensive ticket can often be purchased as late as the day before the flight
- The price discount charged on one-stop flights also widens markedly in the last week, consistent with our interpretation that these flights do not generally appeal to high-value business travellers from whom a price premium can be extracted on last-minute ticket sales.

Analysis of the link between concentration and price discrimination

We have found that the overall position of the intertemporal distribution of prices, as measured by the mean value of prices observed, is related to the size distribution of sellers. Is the shape -- in particular, the slope -- of the distribution also a market structure-related variable? Hazledine (2006b) predicts that it will be, at least under Cournot-Nash assumptions: in his model the high/low dispersion of prices is larger the smaller the number of competitors. That is, a monopolist is able to extract the most surplus out of a

market by means of price discrimination, and, at the other structural extreme, a near-competitive industry with many firms will have very little discriminatory power, simply because its firms lack the power to raise any of their prices much above marginal costs.

There have been two previous studies of airfare price dispersion, both using U.S. data of samples of fares actually paid during the pre-internet era, when legacy carriers partitioned their markets using the Saturday Night Stayover advance purchase restriction on their cheaper fares. Borenstein and Rose (1994), and Stavins (2001) both find that the dispersion of fares paid on particular flights was increasing in the number of airlines flying the route. Borenstein and Rose explain this by distinguishing conceptually between "competitive-type" and "monopoly-type" price discrimination. The latter is based on differences between customers in their elasticities of demand at the total market level, and the extent of such discrimination would be expected to be greater under monopoly conditions. However, if within-market cross elasticities of demand are larger at the lower willingness-to-pay end of the demand curve -- that is, such customers are also keener comparison shoppers – then introducing more competition onto a route could result in larger falls of price at the lower than at the upper end of the fare distribution.

Table 2: Regression Results

with WestJet classified as an LCC

dependent	log(Pavk)		log(Pavk)		log(Pmink)		log(P8k)		log(Pmaxk)		log(P0k)	
		t-stat		t-stat		t-stat		t-stat		t-stat		t-stat
C	0.873	8.2	0.865	8.4	0.412	4.2	0.576	6.0	1.688	11.8	1.713	11.9
log(RCOSTB)	1.026	24.9	1.051	26.1	0.969	25.3	1.009	26.7	1.215	21.7	1.219	21.6
HHI	0.279	3.4	0.568	5.8	0.612	6.5	0.424	4.6	0.597	4.4	0.633	4.6
HHI*DOMINATED			-0.259	-4.9	-0.284	-5.7	-0.223	-4.5	-0.312	-4.3	-0.315	-4.3
SOLDOUT	0.031	3.2	0.029	2.9	-0.002	-0.3	-0.020	-2.1	-0.002	-0.1	0.011	0.5
LEISURE	-0.004	-3.9	-0.005	-4.0	-0.006	-5.3	-0.005	-4.6	-0.004	-2.5	-0.005	-3.1
WEEK1	-0.094	-12.0	-0.094	-12.0	-0.023	-4.6	0.007	1.0	-0.015	-0.9	-0.013	-0.7
WEEK2	-0.052	-6.6	-0.052	-6.6	-0.011	-2.2	-0.025	-3.3	0.002	0.1	0.007	0.4
WEEK3	-0.042	-5.3	-0.042	-5.3	-0.005	-1.0	-0.021	-2.7	-0.040	-2.4	-0.039	-2.2
LCC	-0.083	-2.6	-0.110	-3.5	-0.122	-4.1	-0.102	-3.4	-0.273	-6.2	-0.268	-6.0
STOPS	-0.149	-5.0	-0.160	-5.5	-0.105	-3.8	-0.094	-3.4	-0.283	-7.0	-0.279	-6.8
weighted R2	0.489		0.505		0.481		0.492		0.440		0.439	
unweighted R2	0.751		0.763		0.774		0.765		0.691		0.685	

with WestJet not classified as an LCC

dependent	log(Pavk)		log(Pavk)		log(Pmink)		log(P8k)		log(Pmaxk)		log(P0k)	
		t-stat		t-stat		t-stat		t-stat		t-stat		t-stat
C	0.856	8.6	0.885	9.0	0.502	5.3	0.651	7.0	1.772	13.0	1.763	13.1
log(RCOSTB)	1.115	30.2	1.145	30.9	1.052	29.4	1.079	30.5	1.437	28.1	1.447	28.5
HHI	0.235	2.9	0.461	4.7	0.522	5.6	0.349	3.8	0.344	2.6	0.370	2.8
HHI*DOMINATED			-0.205	-4.0	-0.237	-4.7	-0.184	-3.7	-0.184	-2.6	-0.184	-2.6
SOLDOUT	0.032	3.2	0.031	3.1	-0.001	-0.1	-0.018	-1.9	0.010	0.5	0.022	1.1
LEISURE	-0.001	-0.6	-0.001	-0.9	-0.004	-3.1	-0.003	-2.7	0.003	1.8	0.003	1.8
WEEK1	-0.094	-12.0	-0.094	-12.0	-0.023	-4.6	0.007	1.0	-0.014	-0.9	-0.013	-0.7
WEEK2	-0.052	-6.6	-0.052	-6.6	-0.011	-2.2	-0.025	-3.3	0.002	0.1	0.007	0.4
WEEK3	-0.042	-5.3	-0.042	-5.3	-0.005	-0.9	-0.021	-2.7	-0.040	-2.4	-0.039	-2.2
LCC	-0.311	-4.9	-0.289	-4.6	-0.147	-2.4	-0.123	-2.1	-0.626	-7.2	-0.698	-8.1
STOPS	-0.159	-5.4	-0.167	-5.8	-0.108	-3.9	-0.097	-3.5	-0.302	-7.5	-0.299	-7.5
weighted R2	0.500		0.510		0.473		0.486		0.447		0.457	
unweighted R2	0.76		0.767		0.769		0.762		0.697		0.698	

So, for example, if all business travellers are keen members of a preferred Frequent Flier Program, whereas leisure travellers are not (or cheap fares don't carry FFP points), then the willingness of business travellers to fly with other airlines, even at a lower price, might be less than the willingness of leisure travellers to take their business to the cheapest provider on the day. The data displayed in the previous section do reveal striking differentials in the lowest prices generally available on a particular route on a given day of flight, especially between LCCs and legacy carriers and especially over the last week or so before the flight date.

However, whilst these differentials are consistent with significant differentiation across the broad product types -- ie LCC versus network legacy carriers -- especially in the minds of travellers making their purchase decision soon before the flight, this does not necessarily imply that high-value customers (who may be valuing, say, convenience as well as other features of the legacy carriers' service) will not generally be sensitive to price differentials within the legacy carrier segment. Looking at it from the airlines' perspective: high value travellers are extremely profitable, and the temptation to undercut competitors to gain their custom must be considerable, and therefore more likely to be acted on the more competitors there are in the market.

We note too that our data are generated by the new regime of internet-available one-way tickets, which may break down some of the old demarcation between 'leisure' and 'business' markets, as well as making consumer price comparisons easier. Our price data are always the lowest available fare available on a flight, and this mostly is below other fares available on the same flight. Sales made at a higher fare than the lowest available on the same flight (which would have been included in the samples used by Borenstein/Rose and Stavins) obviously indicate a low level of price sensitivity on the part of the customer, who may indeed be influenced by frequent flier loyalty programs and related considerations, such as access to airline lounges and the possibility of using upgrade certificates to business class, which often cannot be applied to the lowest priced tickets.

In any case, our econometric results do not give strong support to predictions of differences in price discrimination between less and more concentrated markets. If we focus on the P8k and P0k regressions, which tell us about the pattern of inter-temporal price discrimination, then we find that the HHI has a larger proportional effect on last-minute prices (P0K) than it does on prices available eight weeks out (P8k), but only for the model in which WestJet is classified as an LCC. We can however say that the dollar difference in ticket prices between early and late-purchased fares tends to be larger in more concentrated markets, because the whole fare structure is higher in these markets.

In summary, orthodox oligopoly theory appears to be alive and well in these air travel markets, despite the striking violation evident in the data of the standard single-price assumption of oligopoly models (and of price theory in general). We have found that the entire distribution of prices, which is largely but not entirely monotonically increasing over time, as flight date approaches, is higher in more concentrated industries than in structurally more competitive markets. But there are some surprises. Prices tend to be lower, for a given HHI value, if a market has a single 'dominant' carrier competing with a number of much smaller operators (more precisely, operators offering a much smaller number of seats on the

particular route) rather than if the seats are spread more equally between a smaller number of competitors. And the coexistence of legacy carriers and LCCs is marked by striking differences in their pricing behaviour, most of all in the last week or perhaps two weeks before flight date, when the legacy carriers are able to increase their fares dramatically even though these are not matched by any LCCs in the market.

7. Conclusions

We have collected and analysed data on the 'new airline price discrimination' – the Low Cost Carrier-inspired innovation of one way fares offered across airline and travel agency websites. These fares differ substantially across routes, across airlines, across flights offered on the same route by the same airline, and within individual flights, such that on any given day, travellers who when they purchased a ticket for a particular journey had paid the lowest fare available at that time may differ by a factor of two or more in what they did pay for their ticket.

Beneath this remarkable diversity of prices we are able to discern a pattern, and this is a pattern familiar from oligopoly theory and from empirical analysis of pricing in other industries as well as previous studies of airline markets. The mean value of prices offered on a particular flight turns out to be a meaningful variable, of which we are able to explain a reasonably large proportion of the variance across flights in terms of plausible cost, demand and market structure factors. In particular, we find that average fares tend significantly to be lower on routes on which there is more competition, and that average fares offered by LCCs are significantly below those charged by network or 'legacy' carriers competing with them.

Thus, it does not appear that the new price discrimination regime requires a new oligopoly model to explain the overall levels of prices, so long as it is assumed that there is product differentiation between legacy carriers and LCCs. But can we go further and explain the discrimination itself, in particular the strong tendency for the lowest available price for a ticket on a particular flight to increase as the day of travel approaches? Descriptive analysis of the data reveals two striking patterns: fares on legacy carriers increase sharply over the last two or even just one week before the flight; and fares offered by LCCs mostly do not increase much over time, so that the price differential between LCCs and legacy carriers widens substantially as the flight date approaches.

Our econometric modelling reveals that both high- and low-price ends of the intertemporal price distribution are influenced by the extent of competition on routes, but we were not able to find evidence to strongly support sharper theoretical predictions about the link between market structure and the range of prices observed.

As for the policy implications of our results: if the new airfare price discrimination does not require a new oligopoly model to make sense of it, then nor does it require a new anti-trust to regulate it -- or exemption from the old anti-trust. Mergers or horizontal alliances between airlines currently competing independently can be expected to result in higher prices, and so must still raise competition policy concerns, whether or not a Low Cost Carrier is or could be present in the market. Further, we find evidence that when small numbers of legacy carriers compete on a route, they appear to be able to tacitly

coordinate the substantial prices increases that occur in the last two weeks before flight date, with this coordination possibly facilitated by the transparency of fares on the new internet booking systems. This finding may be of particular policy relevance to Canada, where there may be a risk of a 'cosy duopoly' forming between Air Canada and WestJet, as the latter airline departs further from its LCC roots. Since the domestic Canadian market does not seem to be able to support additional home-grown airlines (witness the recent departure of CanJet), there may be a case for opening the market to entry by established carriers through extended 5th Freedoms; allowing a foreign carrier to fly between domestic points having started its journey in its home market.

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