Oligopoly Behaviour in the Trans-Tasman Air Travel Market: TheCase of Kiwi International

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by

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ABSTRACT

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The duopoly of Air New Zealand and Qantas serving the trans-Tasman air travel market was disturbed in August 1995 by the entry of a small former charter airline, Kiwi International, based in Hamilton, NZ. Kiwi exited into liquidation in September 1996. The intervening thirteen months saw the entry of a 'fighting brand' no-frills airline, Freedom Air, set up by Air New Zealand to compete directly with Kiwi, and then a general price war initiated by Qantas, which directly preceded Kiwi's demise.

Was the behaviour of the incumbent duopolists 'predatory', in the sense of being designed to drive the new entrant from the market? Standard tests based on comparisons of price and costs are inconclusive. The innovation of this paper is to model the oligopolistic behaviour of the firms before and after entry. It is found that the duopolists became substantially more 'competitive' during the price war period, consistent with an interpretation of intent to predate.

1. Introduction

The Trans-Tasman air route carries more than a million return passengers between Australia and New Zealand every year. For decades, it has been dominated by the duopoly of national carriers, Air New Zealand and Qantas, but for a period of just over a year in 1995 and 1996 this settled situation was disrupted by competition from a small new operator, Kiwi International, which, having started as a charter operator, began offering scheduled services in August 1995 and exited into liquidation just over one year later, in September 1996. The period of Kiwi's presence was marked by bouts of substantial price cutting by all the competitors, and the introduction by Air New Zealand of a subsidiary airline, Freedom Air, to compete directly with Kiwi.

The responses of the incumbents were widely regarded at the time by the public as an attempt to oust Kiwi from the market, with many expecting both Freedom Air and the low prices to disappear as soon as Kiwi International collapsed. Prices have indeed risen, but Freedom remains in the market, and it has become apparent that Kiwi had suffered from other difficulties which had contributed to its collapse, including poor financial and strategic management. Thus there is reasonable uncertainty about how to regard the events that unfolded through Kiwi's brief history.

That is, just how should the pricing and behaviour of the main incumbents in response to Kiwi's entry be interpreted? Were Air New Zealand and Qantas merely aggressive competitors with which Kiwi just wasn't efficient enough to compete, or had they engaged in predatory behaviour with the aim of ejecting a troublesome new entrant? NZ's competition authority, the Commerce Commission, investigated a complaint by Mr Ewan Wilson, the former CEO of Kiwi, against Air New Zealand's actions, but dismissed this without considering the matter of predation on the grounds that the incumbent airline is not 'dominant' in this market. (Under the weak NZ competition law, it is in effect assumed that no firm which was not dominant would in fact have the power to predate.)

No doubt Air New Zealand is not dominant, but the duopoly it shares with Qantas probably is, and the interesting economic issue is whether the duopoly predated Kiwi out of the market. The traditional method for considering this has relied on comparisons of price charged with appropriate measures of costs. If price is too low relative to costs to be consistent with normal optimising behaviour, then predation may be inferred.

This approach is problematic. Apart from the difficulties in measuring costs (for example, choosing the appropriate time frame for assigning variable and fixed costs), simple price/cost comparisons do not uniquely identify the motives of the players. It could be the entrant that has forced the issue and is predating, or it could just be that the presence of an additional competitor changes the oligopoly outcome by this amount even with no change in the underlying motivations of the existing firms.

We need to dig below the surface of the pricing data and investigate how they were generated. Such is the innovation developed in this paper, which, in essence, seeks first to identify the oligopolistic behaviour that generated the pre-entry price structure, and then asks whether behaviour was markedly different in the period of fiercest competition that preceded the exit of Kiwi International.

The paper is set out as follows. The next section is a narrative of the events preceding and following Kiwi's entry. Section 3 reviews the analytical issues involved with standard tests of predatory pricing. Section 4 develops data for pricing and costs in the trans-Tasman air market, and applies these to the standard tests. Then, in Section 5, we write down, calibrate, and simulate the oligopoly model. Section 6 discusses the results, and Section 7 concludes the paper.

2. The Trans-Tasman Air Market and the Kiwi International Saga

The Trans-Tasman market is defined as the air routes that connect cities in both islands of New Zealand with the major cities on the East Coast of Australia: Brisbane, Melbourne and Sydney. The market is dominated by Air New Zealand and Qantas, who in 1996 had an estimated combined market share of 89%, with Air New Zealand at 47%, and Qantas 42%[1]. The remainder of the market is served by a fringe of foreign carriers, some of which are very large airlines in their own right, but none of which have more than a very small share of the Trans-Tasman market, which they serve as a relatively unimportant add-on to their long-haul trans-Pacific flights. For calendar year 1996 the two new operators Freedom and Kiwi had about 3% of the market each, which in the case of Kiwi was achieved over the nine months that it flew in that year. Appendix 1 gives a table of market shares in 1996.

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 grantly automatically and almost always involve a reciprocal concession from the foreign airline's government. Under various treaties and agreements, any NZ or Australian airline[2] can fly between the two countries without restrictions on destinations or capacity. Thus entry is quite free for local airlines, but difficult for third-country based carriers.

In August 1995 Kiwi Travel International Airlines (later Kiwi International Airlines), with capital of $778,888, became New Zealand's second international carrier, following a profitable year as a charter operator across the Tasman. Initially Kiwi flew to Sydney and Brisbane only from the small regional cities of Hamilton and Dunedin, which had not previously been served by scheduled international flights, using a leased 173 seat Boeing 727-200. But it rapidly expanded and at its height was flying from Dunedin , Christchurch, Hamilton and Auckland to Brisbane, Sydney, Melbourne and Perth in Australia, with a total of 30 flights a week and using 2 aircraft (737-300 and Airbus A320).

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[1] About one third of the flights were flown as codeshares by Air New Zealand and Qantas. In the absence of any other information, passengers on these flights are allocated evenly between the two airlines.

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

The impact on prices can be seen on Table 1, which shows fares in the months that they were changed. The general impression in the media at the time of Kiwi's launch as a scheduled operator was that it was a low cost, low price budget operator, offering no-frills 'nuts and cola' return tickets for as low as $399. But a closer examination of its initial pricing practice reveals a slightly different picture. At entry it was charging $678 to Brisbane, with none of the $399 seats actually available on this route because it had a 90% load factor at the standard rate. The Sydney flights were more difficult to fill and therefore Kiwi offered the $399 seats in limited numbers in order to increase the load factor on these flights. The standard fare to Sydney, while $100 below Air New Zealand's lowest, was still $549, and 70% of passengers were paying this rate.

Table 1 : Prices in the Trans-Tasman Market August 1995-November 1998

Date	Aug-95	Nov-95	Dec-95	Mar-95	Jun-96	Sep-96	Dec-96	Nov-98
Event	Kiwi enters		Freedom enters			Kiwi exits		
Air NZ/ Qantas								
Standard Fare								
High Season:								
Brisbane	849				499		699/799	659
Sydney	749				499		699/799	659
Low Season:								
Brisbane	749						599/699	559
Sydney	649						599/699	559
Special Fare								
Brisbane			559		399		499	
Sydney			449		399		499	
Freedom								
Standard Fare								
Brisbane			549				499/599	459
Sydney			449				499/599	459
Special Fare								
Brisbane			495	349			449	
Sydney			395	299			449	
Kiwi								
Standard Fare								
Brisbane	678	649	549					
Sydney	549	549	449					
Special Fare								
Brisbane			449	349				

Sydney	399	399	399	299				

In December 1995 competition intensified with the entry of Freedom Air, a 'new' operator run by Air New Zealand subsidiary Mount Cook Airlines, with standard Kiwi and Freedom fares of $549 and $449 for Brisbane and Sydney with specials below that. Furthermore, Air New Zealand itself and Qantas began to offer very cheap fares with their lowest being $449.

Initially Freedom, using a wet-leased Boeing 757 and flying from Auckland, Hamilton, Wellington, Christchurch and Dunedin, with 2 flights per week from each, achieved poor load factors (40-60%). These improved when Freedom changed its schedule in March 1996 to concentrate solely on Palmerston North, Dunedin and Hamilton, the latter two cities being Kiwi's key home markets. It was also in March 1996 that Freedom began a more aggressive pricing strategy with new specials of $299 and $349 to Sydney and Brisbane respectively . By April 1996 Kiwi had been forced to drop its standard rate to Sydney to $429 from its original $549.

The catalyst for the final blow in the price war seems to have been Kiwi's decision to expand into Auckland and Christchurch, which prompted Qantas in June of 1996 to offer fares as low as $399 to the entire East Coast of Australia(Wilson, 1996). This was immediately matched by Air New Zealand. At this time $399 fares were sold very quickly, but nearly everybody who missed out on the $399 fare was able to get a return ticket for $499. In effect $499 was the Air New Zealand and Qantas standard discount economy airfare to the East Coast of Australia. This compares with $749/$649 (High Season/Low Season) to Sydney and $849/$749 to Brisbane prior to Kiwi's entry.

In addition to the price war Kiwi had equipment failures and systems problems (eg no electronic link between accounting and reservations system), and in September 1996 Kiwi went into voluntary liquidation after losing up to $8 million in passenger and creditor money. Following its demise, prices rose, as they did in 1993 when the aggressive price competitor Continental Airlines left the market.

At time of writing (November 1998) prices have fallen back to very reasonable levels. Low season fares of $559 are readily available (and the 'low' season covers all but school holidays and about three weeks around Christmas), and advance purchase requirements have been reduced from 21 days, as they used to be, to almost zero. The primary reason for this desirable state of affairs appears to be aggressive capacity expansion by both major airlines, who no longer have any code sharing arrangements[3]. Air New Zealand, for example, now has four wide-body flights daily out of Auckland to Sydney.

Freedom Air remains as an operator serving the regional NZ cities, very much on a 'niche' basis. Their flights do not show on computer reservation systems, and indeed an Auckland travel agent we contacted was not sure whether the airline was still flying. Freedom direct markets through an 0800

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[3] Air New Zealand and Qantas are now members of different global airline alliances. Qantas actually initiated capacity expansion in April, 1996.

number and their fares currently start at $459 to both Sydney and Brisbane.

3. Standard Tests for Predatory Pricing

Did Air New Zealand (including its wholly-owned subsidiaries) and/or Qantas engage in predatory behaviour to drive Kiwi International from the market? The basic notion of predatory pricing is that of a dominant firm cutting its price to such a low level that it drives smaller rivals out of the market and/or deters new entrants. This action will impose short-term losses on the predating firm but these will be exceeded by the gains that it anticipates it will earn from the increase in its market power following the exit of its rivals. The dominant firm may be able to outlast its rivals because of its larger capital resources, or, if it is a multi-market player whereas its rivals are not, because of its ability to cross-subsidise from one market to another.

A number of authors have suggested methods of detecting predatory pricing and regulating it. The first and probably best known of these are Areeda and Turner (1975) who concentrate on short run profit maximisation. They argue that a firm that is selling at a short run profit maximising price or loss minimising price is not a predator, and that a necessary but not sufficient condition for predatory pricing is deliberate sacrificing of short run profits. They choose marginal cost (MC) as the dividing line between predatory and non-predatory prices. If price is below marginal cost then the firm is making a loss on at least part of its output. It could eliminate this loss by decreasing output, or, if its price is below average variable cost (AVC), by shutting down the firm. In the case of excess capacity -- where MC is below AC (average total cost) -- they argue that a price below AC but above MC should be tolerated even though it could drive an equally efficient rival from the market where that rival has insufficient capital reserves. Their reasons are that a rule which required price to be not only higher than MC but also some level above MC in order to be considered not predatory would permit the survival of less efficient rivals. Furthermore, in the short run, entry even by an equally efficient rival will be undesirable because excess capacity already exists.

On the other hand, if price is below MC it should be presumed that it is predatory. At a price below MC the firm is wasting social resources and the probability of a more efficient rival being eliminated or failing to enter is much greater. The possible exception is that such pricing could be used for promotional purposes, especially where strong brand loyalty exists or in order for a firm with declining costs to move to a more efficient level of output. When costs are increasing with output, a price below MC but above AC should be tolerated even if predatory in intent, because then more efficient rivals will be making supernormal profits and therefore will remain in the industry.

Due to the practical difficulties of estimating marginal cost, Areeda and Turner suggest that average variable cost (AVC) be used as a proxy. Thus the Areeda-Turner rule which has been widely used in United States jurisprudence (Van Roy (1991)) is that a price is predatory if is below reasonably anticipated average variable cost. The authors contend that where MC is below AVC the rule is stricter, but that this is the correct test because a firm selling below AVC is not loss minimising as it would be better off shutting down. If MC is greater than AVC then using the proxy will allow a firm to price below MC, but the authors do not see this as a problem because if MC is greater than AVC the firm is likely to be at its capacity constraint, with the result that predatory behaviour will be unlikely as it will be difficult for the predator to satisfy any new demand.

One of the criteria that Areeda and Turner use to decide the dividing line between predatory behaviour and competitive pricing is whether the price would eliminate equally or more efficient rivals.

Baumol (1996) agrees with the use of the Areeda-Turner rule, and argues further that it should be the theoretical rule as well. His main argument is that if a predatory price is defined as one that will drive an equally or more efficient rival from the market, then AVC is actually a superior standard to MC.[4] This is because while a price below MC will not always drive an at least equally efficient rival from the market -- for example where MC exceeds AC -- if price is below AVC then it is always rational for the firm to shut down.

Joskow and Klevorick (1979) argue that prices below average total cost can also be predatory. They justify this on the grounds that such prices can eliminate equally or more efficient rivals, and also that a firm with market power will only price below AC and sustain losses if it expects to earn monopoly profits in the long run which make this worthwhile. The Canadian Bureau of Competition Policy (1992) adopts an intermediate position, from which prices above AVC but below AC are treated as falling in a grey range in which determination of predatory purpose depends on the circumstances. For example, such a price may be regarded as not predatory if demand is declining or there is substantial excess capacity in the market, whereas it may be considered predatory if the firm was failing to raise prices above this level despite increasing demand.

Measuring average total costs is in practice even more difficult -- and thus likely to be controversial -- than calculating AVC, and so Joskow and Klevorick propose a two-stage procedure. In the first stage structural characteristics of the market and the market power of the predator are examined in order to determine whether there is reasonable expectation that predatory pricing could occur. If there is no serious monopoly problem then investigation of predatory pricing should cease. If there are no barriers to entry it is unlikely that predatory pricing is taking place because the opportunity to recover losses through earning monopoly rents is non-existent.

But if the market is judged conducive to predatory pricing -- that is, there is a strong possibility that the predator will be able to earn monopoly rents -- then the second stage involves examining the behaviour through price-cost comparisons to determine whether the pricing is predatory. Their aim is to make the probability of false positive and false negative errors low when the cost of such errors is high. For example, the greater the market power possessed by the predator, the greater the cost of a false negative, or the less elastic the demand, the lower the cost of a false positive error.

The Joskow/Klevorick approach can be seen as a move towards a more sophisticated analysis of oligopolistic market structure and behaviour in possibly predatory situations. In this spirit we can also place the proposals of Williamson (1977) and Baumol (1979). Williamson proposes an 'output restriction rule' which states that in the period after entry occurs the dominant firm cannot increase output above the pre-entry level for a period of 12 to 18 months. This is designed to take into account the effect that rules have on the strategic behaviour of firms. Using an example, Williamson shows that the output restriction rule has superior welfare consequences to the Areeda-Turner cost rule if strategic responses are taken into consideration, although this has been disputed (Lefever (1981); Williamson

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[4] Baumol actually uses the concept of 'Average Avoidable Costs' as his preferred variable cost measure.

(1981)) .

Baumol suggested a restriction rule directed towards price. Under his 'quasi-permanent price reduction rule', firms would be free to cut prices in response to new competition, but they would not be permitted to put them up again for a certain period of time if the entrant leaves the market. Thus firms are free to respond to entry but they must ensure that their price will still cover their costs.

Even theoretically quite simple rules are likely to be problematic in practical application, and for this and other reasons -- especially, the difficulty in distinguishing predatory from worthily competitive behaviour -- some economists and anti-trust specialists believe that is unwise to attempt to proscribe it. McGee (1980) contends that predatory pricing will be rare because it will usually be irrational -- the predator will not recoup its losses. He argues that it is generally rational for the victim to "stick it out" if a predatory campaign occurs because any predatory pricing strategy is characterised by only a temporary cut in prices. Furthermore (Easterbrook, 1981), the victim has the same incentive as the predator to outlast its rival and collect the eventual monopoly rents.

Both McGee and Easterbrook argue that the "deep pockets" argument of predator being able to sustain losses for longer than its victim is not valid. The predator will be sustaining larger losses than the victim because its output will be larger, and the victim should have similar access to finance. It may also be able to call on its customers for assistance, given that these will benefit from its continued participation in the market, in the form of long term agreements to buy at the true competitive price.

Perhaps both McGee and Easterbrook are over-optimistic about the likelihood of a victim, especially a small player, of obtaining finance. Lenders normally require substantial security, a demonstrated ability to repay and will charge high interest rates if they perceive the loan to be risky. More prudent lenders are unlikely to extend credit at all to a small firm facing a tough competitive move by a large and experienced firm. The difficulty faced by Kiwi International in obtaining financial capital prior to its demise may be an example of how even a firm with strong customer loyalty and a successful track record, but in trouble due to competitive pressure, may not be able to convince anyone to provide it with the resources it needs. In a world of perfect information and perfect competition predation is not likely to be a problem, but in the (real) world of small-number oligopoly it is prudent not to rule out a priori the possibility of anti-competitive behaviour. In the following sections we first apply the cost-based methodologies of Areeda-Turner and Joskow-Klevorick, and then construct our own oligopoly modelling approach to analysing the events that preceded the exit of Kiwi International.

4. Pricing and Costs in the Trans-Tasman Air Travel Market

In this section we develop data on incumbent pricing and costs and use these to implement the standard tests for predation as set out in the previous section. We will focus on the behaviour of Air New Zealand's 'fighting brand' subsidiary, Freedom Air, which embodied the most direct competitive response to Kiwi International, first measuring price, then costs, and then comparing these.

4.1 Price and pricing

'Price' is not a simple concept in air travel. Even a leisure-travel carrier like Freedom (ie, with no 'full fare' business passengers) usually offered more than one fare, with limited numbers of seats made available at the lowest price. We will use the total revenue per passenger kilometre (RPPK) as our measure of effective price. The first step in calculating this is to determine RPPK for each fare level, dividing the fare by the number of kilometres travelled in order to obtain the revenue per passenger kilometre. Thus, given that it is 2158km from Auckland to Sydney or 4316km return, if the return fare is $395, which was Freedom's special fare to Sydney in December 1995, then the revenue per passenger kilometre is 395/4316 or 9.2 cents per kilometre.

Then the second step is to calculate the overall RPPK for the flight. Freedom sold approximately 30% of their aircrafts' capacity at the special price, and it is assumed that all these seats were sold before standard fares are purchased. When the load factor was 40%, it is assumed that 30% of the aircraft or 75% of the seats sold will be have been at the lowest price with the remaining 25%, or 10% of the aircraft, at the standard price. Thus at Freedom's December 1995 prices to Sydney, overall RPPK at a load factor of 40% is $0.75*9.2 + 0.25*10.4 = 9.5$ cents. Table 2 shows Freedom's overall RPPK for four months from December 1995 and December 1996; in each case calculated for a range of load factors encompassing our estimate of the most likely loading for each month.

Table 2: Freedom's Overall Revenue per Passenger Kilometre

Period	Load factor(%)	Overall RPPK Sydney (NZ cents)	Overall RPPK Brisbane (NZ cents)
December 1995	40	9.5	11.1
	50	9.7	11.3
	60	9.8	11.4
March 1996	40	7.8	8.7
	50	8.3	9.4
	60	8.7	9.8
May 1996	60	8.7	9.8
	70	8.9	10.1
	80	9.1	10.3
December 1996	70	11.7	11
	73	11.8	11.1
	80	11.9	11.2

The table shows Freedom's RPPK falling in the early stages of its price war with Kiwi, before picking up somewhat with higher load factors, then increasing substantially following Kiwi's exit in September 1996, as both fares and (slightly) load factors increased. The delayed response of Freedom Air's load factors to its initial price cuts is interesting. The airline claims that it had load factors in the 40-60% range which improved to 70-80% following a change in its schedule in April 1996. Initially it flew from Auckland, Hamilton, Wellington, Christchurch and Dunedin with approximately two flights per week from each location. From April onwards, Freedom concentrated solely on Palmerston North, Hamilton and Dunedin (the latter two being Kiwi's key markets) with 5 or 6 flights per week from Hamilton and 4 times per week from Dunedin and Palmerston North. Another important factor contributing to Freedom's initially low load factors was probably the strong local loyalty that Kiwi enjoyed and a public perception that Freedom was just Air New Zealand's tool for getting rid of its upstart rival. Freedom therefore had to work very hard to break into the market.

Kiwi's exit in September 1996 no doubt contributed to a further rise in Freedom's average load factor, which for the period October-December 1996 was 73%, according to reliable data on Freedom's seat capacity and passengers carried, recorded by the Australian Department of Transport (1996).

4.2 Costs

We need estimates of the costs incurred by the incumbent airlines in offering trans-Tasman air services that compete with those offered by Kiwi International. We begin with aggregate Air New Zealand data from its annual accounts. The first step is to break this down into costs of flying domestic and international operations, which we do by assuming that the proportion of total cost attributable to providing international passenger service is equal to the proportion of total revenue provided by international passengers. This figure -- $1621 million for 1997 -- divided by the number of revenue-earning passenger kilometres carried, which was 18,440 million that year, gives a figure of 8.8 cents as the cost per passenger kilometre.

Most of Air New Zealand's international network has longer stage lengths than the trans-Tasman route, and cost/kilometre falls as per-flight fixed costs, such as passenger processing and heavier fuel use in takeoffs are spread over longer journeys. We used (1994) Bureau of Transport and Communications Economics (BTCE) data on costs differences by length of stage to arrive at a scale factor of 1.25 for the Tasman route. That is, we estimate that, holding the load factor constant, it cost 11 cents per passenger kilometre travelled to move people between Australia and New Zealand.

Load factors (ratio of seats sold to seats available on a flight), of course, are not held constant in reality, and they have a large effect on unit costs, since only about 15% of the cost of providing a flight varies with the number of passengers (mostly food, drink; some fuel expenses). We will take this percentage to hold at Air New Zealand's average 1997 load factor of 68%, and assume that the variable costs are linearly related to the number of paying passengers, in order to adjust costs for different observed load factors.

Three time periods will be used for this analysis, the extreme short run, the 6 month short run and the long run. The extreme short run can be thought of as a month or less, and the long run is the period in which all costs are variable. These periods have been chosen to provide different scenarios

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under which to analyse predatory pricing according to the Areeda-Turner rule. The shorter the time period, the less likely it is that pricing will be found to be predatory. This is because the proportion of costs that are variable decreases with the time period and therefore the price that is below AVC decreases with the length of the time period. The 6 month short run scenario was chosen in order to approximate the period over which Freedom and Kiwi were in competition with each other .

In the extreme short run -- ie if the airline decides not to fly today -- the only costs that can be varied are aircraft fuel, passenger services, and landing and associated charges. In the 6 month short run, the airline can vary a great deal more including all its flight operations costs and at least some of its maintenance costs . In Table 3 are variable and fixed costs proportions using data from the 1997 Air New Zealand annual accounts as well data for the aggregate costs of world airlines contained in BTCE (1994).

Table 3: Fixed and variable costs as a percentage of total costs

Scenario	Data	VC % of TC	FC % of TC
Extreme SR	1997 Accounts	30	70
	BTCE	27	73
6 Month SR	1997 Accounts	72	28
	BTCE	66	34

A greater proportion of Air New Zealand's costs are variable under each scenario than for world airlines on average. This could be due to Air New Zealand having a greater average stage length and therefore higher fuel costs as a proportion of total costs than the average and/or Air New Zealand's 1997 average load factor (68%) being above average in that year. As can be seen from the data the choice of time period is critical in deciding what proportion of total costs are variable.

4.3 The comparison of price and costs

We now bring together the numbers for prices received and costs incurred to apply the standard test for predatory behaviour. Two problems must be recognised, if not fully addressed. The first is that although we have constructed satisfactory revenue data for Air New Zealand's 'fighting brand', Freedom Air, this wholly-owned subsidiary's costs are buried in the accounts of the parent company, whose costs as developed in section 4.2 above we will have to use for this analysis. It is impossible to be precise about the error thereby introduced. On the one hand, Freedom's no-frills inflight service and use of possibly cheaper airports will reduce its costs relative to Air New Zealand's, but, in the other direction, it might not be able to exploit the scale economies available to the larger operation.

The second problem is caused by the effect on costs per actual passenger kilometre of the load factors achieved. If the airline flies with a lot of empty seats, as did Freedom Air in its early months, then its unit costs will be rather high, and the likelihood of them exceeding price, and so apparently signalling predation, thereby increased. Yet, taking price as the weapon of predation, low load factors would, *ceteris paribus*, be associated with higher rather than lower prices. On the other hand, if it is capacity (investment) that is the predatory instrument -- for example, the predator adding more flights to a service

than the market can profitably sustain -- then this would indeed be associated with low load factors.

Table 4 gives prices and costs, with the latter shown for different time horizons, for the Auckland-Sydney run. Data are shown for months representing key episodes in the Kiwi story, and are given for a range of three load factors, which straddle our estimate of the actual average load factor achieved by Freedom Air in that month.

Table 4: Price and cost comparison by load factor and scenario

Period	Load Factor(%)	Total RPPK	Extreme SR VCPPK	6 Month SR VCPPK	Long Run CPPK
Dec-95	40	9.5	4.6	**12.4**	**17.6**
	50	9.7	4.0	**10.2**	**14.4**
	60	9.8	3.6	8.8	**12.3**
Mar-96	40	7.8	4.6	**12.4**	**17.6**
	50	8.3	4.0	**10.2**	**14.4**
	60	8.7	3.6	**8.8**	**12.3**
May-96	60	8.7	3.6	**8.8**	**12.3**
	70	8.9	3.3	7.7	**10.8**
	80	9.1	3.1	7.0	**9.6**
Dec-96	73	11.8	3.2	7.5	10.4

In no case is price below the extreme short run VCPPK, but it does fall below six month VCPPK for the December to April 1996 period, and below total CPPK for all the months in which Kiwi and Freedom coexisted. In the winter months before Kiwi exited in September 1996, price seems to have been above six-month average variable costs, despite the price war, at the most likely load factor of around 70%, and quite substantial profit margins return, even on total costs, in the fourth quarter of 1996, when Freedom's actual load factor (from data supplied by the Australian Department of Transport) is known to have been 73%.

So do we have evidence of predatory pricing? The main reason for price being below cost in the early months is the low load factor that Freedom had then, which in turn could be attributed to the usual difficulties faced by new businesses in building up their clientele (Freedom, unusually for an alleged predator, is a quasi-'new' firm itself). By May 1996, load factors had built up enough to probably pull variable costs below price

But it does seem that price was below average total cost, CPPK, for the entire period in which Kiwi and Freedom were competing. Although it may have been rational for Kiwi to stay in the market if it was at least as efficient as Freedom because it could cover at least some of its fixed costs, Kiwi's lack of financial capital meant that it did not have this choice open to it. Although Air New Zealand, through Freedom, may not have engaged in predatory pricing according to the generally acceptable Areeda-Turner rule, its behaviour could have driven an equally efficient rival from the market with detrimental effects on the level of competition and overall welfare in the market.

This calls into question the approach of relying entirely on the Areeda-Turner rule because it could lead to the exit of an equally or more efficient rival which is not a desirable result. Is there a viable alternative? The advantage of the rule is its basis that it is not rational for an equally efficient rival to stay

in the market if the predator is pricing below its AVC. If price is above AVC then it is rational for a rival to stay in the market unless they are not as efficient as the predator.

One alternative would be to have a price floor at AC where a price below AC could be predatory but not necessarily. In order for such a price to be regarded as predatory two conditions would have to be met, firstly, the victim would have to demonstrate it was at least as efficient as the predator but unable to sustain losses over an extended period and therefore could not choose the rational action. Secondly, the predator would be unable to show that it had priced below AC because of falling market demand or for promotional purposes. This would ensure that only equally or more efficient rivals were protected despite the price floor being above AVC, and that the predator still had the freedom to pursue actions which were aligned with the furtherance of long term competition and efficiency, eg using promotional pricing to enter a market leading to greater competition in the long run. Such an approach would be more difficult to implement and is more subjective than the Areeda-Turner rule, but the alternative under Areeda-Turner involves accepting that more efficient rivals could be driven out of the market.

If this approach is used in the Kiwi case then the first requirement that price is below average cost is satisfied but the next requirement to meet is that Kiwi was as least as efficient as Freedom, and did not have the financial resources to sustain losses for an extended period. The latter requirement is definitely met, there is no doubt that Kiwi did not have the financial capital to sustain a battle against Air New Zealand. Also, on balance, it may be concluded that Kiwi was at least as efficient as Freedom, principally because they were both of a similar size ie 1 to 2 aircraft operators, both were using leased aircraft of similar type, and they were flying the same routes. This conclusion is supported by the Commerce Commission's finding that Kiwi would have had lower operational costs than Air New Zealand (Commerce Commission, 1997).

On a unit cost basis Kiwi's costs were almost certainly lower. Although Kiwi's load factor fell to as low as 58% in July, its overall load factor for the 1996 year was 78%, which is far better than Freedom's for the early part of 1996, and likely at the very least to equal the best load factor that Freedom achieved throughout that year, given Freedom averaged only 73% for the October-December 1996 period after Kiwi had exited the market. This means that Kiwi's average and variable cost per passenger kilometre were almost certainly lower than Freedoms.

The final requirement is that Freedom could not justify pricing below average cost on grounds such as promotional market-building, or falling market demand. Overall, market demand was strong, but what about promotion? Freedom's initial load factors were low, but from May 1996 when a more efficient load factor was achieved the promotion justification could no longer apply. Freedom had secured itself a niche in the market but continued to price below average cost.

Thus we conclude that Freedom was probably not engaging in predatory pricing according to the orthodox Areeda-Turner rule, but that on the basis of the alternative approach set out above, its behaviour may have driven an equally efficient rival from the market.

5: Oligopoly Behaviour in the Trans-Tasman Air Travel Market

At the very least, the preceding section reveals the difficulties in resolving issues of alleged predatory behaviour with the orthodox price/cost comparison methodology. The basic problem is in knowing what to expect when structure changes in the absence of a model of oligopoly behaviour. Could more 'competitive' pricing post-entry just be a natural consequence of a more 'competitive' industry structure? There are, for example, well documented instances of price cuts of around 50% in US city-pair routes entered by the low-cost carrier Southwest Airlines which have not resulted in charges of predatory behaviour (Dresner *et al, 1996)*. In this section, we attempt to move the analysis forward by interpreting before and after behaviour in the context of an explicit oligopoly model.

Our approach is as follows. First we use data and our knowledge of the industry to calibrate an oligopoly model to fit pre-entry behaviour. Then we similarly analyse the pre-exit period of intense competition. If the nature of the oligopoly game being played appears to have changed significantly after entry in the direction of more aggressive behaviour, we infer predation.

We believe that this approach represents a useful step forward from price/cost rules, but it suffers itself from at least two difficulties. The first (shared by all applied oligopoly calibration exercises) is the damage done to reality by the simplifications needed for a tractable analysis. The second problem is our lack of a well established theory of the determinants of oligopoly behaviour. Suppose we established that a settled duopoly could be modeled as Cournot-Nash and that so too could the triopoly following entry.[5] Then we could reasonably infer that post-entry price reductions were not predatory in intent (even if large enough so that revenues no longer covered incumbents' total costs), but were just what would be expected from the addition of another player to the Cournot setting.

But what if, post-entry, the nature of the oligopoly game changes? Since we might reasonably expect that conjectures become more competitive[6] as the number of firms increases (as we do in the

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[5]A Cournot oligopolist takes rivals' output as given when choosing its output; Cournot-Nash equilibrium is the set of outputs such that, given their others', no one of the oligopolists wishes to change its own output.

[6] (Perfectly) competitive conjectures mean that each firm expects that a unit increase in its own output will not affect the market price, which implies, mathematically that it expects the other firms to

limit of very large numbers of competitors) how can we ascertain whether the change reflects a conscious effort to behave more aggressively by incumbents? We will not be able to settle this matter, but will return to it in our discussion of results.

5.1 The model

We make the usual tractability assumptions of linearity and constant costs. For demand, we assume that the incumbents Air New Zealand and Qantas are offering an effectively identical product, which is both horizontally and vertically differentiated from the service supplied by the entrant Kiwi International. We fold the operations of Air NZ's subsidiary Freedom Air into its parent.

That is, we will be modelling 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):

$$(1) \qquad P_I = a - bQ + eq_E$$

$$(2) \qquad P_E = á - âQ + åQ_I$$

where: $Q = Q_I + q_E = q_i + q_j + q_E$,

using i and j to subscript the two incumbents. The e and å coefficients measure the extent of horizontal product differentiation. If, say, $e = b$, 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, $e = 0$, then the products are perfect substitutes.

Total cost of firm i is:

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

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

Incumbent firm i's profit function is:

$$(4) \qquad ð_i = q_i P_i - Ci$$

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reduce their output by one unit, in total.

$$= q_i [a - bQ_I - (b-e)q_E] - f_i - c_i q_i$$

Differentiating with respect to firm i's output:

(5) $d\eth_i /dq_i = a - bq_i \, dQ_I/dq_i - bQ_I - (b-e)q_i \, dq_E/dq_i - (b-e)q_E - c_i$

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

$$q_i = q_j = q$$

Substituting into (5), and writing $dQ_I/dq_i = (1+ë_I)$, and $dq_E/dq_i = ë_{IE}$, for the response expected by an incumbent firm of the changes in output of the other incumbent and of the entrant induced by a unit change in its own output:

(6) $d\eth_i /dq_i = a - 3bq - bqë_I - (b-e)q_E - (b-e)q \, ë_{IE} - c$

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) $\eth_E = q_E[á - âq_E - (â - å)Q_I] - f_E - c_E q_E$

Differentiating and substituting as for (6):

(8) $d\eth_E/dq_E = á - 2âq_E - 2(â - å)q - (â - å)q_E ë_E - c_E$,

where $ë_E$ is the entrant's conjectured response of total incumbent output to a unit change in its own output.

We assume that at any time observed industry outcomes were generated by profit maximising behaviour 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) $ë_{IE} = èë_I$

With this, we get expressions for $ë_I$ and $ë_E$:

(10) $ë_I = [a - 3bq - (b-e)q_E - c]/[(b +(b- e)è)q]$

(11) $ë_E = [á - 2âq_E - 2(â - å)q - c_E]/[(â - å)q_E]$

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

5.2 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).

First, we define the product to be a trans-Tasman return leisure trip, and measure this by numbers of travellers paying discounted fares. This assumes that differences in the origin and destination of flights are not significant to the analysis. This simplification is probably not problematic -- the airlines themselves seem to act as though all New Zealand cities are the same distance from all Eastern Australian cities, with a standard add-on to Brisbane fares. However, there is usually some difference in prices ex-Australia and ex-NZ, which travellers cannot easily arbitrage away because of the return-flight requirement imposed on purchases of cheap tickets.

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 -- for example, the largest fringe member, United, only flies the Auckland-Melbourne route.

We have lumped Freedom Air in with its owner Air New Zealand, and assumed symmetry between Air New Zealand and Qantas. The first of these assumptions is motivated solely by the desire for analytical tractability. Certainly, in a proper 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 behaviour, since the creation of Freedom may itself have been a predatory act.

As for symmetry, this goes slightly against the fact of Air New Zealand's larger share of the trans-Tasman market. But we suggest that this is not due to any fundamental cost or product superiority of the New Zealand airline over Qantas, but simply because (a) each airline has a natural advantage in picking up custom from its own nationals (if only because of the flow-on from its internal feeder network), and (b) rather more New Zealanders want to travel to Australia than Australians to NZ.[7]

Even the basic data of price and quantity are not trivially measured. For 'price' we use the discounted economy return fares from Auckland to Sydney -- that is, the fares below the full economy fare which carry conditions such as advance purchase and limited refundability. Pre-entry in late 1995, we take the simple average of high and low season fares, which is $699, but during 1996 the airlines offered portfolios of fares, with differing availability, and so our prices are calculated as share-weighted averages of the posted fares: $483 for Air New Zealand (with Freedom Air) and Qantas; $354 for

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[7]For example, in the year to March 1995, 431,365 New Zealanders travelled to Australia, and 402,580 visitors from Australia arrived in New Zealand (NZ Official Yearbook 1996).

Kiwi Air. For quantity, we use the number of leisure or non-business flights, which was 82% of the total in 1995, and assume that all airlines other than Kiwi and Freedom carry business travellers. The output of the non-Australasian carriers is subtracted from the total. Our (annualized) outputs of return trans-Tasman flights are 445,000 and 535,000 for each incumbent pre- and post-entry, and 52,000 for Kiwi.

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 incumbent price function (1), we solve for parameters a and b using actual pre-entry output and price and an estimate of the market demand elasticity from within the range suggested by our literature survey (Appendix 2). Then we can add the post-entry data for P_I, Q_I and q_E to solve for the 'cross-price' parameter e, assuming that the demand curve did not shift between the two periods. The parameter e must lie in the range (0,b). If it is larger than b, this implies that the entry of Kiwi expanded the market so much that the demand for the incumbents' services actually shifted out. If it is less than zero, then Kiwi's arrival has actually contracted the total trans-Tasman market. While neither of these eventualities is totally inconceivable, they must be considered very unlikely (and certainly not consistent with the 'stories' told by industry participants, including travel agents).

The range of (pre-entry) market price elasticities of demand that keep e within this range is approximately (-0.85, -0.65). This implies market demand slightly less elastic than the literature suggests is normal for international leisure travel. Such is probably quite reasonable for the relatively short trans-Tasman route, for which fares are below those the airlines charge for many of their domestic flights, and it covers the econometric estimate for this route by BTCE (1995). We will use an elasticity of -0.75 for our base case, and show the sensitivity of results to changes in this. We will also show results based on the assumption of some total market growth due to population and/or income increases, which we model as reducing the slope [b] of the demand curve (1), while keeping the intercept, a, constant.

Next we calibrate 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. The first of these is:

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

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) $\hat{a} - \mathring{a} = b - d$

The second piece of 'information' that we feed into the system is the price at which Kiwi International would lose (virtually) all its customers, given the actual post-entry output of the two large airlines. Kiwi's disadvantages -- limited schedule, no Frequent Flier Program, frugal service, no history of carrying passengers without crashing -- are such that it is unlikely it would even be able to even match the incumbents' fare and attract significant custom, given that even its 'horizontal' niche advantage of specialised location was negated by the presence alongside it of Freedom Air in the regional markets. We will try a range of zero-demand price assumptions, starting from $450.

This price and $q_E = 0$, together with ($\hat{a} - \mathring{a}$) allow us to solve (2) for á, and then we plug in the actual values of output and price to get â.

Finally, we need estimates of marginal cost. For the incumbents we use our estimate of the variable cost per passenger kilometre (VCPPK), 6 month short run scenario, at a 69% load factor, which was the approximate average for Air New Zealand and Qantas over the 1994-1996 period,

multiplied by the total return distance from Auckland-Sydney of 4316km which gives a constant marginal cost of $338 per return flight.

As for Kiwi, its bare-bones 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 numbers.

5.3 Results

We are interested in the nature of oligopolistic interaction before Kiwi's entry in August 1995, and then during the 1996 period of intense competition. Did the 'rules of the oligopoly game' change significantly? We will show our estimates of the conjectural variations parameters before and after entry for a number of sets of the other parameters and variables.

First, we show, as Scenario A, what we believe to be the least unlikely or middle-of-the road results. For this we set the 1995 point elasticity of market demand in the middle of its permissible range, at -0.75; the price at which demand for Kiwi's services would dry up, given the 1996 output of Air New Zealand and Qantas is $450; and Kiwi's marginal costs are put at $300 (about 10% lower than those of the big airlines). Market growth is set at zero (no shift in the demand curve between 1995 and 1996). We will, throughout, set the parameter è at 0.2. We have no precise reason to do this, but it is not an important parameter and changing its value has little effect. Here we simply report the results, saving most discussion of them to the next section.

Scenario A: Middle-of-the-Road Parameter Values

Kiwi zero-demand price = $450	duopoly: $ë_I$ = -0.23
Kiwi marginal cost = $300	triopoly :
1995 market demand elasticity = -0.75	$ë_I$ = -0.67
market growth = 0%	$ë_E$ = -1.53

Our MoR scenario reveals (a) incumbents pre-entry had conjectural variations quite close to Cournot, at -0.23; (b) the incumbents' behaviour changed substantially in the post-entry period, moving to two thirds of the way towards perfect competition; (c) Kiwi's conjectures are what might be called 'super-competitive', being larger in absolute value than -1. These results are quite striking and we will be anxious to find out how sensitive they are to errors in our parameters.

First, we move the market demand price elasticity up and down within its quite restricted permissible range:

Scenario B: Less elastic market demand elasticity

Scenario B: Less elastic market demand elasticity

Kiwi zero-demand price = $450	duopoly: $ë_I$ = -0.28
Kiwi marginal cost = $300	triopoly :
1995 market demand elasticity = -0.70	$ë_I$ = -0.72
market growth = 0%	$ë_E$ = -3.0

Scenario C: More elastic market demand elasticity

Kiwi zero-demand price = $450	duopoly: $ë_I$ = -0.17
Kiwi marginal cost = $300	triopoly :
1995 market demand elasticity = -0.80	$ë_I$ = -0.63
market growth = 0%	$ë_E$ = -1.1

We think it reasonable to infer from Scenarios B and C that our results for incumbents' conjectural variations parameters are fairly stable, but not so the estimate of Kiwi International's beliefs on the response by the incumbents to its actions. This last result is repeated when we return to Scenario A but increase the price at which Kiwi would have lost all its customers, to $500:

Scenario D: Higher value for demand-eliminating Kiwi price

Kiwi zero-demand price = $500	duopoly: $ë_I$ = -0.23
Kiwi marginal cost = $300	triopoly :
1995 market demand elasticity = -0.75	$ë_I$ = -0.67
market growth = 0%	$ë_E$ = -3.35

Changing this parameter does not, of course, affect the incumbents' CVs, but it more than doubles the Kiwi ë. Something similar happens if instead of changing Kiwi's demand we change its costs:

Scenario E: Higher marginal cost for Kiwi

Kiwi zero-demand price = $450	duopoly: $ë_I$ = -0.23
Kiwi marginal cost = $350	triopoly :
1995 market demand elasticity = -0.75	$ë_I$ = -0.67
market growth = 0%	$ë_E$ = -3.34

It is no surprise that changes in demand and costs have similar effects, as inspection of equation (11) makes clear.

Finally, we suppose that the total market increased (due, say, to income and/or population growth) from 1995 to 1996, such that the slope parameter 'b' in equation (1) is 3% smaller in absolute

value ('flatter' demand curve). This necessarily must lower our estimate of market demand elasticity, if the entry of Kiwi is still to have an overall market-expanding effect. The permissible range of market elasticities becomes (-0.72, -0.54). The results for a scenario with market growth and elasticity in the middle of this range are:

Scenario F: Market expands by 3%; 1995-96

Kiwi zero-demand price = $450	duopoly: $\ddot{e}_I$ = -0.35
Kiwi marginal cost = $300	triopoly :
1995 market demand elasticity = -0.63	$\ddot{e}_I$ = -0.71
market growth = 3%	$\ddot{e}_E$ = -0.17

Scenario F shows that our estimate of post-entry incumbents' oligopoly behaviour is not much affected, but there is a quite substantial (about 50%) increase in the absolute size of the pre-entry CV estimate, in the direction of more competitive behaviour. As for the Kiwi International CV parameter, this now becomes rather small.

6. Discussion and Welfare Analysis

We discuss, in turn, what the results of our oligopoly model calibration exercise imply for the behaviour of the two incumbents pre-entry, their behaviour post-entry, and the behaviour of the entrant, Kiwi International, during the period that preceded its demise. We then do a simple public benefit analysis of Kiwi's contribution to the Trans-Tasman market.

6.1 The Duopoly

In our base-case solution, we find that Air New Zealand and Qantas, modeled as symmetric duopolists in 1995, generated an estimate for the conjectural variations parameter equal to -0.23, thus implying behaviour just on the 'competitive' side of Cournot. This estimate is quite stable to sensitivity analysis, with the possible exception of assuming a non-zero increase in the total trans-Tasman market between 1995 and 1996 (which requires a lower estimate of the 1995 market demand elasticity).

We find this result quite intuitively appealing as a description of interaction in a fairly mature but vigorous duopoly. It corresponds more to what business people, rather than economists, would describe as 'competitive' behaviour. Consider output as sales. Then Cournot conjectures (no change in rival's sales in response to successful effort to increase own sales) mean that the firm expects its rival to defend its market -- to be willing to take a price cut to keep from losing any of its customers. A small negative conjecture means that the firm does expect it can steal a few customers from its rival without the latter responding, or, even, noticing (given the usual amount of 'noise' and fluctuations in sales data).

Near-Cournot conjectures are consistent with the study of multiple city pair routes in the US by Brander and Zhang (1990), who find mean values of the CV parameter equal to -+0.06 and +0.12 for American Airlines and United Airlines, respectively, over 33 routes which these airlines operate as a duopoly.

6.2 The duopolists post-entry

What do we expect to happen when two duopolists are joined by a third firm in the market? Even if conjectures do not change, the equilibrium outcome should have a lower price, basically because each firm, having now a smaller market share, perceives their demand to be more elastic. But we should expect conjectures also to alter in a more 'competitive' (in the economists' sense) direction. Take a symmetrical duopoly CV of -0.20, meaning that each of the firms expects it could pick up one of every five additional customers from its rival if it increased output. What would firms in a symmetrical triopoly expect?

It seems reasonable that the lower bound for each firm's CV would now be -0.40, which would hold if the firm thought it could now pick up one of five additional customers from each of its competitors. But the likely number is probably smaller (in absolute value) than this, because loss of a customer is a relatively bigger event to a (triopoly) firm with just 33% of a given total market than to a (duopoly) firm with half the market, and so more likely to be noticed and responded to. This implies that the bilateral firm i/firm j conjectural variations will be smaller than the duopoly CV.

In the present case the triopoly is hardly symmetric, with the entrant Kiwi's limited range of regional departure points and perceived inferior product, and we impose on the model the requirement

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that each incumbent's conjectured variation with respect to Kiwi be just a quite small fraction (0.2) of their conjectured response from the other incumbent.

But it is this incumbent response that is germane to the predation issue, and of course our most striking result in section 5.3 was that, far from shrinking, incumbent conjectural variations just about triple (in absolute value) during the period that preceded Kiwi's exit from the market. That is, Air New Zealand and Qantas suddenly started perceiving each other as much more competitive in the economists' sense, and much less competitive according to the everyday businessperson's understanding of the term.

This is really very suspicious, not just because the change in conjectures is so large, but also because of the nature of that change. Bear in mind that these competitive conjectures are actually seriously wrong (mutually inconsistent) -- each firm is now acting as though the other would accommodate most (about two thirds) of its output increases, when of course the result of such conjectures is that the other firm, thinking similarly, actually *increases* its output. Such a breakdown in mutual understanding does not seem to match the direct evidence on pricing responses, which rather suggests a quite well coordinated response to entry by two well-established airlines, who know each other and their shared market very well indeed. It is difficult to resist the inference that the observed behaviour was not generated by normal everyday commercial considerations, but instead was part of a bigger game, designed to alter the structure of the industry.

By July 1996 Air New Zealand had set up Freedom Air, and then Qantas, followed quickly by Air New Zealand, had cut their fares, without either airline complaining about the behaviour of the other despite these actions resulting in a large fall in fares from the average of $699 prior to Kiwi's entry. Indeed, Air New Zealand subsequently seemed to blame Kiwi entirely for starting the airfare discounting war and for fares being sold "at less than an economically viable level"[8] when explaining its poor profit performance for the year ending June 30 1997. No complaint was made about Qantas and no mention was made that it was Qantas, not Kiwi, that slashed fares to the $399/$499 level in June 1996.

6.3 Kiwi International's behaviour

Our model showed estimates for Kiwi International's conjectures as being 'super-competitive', and quite variable with respect to changes in scenario assumptions. What is happening is this: given the estimated demand curve and the incumbents' output, Kiwi's own output levels are too high, in that marginal revenue is below marginal cost. The only way to rationalise this is to deduce that Kiwi's management believed that, were they to cut back output, this would be countered by even larger increases in incumbent output, such that profits would not increase.

Such conjectures make little economic sense, and could even be interpreted as evidence of

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[8]Bob Matthews, Chairman and Jim McCrea, CEO Air New Zealand, quoted in the (Wellington) *Evening Post* September 2, 1997.

predatory behaviour by Kiwi itself! However, unwise though the new airline no doubt was to expand from its regional base into the big city markets of Auckland and Christchurch, it cannot seriously be accused of attempting to eliminate one or both of its incumbent competitors. A more reasonable interpretation of its actions is probably that, *in extremis*, it was just trying to keep flying, with no ability to develop and sustain normal commercial pricing practices.

6.4 Welfare analysis

We conclude with a 'back-of-the-envelope' analysis of the net welfare impact of the Kiwi saga. The numbers are so large that no great precision is needed. On the cost side, we have the $8 million owed to the liquidated Kiwi International's creditors. Just about all of this is lost — the airline had very few tangible assets, and there is no suggestion that any of this money is still around, for example in someone's overseas bank account. The benefits are the allocative efficiency gains from lower prices and higher output, equal to the area of the 'trapezoid' made up of the sum of the consumer surplus welfare triangle, and the rectangle of additional profit when output expands with price above marginal cost.

For the six-month period of intense price competition in 1996, these efficiency gains total more than $40 million[9]. For the two years to date since Kiwi International's exit, readily available fares for trans-Tasman travel appear to be still around 20% below their 1995 levels, implying another two years of efficiency gains totalling upwards of $50 million, of which it seems reasonable to attribute a large proportion to the threat, which Kiwi's entry demonstrated to be real, of new competition. Freedom Air remains servicing the niche regional market that Kiwi demonstrated to be viable.

Consumers, of course, have benefited much more than the net efficiency gain figures: this is an approximately 1 million flights/year market, so that every $100 on or off the average price is worth

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[9] Using the data from our simulation analysis (annualised output before and after Kiwi's entry rising from about 900,000 to about 1,170,000; price falling from $699 to $483; marginal variable costs = $338), we get the allocative efficiency gain for half a year as:

$$0.27[\ 145 + 0.5(361)]/2 = \$44,000,000$$

about $100 million/year to consumers. Without condoning the questionable management practices of Mr Ewan Wilson, Kiwi's founder (for which he has been sentenced by the courts), and without attributing all or even most of these benefits as the result of entry-deterring pricing spurred by the desire on the part of the incumbents not to have to put up with a Kiwi-type operator again, it is hard to resist the conclusion that, within the amoral calculus of cost-benefit analysis, Mr Wilson was a considerable benefactor to the travelling public of New Zealand and Australia.

7: Summary and Conclusions

Kiwi International Airline's participation in the Trans-Tasman market was short in term but significant in its impact on prices, quantities and product variety. Both the incumbent airlines Air New Zealand and Qantas expanded output and engaged in significant price cutting in response to the entry of Kiwi. In the case of Air New Zealand this was done not only directly but also through the creation of what was effectively another marketing arm, Freedom Air, which was directly targeted at the Kiwi International regional market. How should these responses be interpreted?

Our analysis of Freedom Air's pricing revealed that it was probably not predatory under the orthodox Areeda-Turner rule because it did not price below anticipated average variable cost. However if an alternative and wider definition of predatory pricing is used -- pricing below average cost under certain conditions -- then Air New Zealand through Freedom Air can be regarded as having engaged in predatory pricing in the sense that it may have driven an equally or more efficient but financially under-resourced rival from the market with consequential detriment to competition, market efficiency, and consumer welfare.

A major problem with these tests is that they do not identify the behaviour that generated observed prices, and so cannot distinguish predation from the legitimate impact on oligopolistic conduct that could follow the entry into an industry of another competitor. We therefore advance the analysis by developing an explicit oligopoly model, and by calibrating this to pre- and post-entry market outcomes. The results of this exercise were that the behavioural assumptions that must be assigned to the participants in a non-cooperative setting in order to generate the actual output outcomes observed, are implausible on the basis of what is known about the main incumbents.

We infer that Air New Zealand and Qantas ceased to play their normal non-cooperative (near-Cournot-Nash) oligopoly game following the entry of Kiwi and switched to aggressively 'competitive' behaviour in order to drive Kiwi from the market. However, our inferences fall short of discovering the 'smoking gun' of direct evidence of collusion to predate. And it should be admitted that, in addition to its difficulties caused by the response of the incumbent airlines, Kiwi also suffered from an array of other problems that must have contributed to its collapse. Chief among these was insufficient capital to survive adverse conditions of any kind for long, compounded by poor financial management systems, which meant the airline did not have the information it required to make timely decisions that may have protected its extremely fragile position. Furthermore it is possible that Kiwi just fell into the trap of increasing capacity because of its success in filling seats with discount fares without considering that these discount fares were not covering the airline's average costs. By increasing capacity and frequency during 1996 it was exacerbating its existing problems. A greater concentration on ensuring that the yield, ie revenue per passenger kilometre, was covering average cost may have helped the airline to survive.

Apart from perhaps a greater concentration on yield and more capital, hindsight suggests that Kiwi International should not have attempted an expansion in size or routes and should, instead, have stuck to the provincial centre niche which it had pioneered so successfully. Without Kiwi's rapid expansion into the main centres such as Auckland and Christchurch, the response of the incumbents may have been more muted. Furthermore, without the expansion Kiwi would not have incurred the associated costs which were not covered by extra revenue for a period of time during 1996 when it was facing fierce competition from Freedom Air. Finally, Kiwi had the advantage of strong public

support in the Waikato and Otago provinces, which meant it was quite difficult for Air New Zealand to break into this market using Freedom. The combination of less aggressive response, lower costs, as well as strong customer loyalty may have been sufficient to give Kiwi the breathing space it needed to consolidate enough to convince Air New Zealand and Qantas that they should accommodate the new airline.

After Kiwi's collapse and the demonstration effect of Air New Zealand and Qantas' aggressive behaviour, as well as their more restrained pricing in the two years since, it is unlikely that there will be a new entrant in the scheduled airline market across the Tasman in the near future. Also, any new entrant would not have the advantage of being able to enter an unexploited provincial market niche because this is now occupied at least to some extent by Freedom which could rapidly expand into any other cities where it is not presently operating. But the fare structure seems still to show the effects of the period of intense competition, and for that New Zealand and Australian consumers should be thankful for Kiwi International's brief but spectacular foray into the tough business of international air travel services.

References

Areeda, P. and Turner, D. (1975), "Predatory Pricing and Related Practices under Section 2 of the Sherman Act", *Harvard Law Review*, Vol. 88, pp697-733.

Australian Department of Transport and Regional Development, *Air Transport Statistics, International Scheduled Air Transport*, 1993, 1994, 1995, 1996, Canberra

Baumol, W. (1979), "Quasi-Permanence of Price Reductions: A policy for Prevention of Predatory Pricing", *The Yale Law Journal*, Vol. 89, No. 1, November 1979, pp 1-26

Baumol, W.(1996), "Predation and the Logic of the Average Variable Cost Test", *Journal of Law and Economics*, pp49-72

Borenstein, S. (1989), "Hubs and high fares: dominance and market power in the US airline industry", *Rand Journal of Economics*, Vol. 20, No.3, pp344-365

Borenstein, S. (1992), "The Evolution Of US Airline Competition", *Journal of Economic Perspectives*, Vol. 6, No. 2, Spring 1992

Brander, James A. and Anming Zhang (1990), "Market conduct in the airline industry: an empirical investigation", *Rand Journal of Economics,* Vol.20, No. 4, pp567-583.

Brueckner, J. and Spiller, P. (1994), "Economies of Traffic Density in the Deregualted Airline Industry", *Journal of Law and Economics*, Vol. 37, pp379-415

Bureau of Competition Policy(1992), *Predatory Pricing Enforcement Guidelines*, Consumer and Corporate Affairs, Ottawa

Bureau of Transport and Communications Economics(1996), *Code Sharing in International Aviation: A Discussion Paper*, Working Paper 21, Australian Government Publishing Service, Canberra

Bureau of Transport and Communications Economics(1995), *Demand Elasticities for Air Travel to and from Australia*, Working Paper 20, Australian Government Publishing Service, Canberra

Bureau of Transport and Communications Economics(1994), *International Aviation*, BTCE Report 86, Australian Government Publishing Service, Canberra

Caves, D., Christensen, L. and Tretheway, M. (1984), "Economies of density versus economies of scale: why trunk and local service airline costs differ", *Rand Journal of Economics*, Vol.

15, No.4, pp471-489

Commerce Commission(1997), *Termination Report: Kiwi International Airlines/ Air NZ*, Wellington

Dresner, Martin, Jiun-Sheng Chris Lin and Robert Windle (1996), 'The Impact of Low-Cost Carriers on Airport and Route Competition, *Journal of Transport Economics and Policy*, September 1996

Easterbrook, F. (1981), "Predatory Strategies and Counterstrategies", *The University of Chicago Law Review*, Vol. 48, pp263-337

Hurdle G. , Johnson R., Joskow, A., Werden, G. and Williams, M. (1989), "Concentration, Potential Entry , and Performance in the Airline Industry", *Journal of Industrial Economics*, Vol. 38, No. 2, pp199-139.

Ippolito, R. (1981), " Estimating Airline Demand with Quality of Service Variables", *Journal of Transport Economics and Policy*, pp 7-13

Joskow, P. and Klevorick, A. (1979), "A Framework for Analyzing Predatory Pricing Policy", *The Yale Law Journal*, Vol. 89, No.2, pp 213-270

Lefever, T. (1981), Predatory Pricing Rules: A Comment on Williamson's Output Restriction Rule, *The Yale Law Journal*, Vol. 90, pp1639-1645

Milgrom, P. and Roberts, J. (1982), "Predation, reputation and Entry Deterrence", Journal of Economic Theory, Vol. 27, pp284-285

McGee, J. (1980), "Predatory Pricing Revisited", *Journal of Law and Economics*, pp 290-330

Muysert, P. (1995), "Airline Deregulation and Liberalisation: The Experience of the 80's", *University of Auckland Research Essay*

O'Connor, W. (1995), *An Introduction to Airline Economics*, 5th ed., Praeger, CT, USA

OECD(1989), *Predatory Pricing,* OECD, Paris

Oum, T. and Gillen, D. (1983), "The Structure of Intercity Travel Demands in Canada: Theory, Tests and Empirical Results", *Transportation Research*, pp 175-191

Oum, T., Gillen, D. and Noble, S. (1986), "Demands for Fareclasses and Pricing in Airline Markets", *Logistics and Transportation Review*, Vol. 22, No. 3, pp195-217

Oum, T., Park and Zhang, A. (1996), " The Effects of Airline Codesharing agreements on Firm Conduct and International Air Fares", *Journal of Transport Economics and Policy*, pp187-202

Oum, T., Waters, W. and Yong, J. (1992), "Concepts of Price Elasticities of Transport Demand and Recent Empirical Estimates", *Journal of Transport Economics and Policy*, pp139-153

Tretheway , M. And Oum, T. (1992), *Airline Economics: Foundations for Strategy and Policy*, The Center for Transportation Studies, University of British Columbia, Vancouver

Van Roy, Y. (1991), *New Zealand Competition Laws*

Williams, G. (1994), *The Airline Industry and the Impact of Deregulation Revised Edition*, Ashgate Publishing, Vermont, USA

Williamson, O. (1977), "Predatory Pricing: A Strategic and Welfare Analysis", Vol. 87, pp284-340

Williamson, O. (1981), "Reply to Lefever", *The Yale Law Journal*, Vol. 90, pp1646-1649

Wilson E. (1996), *Dogfight,* Howling at the Moon Productions, Auckland

Windle, R. (1991), "The World's Airlines, a Cost and Productivity Comparison", *Journal of Transport Economics and Policy*, pp31-49

Appendix 1: The Trans-Tasman Market in 1996

Airline	No. of Flights	Passengers Carried	Seats Available	Load Factor	Market Share
Air New Zealand	5512	846384	1384921	61%	32%
Ansett Australia	216	13154	20612	64%	0.5%
Eva Air	306	15464	74458	21%	1%
Freedom Air	960	73069	123248	59%	3%
Kiwi International	421	69383	89469	78%	3%
Qantas	3171	705208	1020524	69%	26%
Thai International	306	29957	115212	26%	1%
United	728	110137	305760	36%	4%
Trans-Tasman Code Share	4105	800407	1040562	77%	30%
Total		2663163	4174766	64%	100%
Air New Zealand Total (Est)	7565	1246588	1905202	65%	47%
Qantas Total (Est)	5223	1105411	1540805	72%	42%

Source: Based on data extracted from Australian Department of Transport(1996).

Appendix 2: Survey of Demand and Costs in the Airline Industry

Air travel is a glamorous and complex business, and it has been extensively studied by econometricians and others. This Appendix surveys studies of demand and cost conditions in the industry. The demand studies serve to constrain our estimate of the elasticity of demand for trans-Tasman travel in the model developed above; the cost studies inform our split of costs between fixed and variable.

1. The Determinants of Demand for Airline Services

The main determinants of the demand for airline services are airfare, income, the quality of air transport service that is offered and the convenience and price of alternative modes of transport or substitutes for transport — for example, communications technology. The quality of air service can be further broken down into factors such as travel time, convenience of service times , service frequency, distance, airlines network coverage, airline service information, in-flight amenities, and airline safety record (BTCE, 1994, Tretheway and Oum, 1992).

For leisure travellers price and income are both very important determinants of demand while for business travellers frequency of service is particularly important (BTCE, 1994). Leisure travel demand is very sensitive to both price and income because it is discretionary spending, and there are many other goods and services which compete for a share of the consumers discretionary budget (BTCE, 1995). The demand of business travellers will not be so responsive to airfares if they value their time more than leisure travellers and therefore their total travel costs (including time and airfare) rise by less for a given rise in the airfare than a leisure traveller's. Furthermore, any price increase will be absorbed by the firm and not the travelling individual.

Frequency, on the other hand, is relatively more important for the business traveller because while they require flight times to fit in with their changing business arrangements, eg meeting times. (BTCE, 1994), the leisure traveller is travelling on personal time and therefore is likely to be not so concerned about maximising time productivity (Tretheway and Oum, 1992). Evidence for this proposition is provided by Tretheway and Oum (1992) who cite Morrison and Winston's (1986) finding that a doubling of the frequency of air service could lead to a 21% increase in demand by

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business travellers but only a 5% increase in leisure demand.

The differing impact of these factors on the demand by various groups has led to market segmentation by the airlines which offer discount fares with restrictive conditions attached (advance booking and purchase, no date changes and minimum stay), as well as full fare tickets that allow complete flexibility, eg last minute time and date changes at no penalty. The discount fares are designed to attract price sensitive leisure travellers, who would not otherwise travel and who are prepared to make commitments well into the future in an exchange for a lower airfare. The restrictive conditions are put in place to discourage business travellers, who may value flexibility, from substituting away from the full fare ticket.

Surveys of the literature by the BTCE (1995) and Oum, Waters and Yong (1992) support the theoretical expectation that leisure travel demand is more responsive to changes in airfares than business travel demand. Oum *et al* survey 13 studies and find that for leisure travel elasticity estimates range between -0.4 and -4.6 with most estimates being larger in absolute value than -1 while business travel elasticity estimates range from -0.65 to -1.15. BTCE surveyed 4 studies of the elasticity of demand for air travel to and from Australia, and added their own estimates. They regressed leisure demand on real airfare, real exchange rate, real income and lagged demand, and business demand on airfare, exchange rate and Australian and foreign GDP. The table summarises the results for travel between Australia and New Zealand:

Table: Price elasticity estimates for Trans-Tasman Travel

Study	Market Segment	Price Elasticity
BTCE(1988)	New Zealand leisure visitors	-1.33
	New Zealand business visitors	-0.56
Poole(1988)	New Zealand leisure visitors	-1.5
	New Zealand business visitors	-0.7
Hollander(1982)	New Zealand leisure visitors	-0.95
BTE(1978)	New Zealand leisure visitors	-1.2
BTCE(1995)	Australian residents: leisure travel	-0.23

	Australian residents: business travel	-0.34
	New Zealand residents: leisure travel	-0.68
	New Zealand residents: business travel	-0.16

Source: Data extracted from BTCE(1995) Tables 4.1 and 6.1-6.4

These results generally, though not unanimously, suggest lower business than leisure demand elasticities for travel across the Tasman, with numbers smaller than those usually estimated for longer routes. This is in accordance with the general pattern that price elasticity decreases with route distance because airfares are lower on short distance routes and therefore a given percentage change in airfare changes total journey cost by a smaller amount on short routes than on long routes (BTCE, 1995). Thus the BTCE's price elasticity estimates for leisure travel between the UK and Australia are -1.79 and -1.14 for UK and Australian residents respectively.

Another factor to consider in modelling demand is that price elasticity varies according to fare class. Oum, Gillen and Noble (1986) use cross sectional data for 200 US intercity routes in the USA in 1978 to obtain own price elasticity and cross-price elasticity estimates for three broad fare classes, first , standard economy and discount. Their results reveal that the demand becomes more inelastic as the quality of the class increases. Thus the demand for first class seats is price inelastic, varying from -0.58 (Philadelphia-Cincinnati) to -0.83 (LA-NY), whereas discount travel demand was elastic ranging from -1.55 to -2.01. The results also show that while the cross elasticity of standard economy demand with respect to the price of discount fares is positive, indicating that standard economy and discount fares are substitutes, this figure was low compared to the own price elasticity for discount fares. This is evidence for the proposition that while offering discount fares will result in some substitution from standard economy to discount fares, the overall result will be a substantial increase in traffic.

2.The costs of airline operation

The business of flying airplanes for profit is complex and unique. We survey here evidence on the basic structure of costs, on economies of scale and density, and the economics of code-sharing alliances. We do not go into the economics of hub-and-spoke networks, which are not particularly

relevant to the trans-Tasman situation.

(a) **The structure of costs**

The International Civil Aviation Organisation (ICAO) divides airline costs into operating and non-operating costs. In general, non-operating costs do not affect short run decisions of the airline, although they will impact on performance in the long run (BTCE, 1994). Operating expenses are in turn divided into direct operating expenses and indirect operating expenses. The former are those expenses very closely related to flying the aircraft, such as fuel and crew wages, while the indirect operating expenses are those associated with activities associated with flying, including terminal and ground expenses (ticketing, landing charges, handling and servicing of the aircraft at the airport), and overheads such as management and personnel functions (BTCE (1994), O'Connor (1995)).

Two items that make up a significant proportion of overall costs are fuel and labour expenses. The development of more fuel efficient technology and this combined with lower real fuel prices and more fuel efficient practices by airlines meant that by 1992 fuel expenses had fallen to 12.4% of total operating expenses for world airlines (BTCE, 1994). However fuel still remains a significant cost item and directly affects unit operating costs and short run airline decisions as evidenced by the price increase of $30 in all fares for flights between New Zealand and the East Coast of Australia in December 1996, which was justified on the grounds of increasing fuel costs by the airlines. Labour expenses are also a large component of airline expenses with labour costs accounting for 19% , 34% and 36% of total costs in 1990 for Far Eastern, US and European airlines respectively (BTCE, 1994). They are also an important factor in determining unit cost differentials across airlines (Windle, 1991).

(b) Costs and scale

Although simple regressions of total airline costs on some measure of output have not revealed any evidence of scale economies in the airline industry (Borenstein, 1992), a closer examination of the production process reveals several potential sources of cost advantage associated with size. Variables to consider include load factor, stage length, aircraft size, fleet size and composition, traffic density, and network size and type. The following discussion will outline why and how these factors are important and also whether they confer any advantage on a larger operator.

(i) Load factors

The basic unit of output of airline passenger services is the available seat kilometre (ASK) which

is equal to the number of seats multiplied by the distanced flown The load factor of an airline is equal to revenue passenger kilometres (RPK) divided by ASK (O'Connor, 1995). By increasing the load factor an airline can decrease its costs per passenger kilometre. This is an example of economies of density and is a potential source of advantage of size because a big airline has a large fleet and is therefore in a better position to assign aircraft optimally across routes in order to ensure that load factors are maximised as demand fluctuates.

(ii) Stage length

Another important consideration is stage length -- that is, the distance flown between take-off and landing. The fixed cost of passenger processing at terminals, the heavy fuel consumption at take-off and landing, and landing fees can all be spread over more passenger kilometres on long haul routes (O'Connor, 1995). Furthermore on short haul routes cost is higher because average aircraft speed is lower, which means there are more crew hours per passenger kilometre..

(iii) Aircraft Size, Fleet Size and Composition

Aircraft size is important as costs per available seat kilometre decline as the size of the aircraft increases, assuming the aircraft is being flown over a distance for which it was designed. A 64 seat F28-3000 has a cost per ASK of 12.4 cents, whilst a B747-200 operates at less than half this -- 5.7 cents per ASK.

Fleet size has been found not to have a large influence on unit costs (BTCE, 1994), but composition of the fleet could be important. The BTCE suggest there could be cost advantages from operating a fleet of identical aircraft, coming from reduced crew training and aircraft maintenance costs.

A large airline may be better able to put together a portfolio of aircraft suitable for different types of routes. A very small operator may only be able to afford a smaller aircraft, which has higher unit costs given the route distance. Furthermore, as the Kiwi case demonstrates, a small airline may have difficulty even obtaining a leased aircraft and may find it impossible if it limits its choice of aircraft to what it considers to be optimal for the route length. The limited choice of aircraft available to a start up operator will also mean that it will find it difficult to have an identical fleet of aircraft even if this is seen as desirable.

(iv) Traffic Density

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Traffic density -- the number of passengers traveling on a route -- is another important determinant of costs. Economies of density occur if unit costs decline as airlines add flights or seats on existing flights, eg through larger aircraft, with no change in load factor, stage length or the number of points served (Caves *et al*, 1984).This is distinct from returns to scale which is the variation in unit costs with respect to proportional changes in both network size and transport services. Muysert (1995), citing Hurdle *et al* (1989) suggests that this distinction is "contrived" in the sense that increasing density, arising from larger aircraft and frequency of flights, which reduces unit costs, is in fact an economy of scale. This is true in the sense that greater output is leading to reduced unit costs, but there is still a valid distinction because if economies of density exist, it is not greater total firm output that is contributing to lower unit costs but more output for a given network size. Theoretically, economies of density should arise because high density allows an airline to use larger more efficient aircraft (Brueckner and Spiller, 1994).

Caves *et al*, Windle, and Brueckner and Spiller all find significant economies of density in the airline industry. Furthermore both Caves and Windle highlight that while significant returns to density exist, returns to scale as defined above do not. Using data for 15 US airlines for the period from 1970 until 1981 Caves *et al*. found that, holding other factors such as points served, stage length, load factor and input prices constant, an increase in output of 1% led to only an 0.8% increase in cost which indicates increasing returns to density, ie as the number of passengers within a given network size rises unit costs fall. On the other hand they could not reject the hypothesis of constant returns to scale, such that a simultaneous 1% increase in both output and points served leads to a 1% increase in cost.

Windle, while investigating the sources of unit cost differentials between airlines from various regions, found that labour costs along with density were the most important factors in explaining cost differences. For example higher US traffic density resulted in US airlines having 22% lower unit costs than Non-US airlines .

Brueckner and Spiller also produce evidence for economies of density by finding that the number of passengers is correlated with lower fares, which is consistent with the notion that greater passenger numbers are reducing the airlines costs, which are being passed on at least in part in lower fares. In order to determine the effect of density on costs and therefore what proportion of costs were being passed on as fare decreases, the authors went on to estimate an equation for marginal cost. They

found that marginal cost falls by approximately 3.75% for every 10% increase in spoke traffic, which is a stronger density effect than found by Caves *et al*, whose results indicate that the marginal cost elasticity is -0.2 , ie that marginal cost falls by 2% for every 10% increase in traffic.

The above papers suggest that it is density and not size in terms of total number of passengers carried and points served that is the more important determinant of unit costs for airlines. While adding more traffic to an existing route means that there are more passengers to spread fixed costs over, thereby reducing the average cost per passenger, adding a new route will increase fixed costs such as ticketing and counter facilities, advertising etc. This increase in fixed costs could offset any effect on unit costs of extra traffic resulting from adding a new destination to the airlines network (BTCE, 1994).

(c) Code-sharing alliances

Code sharing (Williams, 1984) is where an airline uses its own designator code -- eg the Qantas code is QF -- on a flight operated by another airline. This practice was used until recently by Qantas and Air New Zealand in the Trans-Tasman market and is therefore relevant to considering supply in this market.

Code sharing can take different forms. Firstly it can involve an airline buying a block of seats on the flight of another and then marketing this block of seats separately. This type of arrangement is often used where traffic on a route is thin and can only support a few flights per week by a single operator, an example is the Qantas-Solomon Airlines code share agreement under which Qantas is entitled to purchase 50% of the seats on Solomon Airlines flights between Australia and the Solomon Islands. Code sharing can also be used to extend a service beyond the point at which the airline's own service operate -- for example, Qantas provides services from Australia to New York by operating its own aircraft to Los Angeles and then has a code share arrangement with American Airlines from Los Angeles to New York.

From a supply-side perspective code sharing is an important feature of the airline industry to consider because of its potential to lower unit costs by creating economies of scope and density. There are potential economies of scope because it allows an airline to expand the number of points it serves without having to expand their operation to accommodate these new markets. For example, by allowing an airline to gain a presence on a route without having to operate its own aircraft on that route the code

share will increase the load factor of the flights on which the airline sells seats and therefore decrease the cost per passenger (BTCE, 1996).

There are also potential economies of density because code sharing could increase the traffic on an airline's routes (BTCE, 1996). If the code sharing airlines split the length of a route and each flies part of it, they will carry all the passengers attracted by both airlines on the leg of the journey for which they are operating an aircraft. In effect, each airline will be operating shorter but higher density routes. Another source of increased traffic could be from new traffic attracted to an existing route because the code share allows the airline to offer a service to a point beyond where its own aircraft's operation terminates .

Indirect evidence of the competitive strength that code sharing can confer on an airline is provided by Oum, Park and Zhang (1996). In an investigation of the effect of code sharing by non-leader carriers on the price and quantity of the leader, they found that code sharing by non leaders decreased the slope of the leaders supply function which suggests that code sharing may have increased the competitive strength of the participants forcing the leader to behave more competitively.