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Some Speculations and Empirical Evidence on the Oligopolistic Behaviour of Competing Low-Cost Airlines

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This paper reviews the theory of cost recovery and oligopoly with a view to advancing some judgements as to the way in which European low cost airlines manage yield, depending upon the market morphology that applies. It would appear that operators offering a scheduled service to a destination not served by competitors at either the departure airport itself, or at adjacent airports, are in a monopoly position. This is especially the case if the potential competition is limited by the costs of entry or some other barrier. In these circumstances, it is expected that the way the airline manages yield is to limit the prospect of new entry, but, at the same time, to generate sufficient surplus to assist in cross-subsidising any route it serves that is subject to competition. Routes with more than one operator in direct (at the same airport) competition or indirect (at an adjacent airport) competition will manage their yield in a manner that is traditional for their sector of the industry, but where this will be affected by the yield management process of the competitors. This paper draws on evidence of airline price setting when they are in direct competition. It would seem that there is evidence of price leadership and more generally of a strong correlation between the fares of the differentiated product that the airlines offer in competition.

1 Introduction

This paper is concerned with the full cost recovery by airlines through the management of yield in differing competitive environments. Airlines that have no direct, or indirect, competition can in unregulated markets generate surpluses above average variable cost to contribute, in part, or in full, to average total costs as they exploit monopoly power. Where barriers to entry break down, or the market is in certain respects contestable, the airline has less freedom in its pricing strategy, and if the competition is actual, then the market may well be diminished for all participating carriers, despite their differentiated products.¹ Full cost recovery may not be possible

¹ Schnell (2004) offers a study of some of the barriers to market entry that still exist in markets that have been outwardly deregulated.

and the recourse to other sources of revenue, such a cross-subsidy from monopoly routes, may well be important.

The recent financial performance of many airlines in a variety of different markets around the world indicate that their abilities to generate sufficient revenues to recover full costs have been diminished. The main exceptions are a number of low-cost carriers, such as Southwest in the US market and Ryanair in Europe, that have consistently been profitable. There have been a succession of studies looking at the interactions between this type of operator and the established airlines, and in particular at the “Southwest Effect” (Vowles, 2001) in the US, but little situations where low cost carriers compete with each other.

In the short term numerous studies have pointed to the comparative advantage of the low-cost carriers in current market conditions. The longer-term questions are whether this is purely a matter of good management practices on the part of these carriers in the prevailing market context, or whether the generic model of the low cost carrier is superior to the “legacy” carriers, and from a market stability perspective, whether if the lost-cost carrier model is stable it is going to prove robust in the future. It is difficult to conduct a full empirical analysis of these subjects, but some insights, set within the context of the theory of the firm, can be drawn.

2 Pricing and Cost Recovery

The low cost airline model is not new but has evolved over forty years and is rapidly becoming the dominant management model for short-haul services. Alamdari and Fagan (2005) discuss the impact on the profitability of low cost carriers from their differing adherence to the principles first adopted by the US domestic carrier,

Southwest airlines. Starting from first principles, however, if price is set at marginal cost when average costs are decreasing then full cost recovery will not occur and in the long run, on the assumption investors are rational, the firm will cease trading. Although revenues may be sufficient to cover variable costs, not all fixed costs can be covered.

This scenario, which in its modern form was first presented by Coase (1946), is more likely to apply to a carrier when there is some form of competition on a particular route². When a monopoly position is held, yield management will allow the airline to charge some consumers more than marginal cost for their flight, so that all costs can be recovered and perhaps a monopoly profit gained (Hanlon, 1994). When a duopoly or oligopoly is the situation, the market is fragmented; demand and average revenues to each participating airline are reduced and price is less likely to cover costs unless costs are reduced. The ability of the airline in such competition to manage yield so that some consumers pay more than marginal cost is lessened. In this case, revenues may be augmented by cross-subsidy from other monopoly routes and from other income sources such as the sale of on board food and drink; car parking and hotel booking revenues.³

Rather than the usual and traditional 'U'- shaped cost curve analysis, it is worth following Hanlon (1994) who supposes that marginal cost is horizontal up to full capacity where no consumer surplus is available if the airline is practising perfect price discrimination (or something like it) and then becomes vertical to reflect airline

² Baumol, et al, (1988) discuss economic sustainability when there is contestability.

³ Issues may be raised as to whether the resulting profitability is a useful guide to the allocation of resources and, if price is to be set equal to marginal cost, problems of measurement may arise.

costs to put on an extra flight. This implies that average cost and average variable cost are also horizontal and pricing below marginal cost would raise similar issues to those discussed above. Hanlon demonstrates how yield management enables some passengers to pay less than the profit-maximizing price, whilst others pay between this and marginal cost.

It seems probable that this cost analysis is more appropriate to the scheduled flights of low cost carriers than the traditional analysis, but the same issue of not covering costs with competition arises.

The nature of these fixed and variable costs are shown in Doganis (2002) where it appears that airline practice supports the arguments from the perspective of pricing and cost recovery theory. Doganis shows that variable direct operating costs such as fuel costs, variable flight and cabin crew costs, airport and en-route charges and passenger service costs, such as handling fees paid to concessionaires, depend on the type of aircraft used and the route being flown. These would be avoided if a flight were cancelled, along with some portion of averaged out engineering and maintenance costs that in aggregate amount to something like 30-45 percent of total operating costs. Fixed direct operating costs cover depreciation and any rental charges for leased aircraft and aircraft insurance as well as fixed flight and cabin crew costs. These sum to about 25-30 percent of total costs and are not avoided in the short term if a flight is cancelled. Finally, there are indirect operating costs. Some of these are route specific, which are escapable (about 5-10 percent), and others are not (25-35 percent). These costs include station and ground costs at the destination airport and

sales and advertising costs at that same destination. The allocation of some of these costs can be approached in a variety of ways as shown by Doganis.

The apparent practice of some airlines is to assess whether a particular flight covers its variable costs and route specific indirect operating costs from revenue. If it does not, then its continued operation should be in doubt. Revenues in excess of this, however, can make a contribution to fixed operating costs (as defined by Doganis) and non-specific indirect operating costs. In the short term, therefore, a flight has to contribute a minimum of some 50 percent of total operating costs to cover all marginal costs, leaving 50 percent as fixed costs. In the longer term the fixed costs can be changed by adjusting route networks and fleet size. It seems from a practical point of view that yield management is vital and that the fixed costs of operation are not at all trivial.

3. Competition Analysis

3.1 Oligopoly

A variety of economic models of oligopoly have been advanced, all of which are well known, including those of Cournot, Bertrand and Stackelberg. In addition, there are models of price leadership by either a dominant firm or a lower cost firm or a barometric firm. The correspondence of actual price setting with these models of oligopoly is of interest but difficult to establish empirically. The issue is really not this, however, but how in different market conditions do airlines modify their yield management in an attempt to cover costs. The games that they play, and how they play them and with whom, is a secondary consideration.

3.2 Yield Management

Yield management, is aimed at maximising total flight revenues by making seats that are expected to go unsold available at a lower price to passengers who would otherwise not travel, whilst at the same time ensuring that those lower fares are not purchased by passengers willing to pay more. Technically, it is a form of dynamic price discrimination. Its advent came in the US after the 1978 Airline Deregulation Act removed fare regulation and necessitated airlines to seek ways of recovering full costs in a commercial environment (Levine, 1987; Borenstein and Rose, 1994)). Direct information, on airline net yield per seat is not however for reasons of commercial confidentiality, in the public domain. Only average yield is available. Fare data is though available on airline web sites. Fares are a direct indicator of yield as they are changed broadly in response to the demand for seats⁴.

Low-cost carriers that have emerged in Europe since the mid-1990s have generally introduced a yield management strategy that sees them offer seats at low fares well in advance of the departure date. As the departure date approaches, so the available fares increase, reaching a peak immediately prior to departure if there are seats still available. This simple pricing strategy of one common fare for the whole cabin should make revenue management simpler and the way the fares have a reverse taper over time has recently been copied by more traditional carriers. The question is, is there a modification of this price setting behaviour when demand falls for the seats on an incumbent airline because of the advent of competition? This can be examined by observation and analysis.

⁴ A discussion of standard revenue management practices of traditional airlines is contained in Belobaba (2002), along with an account of how it has evolved over time.

3.3 Data and Methodology

Cases where there is direct competition between low-cost carriers are to-date relatively few in number. At the UK's Nottingham East Midlands Airport (EMA)⁵ in 2003 different low-cost carriers, however, offered service to identical destinations in direct competition with each other. At that time, the incumbent airlines were easyJet and bmibaby⁶. It was decided to monitor fares offered on each of their web sites at midday for 30 consecutive weekdays before departure to destinations that were served by similar frequencies of service. The leisure destinations of Alicante and Malaga in Spain had a Saturday departure, with very close departure times in the case of Alicante, whereas the business destinations of Glasgow and Edinburgh, Scotland, where flight times were within a maximum of 20 minutes of each other in the morning, allowed a return trip to Scotland in the working day. In addition, competing start up services from London Gatwick Airport (LGW) to Prague by the same airlines were examined for 51 weekdays in early 2004.

To examine the relationship between these price series involves the use of ARIMA time series models so that the cross correlation function (CCF) can be determined. First of all Autocorrelation Functions at appropriate lags (ACFs) and Partial Autocorrelation Functions (PACFs) are calculated on stationary data and plotted as a guide to model identification. The models that are produced have the characteristics that their residuals are white noise. It is the correlation between these residuals or pre-whitened series that establishes the CCF and tells us at which lead or lag that it is strongest. The detailed methodology and full results are found in Pitfield (2005).

⁵ This is a medium sized airport located centrally in England that has been a traditional facility for charter services to Europe and as a base for scheduled services offered by BMA. It has a significant catchment area and is on the main North-South Motorway with good road access to the east of England.

⁶ They have since been joined by Ryanair.

3.4 Results

The Malaga fare for EMA services data is shown in Figure 1. The data is first differenced to achieve stationarity and the ACF and PACF suggest an AR(1) model for bmibaby and a MA(1) model for easyJet. Such models produce white noise residuals.

If the raw data is Y_t , then the differenced data is $z_t = Y_t - Y_{t-1}$ and the AR(1) model is

$$z_t = \theta_1 z_{t-1} + a_t \quad (1)$$

and using the backshift operator, B

$$(1 - \theta_1 B) z_t = a_t \quad (2)$$

A MA(1) model is

$$z_t = a_t - \theta_1 a_{t-1} \quad (3)$$

or

$$z_t = (1 - \theta_1 B) a_t \quad (4)$$

For bmibaby, $\theta_1 = -0.413$ (-2.42)⁷ and for easyJet $\theta_1 = -0.291$ (-1.48). The goodness of fit indicators of standard error, Schwartz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) are all acceptable and are reported in Pitfield (2005). The filtered series are subject to a cross correlation function analysis and the results of this are shown in Figure 2.

This shows that easyJet fares lead bmibaby fares by one day with a correlation of 0.452. A price leadership model could be being followed, perhaps that of a low-cost firm, if the initial fares of easyJet reflect costs and undercut bmibaby.

The fare data for Alicante is shown in Figure 3. easyJet's fare remains constant for a large part of the survey period and then rises in two steps prior to departure.

⁷ t statistics are in parenthesis.

bmibaby's fare has not, however, got the expected pattern as it falls twice before rising twice, although not to previous levels, before departure.

Applying ARIMA models to these two fare series results in AR(1) models fitted to the original data series. For bmibaby, $\theta_1 = 0.994$ (109.177) and for easyJet, $\theta_1 = 0.996$ (120.495). The CCF of the filtered series in Figure 4 shows a 0.808 correlation at zero lag with prices following each other but with no lead or lag.

The fares on the Glasgow and Edinburgh routes are shown in Figures 5 and 6. Pitfield (2005) describes the difficulties encountered in modelling these series. Nevertheless, the best models obtained indicate a weak cross correlation between the filtered fare series which is surprising given that it could be argued that these routes should be a good illustration of low-cost competition. The lack of correlation may be because it can be seen from the figures that easyJet manages the yield and sets its fares identically for both Scottish destinations for this survey period.

Finally, the patterns of LGW to Prague fare changes are shown in Figure 7. Models that produce white noise residuals are of the AR(1) form applied to the non-differenced data. The resulting CCF shown in Figure 8 reveals a strong relationship with no lag.

The CCF analysis produces varied results from this sample of routes. For one route out of EMA, that to Malaga, evidence of a price leadership model is provided, with a one day lag in fare setting by the less experienced low-cost airline. A strong contemporaneous correlation is evidenced by the price data for Alicante from EMA as well as from LGW to Prague, whereas relatively weak evidence of correlation is found on the 'business routes' to Scotland from EMA. It seems there is little doubt for these cases that there is some form of correlation in fare setting arising from the competing airlines' simultaneous management of yield. It is likely that this would be repeated with a more extensive analysis and that more cases would be found that might hint at the appropriate price setting model. In addition, of course, in all of these situations, it is less likely that full cost recovery is possible in the presence of competition.

4 Conclusion

Low cost carriers are increasing their shares of virtually all airline markets but there has been little analysis of situations where they compete head-on, and the implications of such competition on their long-term financial viability. Much depends on the broad nature of the strategic games that they do and will play but given our limited experience of these the future remains uncertain. The empirical results here are very restrictive, focusing as they do on a few UK based markets, and they are not conclusive. It seems there is some evidence, though, of correlation of price setting in markets. Where this correlation is simultaneous, it is not easy to speculate on either the nature of the competitive game or how it is being played. Where there is a lag in price setting between the two airlines, a traditional text book explanation can be posited. Price leadership models would seem apposite.

It is clear, however, that, although further more detailed empirical work will be needed to pinpoint the nuances of the situation, the price setting behaviour in the duopolistic markets that are gradually evolving in the supply of low-cost airline services is a threat to the recovery of all fixed costs.

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Figure 1: Fares from EMA to Malaga

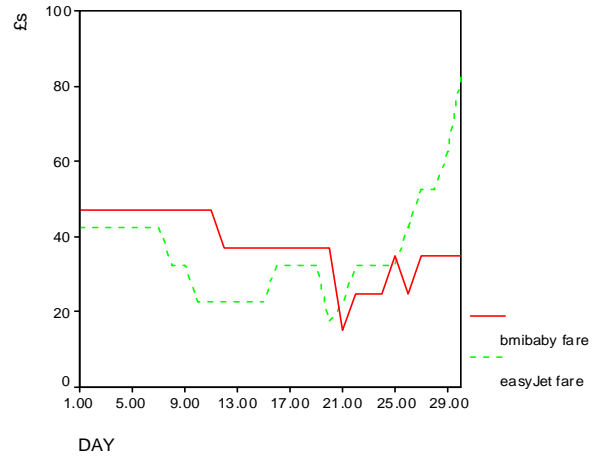


Figure 2: Cross correlation function plot, Malaga

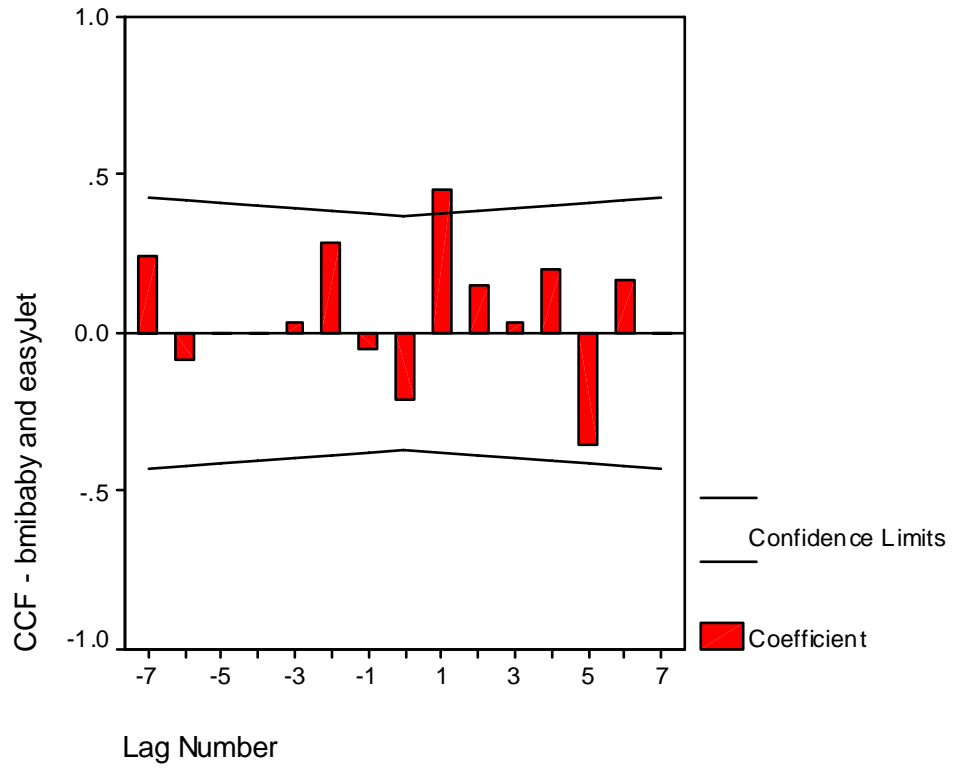


Figure 3: Fares from EMA to Alicante

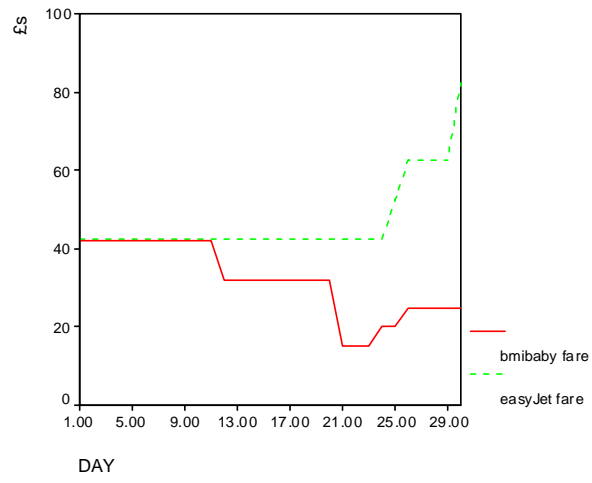


Figure 4: Cross correlation function plot, Alicante

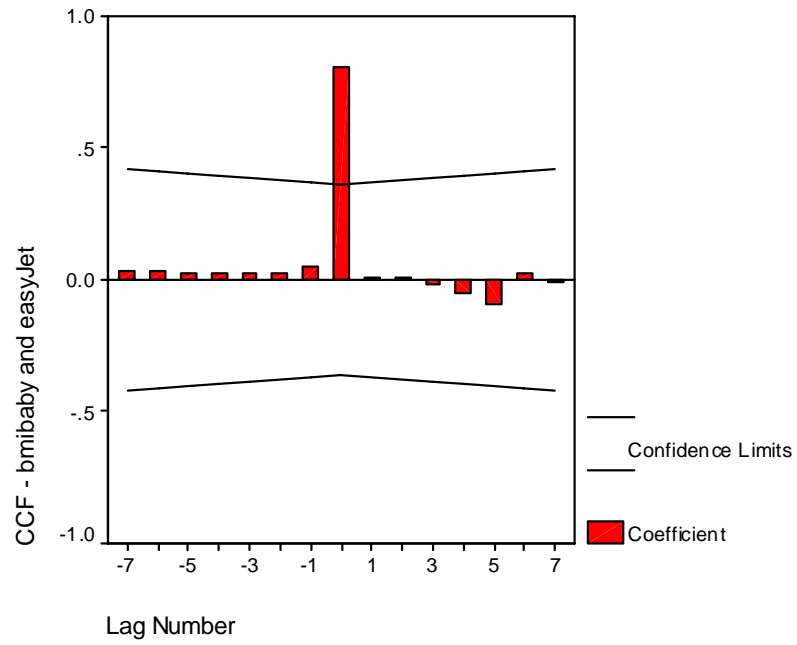


Figure 5: Fares from EMA to Glasgow

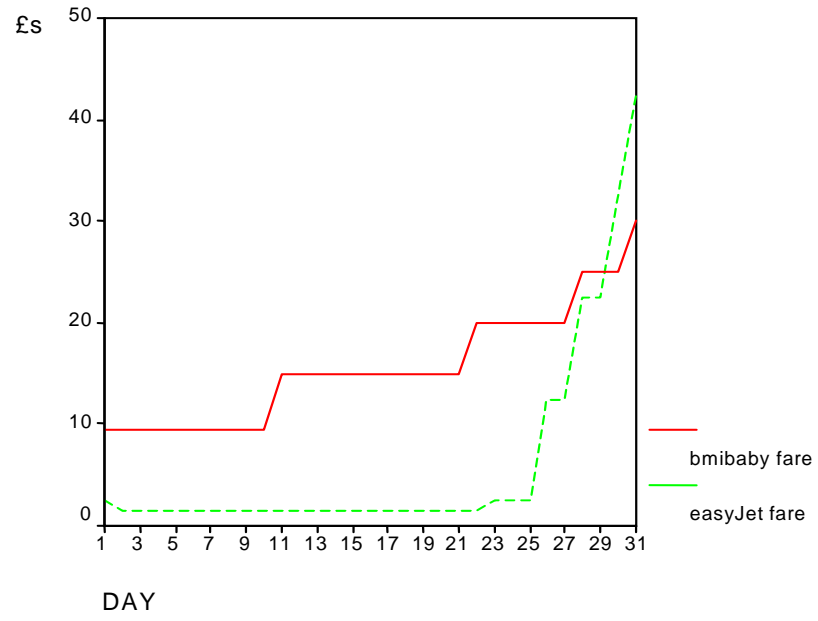


Figure 6: Fares from EMA to Edinburgh

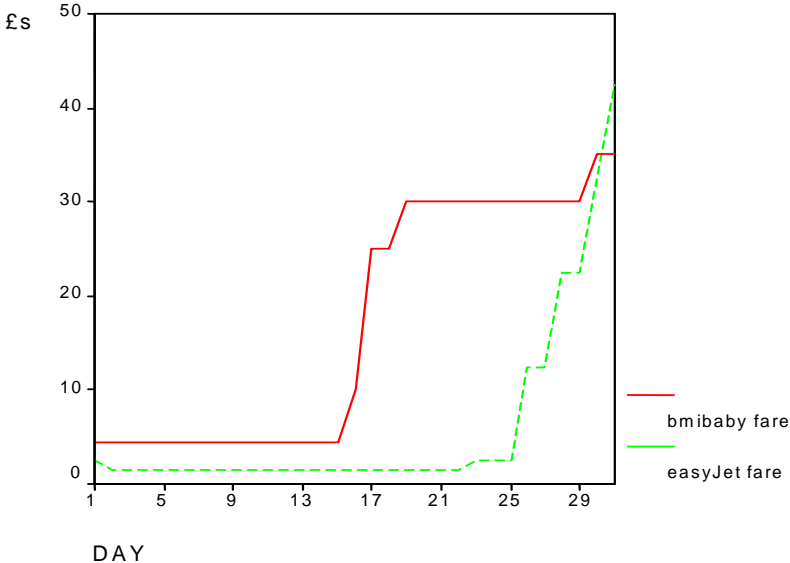


Figure 7: Fares from LGW to Prague

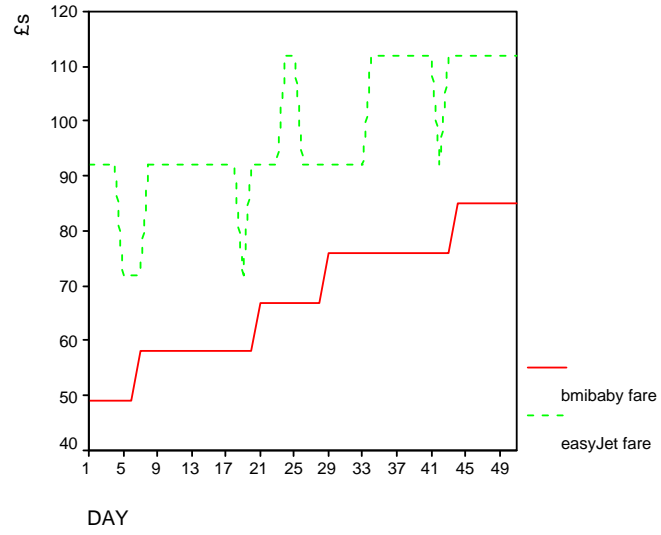


Figure 8: Cross correlation function plot, Prague

