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The Smoking Gun? Competition and
Predation in the Trans-Tasman Air
Travel Market

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ABSTRACT

This paper proposes and demonstrates a new method for testing for predatory behavior by incumbent oligopolists towards new entrants. Traditional tests for predation, such as the Areeda-Turner Rule, focus on the level of price relative to average variable cost, such that if $P < AVC$, the incumbents cannot be maximising profits even over the short run, and so are predating.

The obvious objection to these tests (apart from difficulties in measuring variable costs) is that just about all oligopoly models predict that price will fall after the entry of an additional competitor: who is to say that even an unsustainable price cut is not just the natural outcome of the market becoming structurally more competitive?

We answer this objection by taking the modelling one level deeper. We ask what type of oligopoly ‘game’ is being played in the market post-entry, and compare it with the pre-entry game. If oligopoly behavior changes substantially in the direction of becoming more ‘competitive’, then we may have found a ‘smoking gun’ – circumstantial evidence pointly strongly towards predation (but falling short of directly incriminating evidence, such as records of email conversations indicating intent to predate).

Our approach is implemented with data on the two million annual flights across the Tasman Sea that separates the main cities of New Zealand and Australia. The market has long been dominated by a duopoly of national carriers -- Air New Zealand and Qantas – who for about a year in 1995/96 faced competition from a new-firm entrant, Kiwi International Airlines. We find that the incumbents’ behavior pre-entry was quite close to Cournot-Nash, but that it became much more competitive during the period of triopoly competition, suggesting predation. After the exit of Kiwi, behavior immediately became less competitive, but it did not return to pre-entry levels, and indeed has more recently tended back towards less cooperative duopoly pricing, perhaps to discourage any other new or existing airline from again disturbing the market.

JEL numbers: D4 L1 L4 L9

1. Introduction

This paper introduces a new method for testing for predatory behavior in markets. The traditional procedure is to compare price with costs: if the former is lower than the latter it is inferred that predation is occurring. For example, Areeda and Turner (1975) propose that a necessary (though not sufficient) condition for predatory behavior is the deliberate sacrificing of short-run profits, which would be signalled by price set below average variable costs, so that the firm is not even making a contribution to its fixed costs and so rationally should close down.

This approach has conceptual and measurement problems. The results are sensitive to the time horizon used to distinguish between variable and fixed costs. And it is silent about the process that generated the observed behavior. For example a third firm entering an established duopoly with scale economies could alter competitive conditions in the market sufficiently that all three firms found themselves pricing below average variable cost, even if none of them were deliberately attempting to drive any of the others from the market, or otherwise altering the qualitative nature of their responses to each other.

The approach developed here will not solve any measurement problems (though the results turn out not to be very sensitive to measurement error), but it does move the modelling analysis a stage further. We propose using calibrated (or estimated) models of oligopoly to identify the ‘game’ being played by the firms serving a market, and, in particular, to test for dramatic changes in the competitive nature of that game over periods when a new firm enters (or threatens to enter) the market.

We illustrate the approach with an application to the market for leisure air travel flights across the Tasman Sea that separates New Zealand from Australia. For decades, this has been dominated by a duopoly of the two countries’ national carriers, Air New Zealand and Qantas, but for thirteen months over 1995/96 a small former charter airline, Kiwi

International, provided competition in the form of no-frills, ‘nuts & cola’ service from various New Zealand cities to and from Sydney and Brisbane. The issue we address is this: was the exit of Kiwi caused or hastened by anti-competitive behavior on the part of the incumbents? We find that the oligopoly game did indeed change radically during Kiwi International’s brief tenure as a scheduled services carrier, and we suggest that this can reasonably be interpreted, at the least, as a ‘smoking gun’ of strongly circumstantial evidence of predation.

The paper is a contribution to the analysis of predatory behavior in general, and to the procedures of empirically calibrating oligopoly models . It also adds to the lively literature of case studies on the airline industry, in which many instances of alleged anti-competitive and collusive practices are to be found (Brock (2000)).

2. The Trans-Tasman Air Travel Market, 1995/99

We are concerned with air travel between New Zealand and the Eastern seaboard of Australia. This market is dominated by the two traditional national carriers – Air New Zealand and Qantas – who carry around 90% of the more than two million passengers who fly across the Tasman Sea every year, of whom most (above 80%) are leisure travellers making return trips. The remaining market share is filled by a fringe of foreign carriers, some very large airlines in their own right, but serving this market as relatively unimportant add-ons to their trans-Pacific flights. For example, United Airlines sometimes flies between Melbourne and Auckland, as part of its service to and from Los Angeles.

The business follows a fairly regular seasonal cycle, beginning in February with the new school year, following the long summer vacation. The airlines move back down their supply curves, typically cutting both capacity and prices by about 15% from their holiday highs. Despite these adjustments, load factors also drop a few percentage points – by less on

Qantas than Air New Zealand. Sales pick up in March and again in April – a school holiday month. Business is always very flat in May and June, and the airlines experience load factors in the 50-60% range, as they hang on for the expansion of demand in the more profitable second half of the year, beginning with the July school holidays, and holding up with the help of the New Zealand ski season until the seasonal summer highs arrive again.

For pricing purposes the airlines have usually been willing to pretend that the three largest Australian (Sydney, Melbourne, Brisbane) and the three largest New Zealand cities (Auckland, Wellington, Christchurch) are all the same distance apart, and in fact they are not far wrong. The longest return journey is Auckland-Melbourne (5270 kms) and the shortest Christchurch-Sydney (4254 kms). When there has been a price differential, it has taken the form of a premium (usually \$100) on flights to Brisbane – a popular sun & sea holiday destination for New Zealanders – even though Brisbane is closer to Auckland and Wellington than is Melbourne.

So-called ‘fifth freedom’ rights for a foreign airline to pick up passengers at a point not in that airline’s home country, and to take them to a destination also not at home are not granted automatically and almost always involve a reciprocal concession from the foreign airline’s government. Under various treaties and agreements, any NZ or Australian airline¹ can fly between the two countries without restrictions on destinations or capacity. That is, entry is quite free from regulatory barriers for local airlines, but difficult for third-country based carriers.

Thus, and for decades, Air New Zealand and Qantas have basically run the market as a rather cosy duopoly. However, this situation was excitingly disturbed in August 1995, when Kiwi International Airlines, a former charter operator², began flying scheduled services

¹ Nationality requirements are (a) at least 50% ownership, and (b) effective board control by Australian or New Zealand nationals.

² Not to be confused with another small, American, airline named Kiwi, which also faced some aggressive

to Brisbane and Sydney from its home-base of Hamilton, and from another small regional NZ city, Dunedin. Neither city had previously been served by scheduled direct international services, and their citizens had been required to travel one or two hundred miles to Auckland or Christchurch to catch an international flight.

Kiwi was therefore offering somewhat of a niche product, not directly competing with the big incumbents. Nor was its pricing aggressive – fares to Sydney and Brisbane set at about \$100 below the incumbents' then current (low-season) prices of \$649 and \$749, which was not much of a real price advantage, if any, given that the entrant offered a no-frills, 'nuts & cola' service with no frequent flier program. Kiwi did benefit from some 'David v. Goliath' public goodwill, and over its first three months built up to a 4% share of the Tasman market.

This was apparently too much for the established carriers to stomach. Their response was interesting. In December 1995 Air New Zealand launched a stand-alone but wholly owned subsidiary airline, Freedom Air, which more or less exactly duplicated Kiwi, flying twice a week out of the regional cities (as well as out of the large centres) and keeping its reservation system (based on an 0800 free call line) separate from the parent's, and difficult to access even for travel agents in the bigger centres.

This strategy could have been designed to compete with Kiwi as directly as possible for its own regional customers, but with as little as possible harmful spill over into the large city markets, though Air New Zealand innocently claimed that all it was doing was taking advantage of a hitherto unrecognised market opportunity of which the viability had been kindly demonstrated by Kiwi. There was also some significant sharpening of pricing, with Freedom Air undercutting Kiwi's previous fares by \$100 (which of course Kiwi had to match immediately), and both Air New Zealand and Qantas offering similar fares for their ex-

responses from incumbents (Brock, 2000, p45). It is somewhat puzzling why people choose to name airlines after a rare nocturnal bird which is almost blind and cannot fly.

Auckland, Wellington and Christchurch customers.

In March 1996 Freedom Air tightened the screws by offering limited quantities of seats to Sydney and Brisbane at the rather extraordinary prices of \$299 and \$349, which forced Kiwi to drop its own standard fares, though not quite to this level. Despite this pressure, Kiwi then boldly announced that it would begin offering scheduled services from Auckland and Christchurch. Retaliation was fast and brutal. Qantas took its turn at leading the duopoly's response, offering limited numbers of seats to all Eastern Australian cities at \$399, with the rest sold at \$499. Air New Zealand matched these fares immediately. Kiwi managed to achieve a five percent market share, but it ran out of money in September 1996³, and went into liquidation, after just over a year in the scheduled air travel business.

Very quickly, the incumbents increased their normal prices by \$100, to \$599, and then to \$659 for the December-January high season. Fares stayed quite high through 1997 and part of 1998, but then began to fall. Since 1999 it has usually been possible for an advance-purchase traveller to obtain a trans-Tasman return ticket for less than \$500. It appears that Air New Zealand and Qantas are competing more keenly with each other than before 1995, possibly because they have by now lined up in opposing airline alliances, and abandoned (in May 1997) the code-sharing arrangements under which around 40% of their customers had travelled. This has required each airline to put on more flights to maintain the attractiveness of their schedules, which in turn means more pressure to keep prices low to fill the seats. The no-frills subsidiary Freedom Air remains in operation, though only serving Dunedin and Hamilton; perhaps as a 'fighting brand' deterrent to any other potential entrant; perhaps indeed because the service offered is actually profitable, especially in the absence of Kiwi.

Currently (May 2001) the internal air travel markets of both Australia and New Zealand are in some turmoil. Since late in 2000 the Australian domestic duopoly of Qantas

³ Actually, it turned out that Kiwi really ran out of money some months before it closed down – a commercial malfeasance for which its founder/CEO would eventually be sent to prison.

and Ansett has been challenged by two cut-price carriers, Impulse and Virgin Blue. Impulse appears now to be about to be taken over by Qantas, which will continue to use it as a budget brand. In New Zealand, the weaker of the two domestic carriers, Qantas New Zealand, collapsed in April 2001⁴, and with surprising (or perhaps not) speed, Freedom Air began serving the main trunk routes (Auckland/Wellington/Christchurch) with low-price fares. Qantas (Australia) has also begun flying in New Zealand, and Virgin Blue wishes to do so (which is not a problem, from a regulatory point of view), but only if it can also fly the Tasman route as well, which requires approval from both countries, since Virgin is a British-owned company. If approval is granted, and if Virgin proceeds, there could again be serious triopoly competition on the Trans-Tasman route.

3. Modelling Oligopoly Behavior

Was Kiwi International predated out of the market by the joint or separate actions of the incumbent airlines? A complaint in April 1996 to the New Zealand Commerce Commission that Air New Zealand was abusing its dominant position did not get past first base – the Commission determined that since Air New Zealand was not ‘dominant’ in the market (which of course it shares with Qantas) it could not be found to be abusing dominance. Orthodox comparisons of price and cost (Haugh and Hazledine, 1999) were inconclusive, even accepting the validity of this approach. So we proceed with the main contribution of this paper, which is to generate estimates of the underlying oligopoly ‘game’ being played before, during and after the participation in the industry of the unsuccessful new entrant.

The approach taken is quite straightforward. We write down an oligopoly model – as

⁴ Qantas New Zealand was an independently owned operation to which Qantas (Australia) franchised the use of its brand-name, along with Frequent Flier, etc, tie-ins. Qantas NZ had previously been Ansett New Zealand, but had to be divested by Ansett when this company was taken over by Air New Zealand, to avoid creating dominance in the New Zealand domestic market.

simple as is possible while capturing the essence of the industry and the market. Extraneous data on costs and demand elasticities are used to calibrate the model – all but the parameters summarising oligopolistic interaction, which are then ‘estimated’ using the calibrated parameters and the actual data on prices and quantities.

We make the usual tractability assumptions of linearity and constant costs. On the demand side, we assume that the incumbents Air New Zealand and Qantas are supplying at similar cost an effectively identical product, which is both horizontally and vertically differentiated from the service supplied by the entrant Kiwi International. That is, we will be modeling first a homogeneous duopoly, and then a triopoly with a mix of homogeneity and heterogeneity of product. The incumbents have consistently responded quickly to each other’s price changes, such that they offer identical fare schedules, which is consistent with the existence of a rather broad margin of customers to whom the services offered by the two airlines are perfectly interchangeable - no price differential can be sustained. Kiwi, however, with its focus on small regional markets, offered a distinctively different product (horizontal differentiation), which overall the market perceived as inferior (vertically differentiated) to the incumbents’, as demonstrated by the entrant’s price and market share being both smaller.

We write the price-dependent demand curves for incumbents (I) and entrant (E):

$$(1) \quad P_I = a - bQ_I - eq_E$$

$$(2) \quad P_E = \alpha - \beta q_E - \varepsilon Q_I$$

where: $Q_I = q_i + q_j$,

using i and j to subscript the two incumbents. The e and ε coefficients measure the extent of horizontal product differentiation. If, say, $e = 0$, then E ’s product is completely independent of I ’s in the marketplace -- they are not at all substitutes, because changes in q_E have no impact at all on P_I . If, at the other extreme, $e = b$, then the products are perfect substitutes.

Total cost of firm i is:

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

where f_i are firm i 's fixed costs, and c_i is its marginal cost.

Incumbent firm i 's profit function is:

$$(4) \quad \begin{aligned} \pi_i &= q_i P_i - C_i \\ &= q_i [a - bQ_I - eq_E] - f_i - c_i q_i \end{aligned}$$

Differentiating with respect to firm i 's output:

$$(5) \quad d\pi_i/dq_i = a - bq_i dQ_I/dq_i - bQ_I - eq_i dq_E/dq_i - eq_E - c_i$$

We will be assuming $c_i = c_j = c$, which will give us symmetry in incumbent outputs⁵:

$$q_i = q_j = q$$

Substituting q into (5), and writing $dQ_I/dq_i = (1 + \lambda_I)$, and $dq_E/dq_i = \lambda_{IE}$, for an incumbent firm's expected responses in terms of changes in output of the other incumbent and of the entrant induced by a unit change in its own output:

$$(6) \quad d\pi_i/dq_i = a - 3bq - bq\lambda_I - eq_E - eq \lambda_{IE} - c$$

These response parameters have traditionally been known as 'conjectural variation' parameters, though more recently the term 'competitive response' has become fashionable.

We will use the older terminology here.

Then similarly, for the entrant E:

$$(7) \quad \pi_E = q_E [\alpha - \beta q_E - \varepsilon Q_I] - f_E - c_E q_E$$

Differentiating and substituting as for (6):

$$(8) \quad d\pi_E / dq_E = \alpha - 2\beta q_E - 2\varepsilon q - \varepsilon q_E \lambda_E - c_E,$$

where λ_E is the entrant's conjectured response of total incumbent output to a unit change in

⁵ Air New Zealand has usually had a slightly higher market share than Qantas, which could be generated in this model by assigning it slightly lower costs, but we do not judge the resulting increase in realism to be worth the loss of analytical tractability.

its own output.

We assume that at any time observed industry outcomes were generated by profit maximising behavior in a market equilibrium, so that we can set (6) and (8) equal to zero and solve them together to find the conjectural variations parameters as functions of observed outputs and the demand and cost coefficients. We have one lambda too many, and will need to assume a relationship between an incumbent firm's expectations about the response of the other incumbent and the response of the entrant:

$$(9) \quad \lambda_{IE} = \theta \lambda_I$$

With this, we get expressions for λ_I and λ_E :

$$(10) \quad \lambda_I = [a - 3bq - eq_E - c] / [(b + e\theta)q]$$

$$(11) \quad \lambda_E = [\alpha - 2\beta q_E - 2\epsilon q - c_E] / [\epsilon q_E]$$

For the pre-entry period we just solve (10), setting q_E and θ equal to zero. Post-entry, we solve for both conjectural variation parameters.

4. Calibration

We need to make a number of additional simplifications to squeeze this oligopoly model into the template formed by the realities of the trans-Tasman air travel market. Such simplifications are always needed, and they always represent a trade-off between empirical accuracy and analytical tractability. Our procedures are in line with those used by other applied oligopoly analysts, for example, in the airline industry context, Brander and Zhang (1990).

We will ignore the activities of all other airlines. The non-Australasian fringe has a small market share (about 9% in 1994), is capacity constrained, and none of its members covers all the main Trans-Tasman routes, with most of them confined to a single city pair.

We have lumped Freedom Air in with its owner Air New Zealand, motivated solely

by the desire for analytical tractability. Certainly, in a full competition policy investigation the role of Freedom Air would be subjected to close scrutiny. By limiting ourselves in effect to the pricing activities of the two large airlines, we are being conservative from the point of view of identifying predatory behavior, since the creation of Freedom may itself have been a predatory act.

For price we use a volume-weighted average of the discounted advance-purchase ‘excursion’ return fares from Auckland to Sydney and from Auckland to Brisbane. When more than one APEX fare was offered, we construct an estimate of the average price actually paid, using information from travel agents and the airlines as to how many seats were offered at the lower fare (and assuming that all seats made available at that fare were sold before customers moved up to the higher fare or fares). For quantity, we use the number of ‘leisure’ (non-business) return flights, which was, for example, 82% of the total in 1995, on average.

To solve the functions (10) and (11) we need to assign values to the parameters of the demand curves (1) and (2) and the cost functions (3). For the incumbents’ price function (1), we solve first for parameters a and b using actual pre-entry output and price and an estimate of the leisure travel market demand elasticity from within the range suggested by a literature survey. Typically, and unsurprisingly, studies of air travel demand tend to find that demand price elasticities are lower for business than for leisure travellers. Oum *et al* (1986), for example, in a study of 200 US intercity routes, found a range of route elasticities for first class travel between -0.58 and -0.83, whereas discounted fare travel demand was elastic, ranging from -1.55 to -2.01. Park and Zhang (2000) estimate the demand elasticity with respect to excursion fares on trans-Atlantic routes to be -1.07 .

For trans-Tasman travel, the Australian Bureau of Transport and Communications Economics (1995) reported new estimates along with the results of four previous studies. The new and surveyed estimates of price elasticity for leisure travellers ranged from -0.23

(statistically insignificant) to -1.5. The average for the six estimates was -0.98, and we will use -1 as the base case elasticity for 1995, to give us initial estimates of the intercept and slope parameters a and b in (1) for the period before Kiwi's entry.

We have no assistance from the literature with the parameter e , which measures the impact of a new entrant's output on the price that will clear the market of a given amount of incumbent output. This parameter depends on the extent to which the entrant expands the total air travel market as opposed to just diverting customers from the incumbents. We will begin with a value for e of $0.5b$, implying that the impact on P_1 of a unit of entrant output is one half the impact of a unit of incumbent output, and will then experiment with larger and smaller values.

We cannot simply substitute this into the pre-entry demand curve as, in general, this will move around from month to month due to factors which we do not know about. The approach we take is to assume that the 'width' of the market fluctuates, but not its 'depth', in the sense that we take as given the pre-entry value for the intercept, a , of equation (1) – which measures the price at which all the incumbents' customers would leave the market (in the absence of any other carrier) – and then solve for the slope parameter, b , so that the line goes through the observed price and quantities.

We do this for both of our triopoly episodes – from August through November 1995, when there was little response from the incumbents, and then for the December through September 1996 period which saw price cutting and the entry of Air New Zealand's 'fighting brand', Freedom Air. Thereafter, with the duopoly restored, we return to choosing the market demand elasticity and letting this and the actual prices and quantities determine the values for the intercept and slope of equation (1). Elasticities are set larger (in absolute terms) than -1 for the low season, and smaller in the high season. The initial range of variation will be ± 0.10 , and the sensitivity of the results to other values will be noted.

In support of these procedures, note that the prices and quantities observed over a certain period of several months will not always refer to the same transactions. This is because leisure customers can stockpile air travel tickets, by purchasing well in advance when prices are especially attractive. The surge in travel taken over the 1996/96 high season after the exit of Kiwi, which occurred despite fares increasing, is almost certainly due to customers having taken advantage of the extremely low price war fares to advance-purchase their Christmas and other future travel. This doesn't affect our results: conjectural variations are determined by price-cost margins and elasticities, not by actual quantities.⁶

For the triopoly months we need the entrant's price function, (2). We have three parameters and only one data-generated equation (the situation post-entry), so two more assumptions are needed. As always, our approach will be to propose something that seems *a priori* reasonable, and rely on sensitivity analysis to alert us to danger. First we assume:

$$dP_I/dq_E = dP_E/dQ_I,$$

which means that small cross-price effects cancel out -- the customers lost to the other airline by an own-price increase will return if the other airline matches the price change. This gives us:

$$(12) \quad \varepsilon = e$$

The second piece of 'information' that we feed into the system is the price at which Kiwi International would just lose all its customers, given the actual outputs of the two large airlines. Kiwi's disadvantages were its limited schedule, lack of Frequent Flier Program, frugal service, and lack of a history of carrying passengers without crashing; on the plus side it had its locational advantage for customers living in or near the cities it served, reinforced

⁶ Note that close to one half of trans-Tasman return flights originate in Australia, not New Zealand, and the fares paid for these will be ex-Sydney, etc, not ex-Auckland. It would be interesting to compare the Australian and New Zealand pricing structures, especially since the competitive threat posed to the incumbents by Kiwi would have applied mainly to ex-New Zealand travel. Unfortunately, the information needed to construct the actual average price paid for a ticket – numbers of made available at each fare – is ephemeral, and it would not now be possible to reconstruct such data for Australia.

by a certain amount of goodwill based on regional pride. Our initial base-case proposed values of the zero-demand price for Kiwi are \$650 for the pre-price war 1995 months, and \$550 for 1996. These numbers allow us quickly to solve for the own-price slope of the entrant price function, β , and then we solve for the intercept.

Finally, we need estimates of marginal cost. We begin with data from Air New Zealand's 1997 Annual Report, which gives a quite detailed breakdown of the actual costs incurred by the airline that year. We have to decide which costs are variable and which fixed within the time horizon of the airlines' responses to changes in their competitive environment. The trans-Tasman trade provides rather more than 10% of Air New Zealand's revenues, and a bit less than 5% of Qantas'. If one of the airlines pulled out of these routes, it would be able to redeploy or sell the equipment used to fly the route, and indeed we see quite large (more than 10%) month-to-month seasonal fluctuations in the number of seats made available. But the airline would not be able to escape from all the associated on-the-ground costs, since it would still need to maintain head office and sales facilities to cover its other business.

So we allocate costs as follows. All 'flight operation' costs, which made up 34.2% of Air New Zealand's total operating costs (excluding interest payments) in 1997, are variable costs. This category includes fuel, flight crew training and salaries, airport charges, insurance, and leasing of aircraft. All 'passenger service' costs, including passenger ground handling and in-flight catering, are variable (13.9%). All 'general and administration' expenses, which are 4.5% of the total, are taken to be fixed. And all remaining costs, including ticketing, sales and promotion (21%), maintenance and overhaul (13.8%), depreciation and amortization (5.2%), and 'station expenses' (7.2%) are divided equally between fixed and variable costs. This gives us a figure for variable costs as 71.8% of total costs.

This percentage is applied to the ratio of total costs to total revenue passenger kilometers flown to get costs per passenger kilometer. This number is then inflated by 1.25 to allow for the higher per kilometer costs on relatively short routes like the trans-Tasman, using data on differences in costs/kilometer as a function of stage length given in BTCE (1994). The result of all this is an estimate of \$350 for the marginal cost of an ‘average’⁷ trans-Tasman return passenger flight in the first part (low season) of 1997.

Air New Zealand (2000, page 28) show data on their overall operating costs per Available Seat Kilometre for each year. Costs fell from 1995 to 1996; were then quite steady for a year, before rising quite sharply in 1998 and again in 1999. Factors here would have been domestic inflation, which was low and steady (around 2% per year), jet fuel prices, which increased (in \$US) from 1995 to 1997, and then decreased to 1999 (before sharply increasing through 2000), and currency changes – the New Zealand and Australian currencies depreciated against the US dollar. We expect that trans-Tasman cost changes would be muted for both Air New Zealand and Qantas, because a relatively large proportion of these operating costs would be borne in local currency. We adjust the cost/ASK figures for this and for changes in average international stage length to get estimates of costs for periods before and after 1997.

As for Kiwi, its no-frills operation out of low-rent regional airports would tend to reduce its costs relative to the incumbents’, against which are its inexperience and inability to exploit such scale economies as are available. The Commerce Commission (1997) determined that Kiwi had lower operating costs. We will use a figure of \$300 and experiment with higher and lower numbers.

⁷ A revenue-weighted average of the distances between Auckland and Sydney, and Auckland and Brisbane.

5. Results

Table 1 reproduces the spreadsheet for our base-case simulation⁸. The ‘bottom line’ of the analysis is the top line of the table – the estimates of the conjectural variations parameter λ_I for the incumbent duopolists, Air New Zealand and Qantas. We see that, before Kiwi, the duopolists were playing very close to Cournot-Nash, and continued to do so for the first three months after Kiwi entered. But with the introduction of the ‘fighting brand’, Freedom Air, and the concurrent and subsequent price reductions, there was a quite radical change in the nature of the duopoly game, with conjectures becoming much closer to perfectly competitive than Cournot.

What are we to make of this? It seems very unlikely indeed that the addition of a third competitor to the market could engender, as a part of the process of normal competition, what amounts to a shift in regime for oligopoly behavior, especially a competitor as weak as Kiwi, as demonstrated by its small market share despite lower marginal costs, and by the insensitivity of the incumbents to changes in assumptions about the entrant’s capabilities (see Table 2, below). The adoption of ‘competitive’ conjectures to the effect that one incumbent increasing output now expects the other to accommodate most of this in a cutback in its own output, so that the market price will not much change, is also highly implausible given what we know from observation about how Air New Zealand and Qantas actually behave in this market – matching each others price changes almost instantly, and apparently competing hard – in the everyday business sense of the concept – for market share and sales.

What about the estimates for λ_E – the expected change in incumbent output resulting from a unit change in quantity supplied by the entrant? Before the price war, λ_E is nearly 20, which seems like a very large number until we note that the total incumbent market share in these months was nearly 40 times that of Kiwi, the entrant, so that a CV parameter of this size

⁸ Quantity variables are measured as monthly averages of return-flight passengers flown, for each seasonal

is roughly equivalent to semi-collusive conjectures in a twenty-firm homogeneous oligopoly. But, be that as it may, the parameter is evidently highly unstable, dropping to less than one in the price war period. Examining the formula (11) for λ_E , we can see how this can happen: the parameter is sensitive to the size of incumbent output (whereas entrant output, being much smaller, has little effect on the estimate of incumbents' conjectural variations, as equation (10) makes clear), and to the cross-price demand coefficient ε , which is here set *a priori* without much empirical information.

Therefore, it is probably sensible to set little store by the estimates of λ_E , which do not matter to our main focus of interest, the behavior of the incumbents. In any case, it is unlikely that the entrant was ever able to settle into behavior patterns from which a stable conjectural parameter could emerge – after all, Kiwi did make a negative profit through its single year in business.

Now look at what happened after Kiwi exited. The almost immediate price increases by Air New Zealand and Qantas imply a quite sharp turn back towards less 'competitive' behavior, which continues through 1997, though never restoring the near-Cournot conjectures of 1995. Then things start to heat up. The two airlines abandon their code-sharing agreements, join rival airline alliances, and increase capacity on the trans-Tasman route. Prices drop steadily, by about 20% from the 1997 high season peak, to just over \$500 by the end of 1999, which is close to the level reached during the triopoly price war. With this, estimated conjectural variations drop, to -0.570 by the spring and summer season of 1999.⁹

Should this evidence of quite aggressively competitive duopoly behavior qualify our conclusion that the incumbents' response to Kiwi International's presence in the market was

period.

⁹ Note that estimated conjectural variations are more competitive in the high than in the low season, despite higher prices. This is entirely due to the assumption made about demand being less elastic in the high season. If elasticities are set unchanged across seasons, behavior is inferred to be less competitive in the higher-price demand period.

probably predatory? Perhaps it does, though the post-1997 change in behavior is slower to develop and does not go so far as did the sharp shift in regime observed in 1996.

6. Sensitivity Analysis

Table 2 checks the sensitivity of the incumbents' conjectured variations to differences in our estimates of the two parameters that shape the model: duopoly market demand elasticity and marginal variable costs. We vary demand elasticity, set at -1 in the base case, by plus and minus 0.25, and add and subtract 50 from marginal costs, which are set at 350 in the base simulation.

Although we of course have no formal tests of significance, it seems reasonable to infer from Table 2 that our qualitative conclusions are quite robust to variations in parameters. In particular, the range of values for λ_I over the 1996 price war (triopoly) episode is just -0.608 to -0.858, and the difference between price war and previous conjectural variations is fairly stable in the range 0.7-0.8.

Finally, in Table 3, we do some sensitivity analysis on our parameterisation of the impact of Kiwi International on the market. Varying the substitutability of Kiwi's product with that of the incumbents over a quite wide range makes little difference to the incumbents' estimated conjectural variations, though the (unreliable) estimate of the entrant's CV swings quite wildly.

Altering our assumed characteristics for the entrant's demand and supply conditions makes no difference to the estimates the incumbents have of each others reactions, because all the information on the entrant needed to formulate incumbent CV (equation (10)) is given by the entrant's output, q_E . Adding and subtracting \$50 to the intercept of the Kiwi demand curve or to Kiwi's unit costs have large and equivalent (see equation (11)) effects on λ_I .

Overall, these and other unreported sensitivity tests tell us two things: (1) we can infer

very little about what was going on in the heads of the managers of Kiwi International, but (2) we can make fairly good or at least stable inferences as to the behavior of the two large incumbents who are the focus of our interest.

7. Conclusion

We have investigated the behavior of two incumbent duopolists faced with the challenge of entry by a low-cost, low-price competitor. Air New Zealand and Qantas certainly responded vigorously, setting up a new ‘fighting brand’ operator to compete directly with Kiwi International, and cutting their own prices on trans-Tasman routes by around 15%. After not much more than a year in operation, Kiwi did exit into bankruptcy. But was it ‘predated’ by the incumbents, or was there just not room for three profitable competitors in this market (and/or was it simply badly managed, and so doomed to failure)?

Standard predation analysis calls for a comparison of prices and variable costs, to ascertain whether the former are sufficient to at least cover the latter, and so be not necessarily inconsistent with short-term profit maximising behavior. But, in this case, such comparisons were not conclusive, even on their own terms, and, in any case, a major problem with these tests is that they do not identify the behavior that *generated* observed prices, and so cannot distinguish predation from the legitimate impact on oligopolistic conduct that could follow entry of an additional competitor.

Our contribution is to write down a specific oligopoly model and to calibrate this to the observed market outcomes before, during and after the period of competition with Kiwi International. We find that the incumbents switched quite quickly and dramatically from near-Cournot to near-competitive behavior when faced with competition, and then reverted to something quite close to Cournot after Kiwi’s demise. Although this falls short of direct ‘eye witness’ testimony (such as documentation of conspiracy), we believe that it adds up to a

'smoking gun' of strongly suggestive circumstantial evidence of predatory intent and action. We have also found that the duopolists have become increasingly aggressive with each other since about 1997, such that their behavior as summarized by the inferred conjectural variations parameter is now to be characterised as about midway between Cournot and competitive, to the benefit of the travelling public.

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Table 1: Base-case Simulation

| | 1995 pre-entry duopoly | 1995 post-entry triopoly | 1996 post-entry triopoly | 1996 High Season duopoly | 1997 Low Season | 1997 High Season | 1998 Low Season | 1998 High Season | 1999 Low Season | 1999 High Season |
|--|------------------------|--------------------------|--------------------------|--------------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| λ_I | -0.018 | 0.013 | -0.733 | -0.221 | -0.107 | -0.220 | -0.164 | -0.408 | -0.351 | -0.570 |
| λ_E | | 19.420 | 0.849 | | | | | | | |
| λ_{IE} | | 0.003 | -0.147 | | | | | | | |
| demand elasticity | -1 | | | -0.9 | -1.1 | -0.9 | -1.1 | -0.9 | -1.1 | -0.9 |
| Zero-demand p_E | | | | | | | | | | |
| c_I | 361 | 355 | 349 | 349 | 350 | 357 | 364 | 373 | 380 | 386 |
| c_E | | 300 | 300 | | | | | | | |
| q_I | 36.0 | 38.8 | 41.3 | 48.0 | 39.0 | 44.3 | 37.6 | 46.7 | 40.3 | 48.9 |
| q_E | | 2.1 | 5.7 | | | | | | | |
| p_I | 709 | 709 | 500 | 615 | 589 | 630 | 587 | 556 | 539 | 507 |
| p_E | | 567 | 438 | | | | | | | |
| θ | | 0.2 | 0.2 | | | | | | | |
| a | 1418.0 | 1418.0 | 1418.0 | 1298.3 | 1124.5 | 1330.0 | 1120.6 | 1173.8 | 1029.0 | 1070.3 |
| b | 9.835 | 9.024 | 10.743 | 7.111 | 6.872 | 7.899 | 7.099 | 6.618 | 6.078 | 5.758 |
| e | | 4.512 | 5.372 | | | | | | | |
| α | | 999.8 | 993.7 | | | | | | | |
| β | | 39.5 | 19.6 | | | | | | | |
| ε | | 4.512 | 5.372 | | | | | | | |
| difference between high and low season demand elasticity | | | | | 0.2 | | | | | |
| substitutability between E and I parameter | | | | | 0.5 | | | | | |

| | 1995 pre-entry duopoly | 1995 post-entry triopoly | 1996 post-entry triopoly | 1996 High Season duopoly | 1997 Low Season | 1997 High Season | 1998 Low Season | 1998 High Season | 1999 Low Season | 1999 High Season |
|---|------------------------------|--------------------------------|--------------------------------|--------------------------------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|------------------------|
| Base Case | -0.018 | 0.013 | -0.733 | -0.221 | -0.107 | -0.22 | -0.164 | -0.408 | -0.351 | -0.57 |
| Less Elastic Demand (Elasticity = -0.75) | -0.264 | -0.268 | -0.81 | -0.438 | -0.31 | -0.437 | -0.354 | -0.572 | -0.499 | -0.69 |
| More Elastic Demand (Elasticity = -1.25) | 0.227 | 0.295 | -0.664 | -0.005 | 0.096 | -0.003 | 0.026 | -0.243 | -0.204 | -0.451 |
| Higher Costs (1997 $C_1 = 400$) | -0.159 | -0.145 | -0.858 | -0.368 | -0.294 | -0.363 | -0.352 | -0.569 | -0.555 | -0.748 |
| Lower Costs (1997 $C_1 = 300$) | 0.123 | 0.172 | -0.608 | -0.075 | 0.079 | -0.077 | 0.023 | -0.246 | -0.147 | -0.393 |

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| Table 3: Sensitivity of incumbents' and entrant's Conjectural Variations parameters in the 1996 triopoly period | | |
|---|-------------|-------------|
| | λ_I | λ_E |
| Base Case | -0.733 | 0.849 |
| More substitutable product ($e = 0.75b$) | -0.769 | 0.576 |
| Less substitutable product ($e = 0.25b$) | -0.7 | 1.67 |
| Kiwi customers more keen (zero demand $P_E = 600$) | -0.733 | -0.784 |
| Kiwi customers less keen (zero demand $P_E = 500$) | -0.733 | 2.482 |
| Kiwi costs higher ($C_E = 350$) | -0.733 | -0.784 |
| Kiwi costs lower ($C_E = 250$) | -0.733 | 2.482 |