International Transport Forum

Why airports can face price-elastic demands: margins, lumpiness and leveraged passenger losses

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THE INTERNATIONAL TRANSPORT FORUM

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1. INTRODUCTION

The extent to which firms face price-elastic demands for their products is important in the application of competition law and in judgments made as to whether they have significant market power. In the context of the airport industry[1], assessing price-elasticities is complicated by the fact that one major type of consumer of airport services, the air passenger, is not charged directly for use of terminals and airside infrastructure[2]. Instead, the airport derives its revenues from charges to airlines and from the supply of non-aeronautical services. The charges to airlines then become one of many input costs that the airlines recoup from passenger fares, and this intermediation has significant implications for the demand analysis.

How the airline reacts to an increase in airport costs will depend, inter alia, on the financial performance of the route(s) concerned, the type of aircraft used and the fleet mix of the airline. Importantly, there is an interaction between (i) a (potential) loss of passengers if an initial increase in airport prices is reflected in fares charged and (ii) the supply of capacity by airlines in circumstances where the supply of this capacity does not lend itself to continuous adjustment. Consequently, adjustments in lumpy airline capacity in response to a (small) passenger loss can have the effect of leveraging the initial charge elasticity, accentuating the losses of aeronautical and commercial revenues. The indivisibilities or lumpiness in the supply of seats by airlines means that the leveraging effect can be very intense at various aeronautical 'charging points'.[3]

Before considering these matters in detail it is useful first to consider the leveraging effect in a context simpler than that faced in the airline industry, one in which supply is a continuous function of charges; this is considered in the next section. It is followed in the third section by an illustration of how airlines constantly search for returns using yield management processes designed to increase aircraft load factors, revenue yields and thus route operating margins and return on capital employed (ROCE). An airline will operate a portfolio of routes usually from several airports and routes will be ranked in the portfolio according to their ROCE. In the fourth section we consider how an airline will react to an increase in airport charges. It can respond in several ways, but none can avoid a negative impact on operating margins. This will lead to the affected routes cascading down the ROCE ranking, prompting a possible reappraisal of the services. A critical factor in the reappraisal is the constraint imposed by lumpiness or discontinuities in the supply of seats, determined by a production unit (aircraft) of fixed size. This constraint can result in a non-marginal change in route capacity with a similar impact on passenger numbers. The point is illustrated in the fifth section by reference to the

1. In the UK, the 2012 Civil Aviation Act requires that a market power assessment is undertaken before an airport can be subject to economic regulation.

2. This is generally the case in Europe (with a few exceptions), but not necessarily elsewhere in the world.

3. Specifically, at those levels of charge such that a further small increase would lead to a lumpy withdrawal of seat capacity.

reaction of Ryanair to an increase in charges at London-Stansted airport in early 2013. Finally, the concluding section considers the general applicability of the main points.

2. LEVERAGING OF PRICE ELASTICITIES WHEN SUPPLY OF SEATS IS A CONTINUOUS FUNCTION OF CHARGES

Assume that the seat capacity made available by airlines (in aggregate) at a particular airport is K, which is a continuous, decreasing function of the airport's aeronautical charges, denoted by p. That is, $K = K(p)$, where $dK/dp < 0$.

Other things being equal, including air fares, the passenger demand for the services of an airport, say Q, can be expected to be an increasing function of the seat capacity on offer, since a higher available seat capacity will typically be associated with either higher frequencies on routes served, or more routes served, or both.4 Passenger demand will also be a function of air fares on routes served by the airport, which can be represented by y, such that the lower are fares the higher will tend to be the number of passengers wanting to use the airport.

Air fares will in turn depend upon the level of aeronautical charges, which are costs to airlines. In the simplest case an increase in aeronautical charge per passenger will feed through into an equivalent increase in air fares, so that $dy/dp = 1$. Depending on the state of competition in the relevant airlines markets, however, other outcomes are possible.

These considerations lead to a specification of airport passenger demand, for a given level of non-aeronautical services, as:

$$Q = Q(y(p),K(p)).$$

In other words, demand depends on airfares (which in turn depend on the level of aeronautical charges), and on the service frequencies and routes that can be supplied at an airport from a given allocation of seat capacity, which again will be influenced by the level of aeronautical charges.

Consider, then, the effect of an increase in the aeronautical charge at the airport of interest, all other things being held constant, including charges at other airports. The effect on passenger demand for the airport can be obtained by differentiating with respect to p:

$$\frac{dQ}{dp} = \frac{\partial Q}{\partial y}\frac{dy}{dp} + \frac{\partial Q}{\partial K}\frac{dK}{dp}$$

4. Capacity can also be varied by changing the size of aircraft, but, for reasons that are discussed below, this is not likely to be a major feature of adjustments to airline schedules in the short to medium term, and the additional complexities that it introduces can be ignored for current purposes.

Multiplying both sides of this equation by p/Q, we have a 'five elasticities formula':

$$\frac{p}{Q}\frac{dQ}{dp} = \frac{y}{Q}\frac{\partial Q}{\partial y}\frac{p}{y}\frac{dy}{dp} + \frac{K}{Q}\frac{\partial Q}{\partial K}\frac{p}{K}\frac{dK}{dp}$$

or

$$\boldsymbol{TEQ_p = ED_y\, EY_p + ED_K\, EK_p}$$

where,

TEQp is the total elasticity of airport passenger demand with respect to aeronautical charges, taking account of both price and quantity/capacity adjustments by airlines,

EDy is the passenger elasticity of demand with respect to airfares charged by airlines serving the relevant airport, for given service levels,

EYp is the elasticity of airfaresw with respect to aeronautical charges, reflecting the degree of pass-through of those charges and their significance as a determinant of relevant airline costs,

EDK is the elasticity of passenger demand with respect to the airline seat capacity available at the airport (encompassing the number of routes that are served and the frequencies of flights on those routes), and

EKp is the elasticity of airline seat capacity made available at the airport with respect to aeronautical charges.

That is, in words, the total elasticity of airport passenger numbers with respect to aeronautical charges is equal to (a) the product of the (airport) elasticity of passenger demand with respect to airfares and the elasticity of airfares with respect to aeronautical charges, plus (b) the product of the (airport) elasticity of passenger demand with respect to seat capacity and the (airport) elasticity of supply of seat capacity.

The leveraging that we are interested in occurs as a result of the term $ED_K\, EK_p$ in this equation. It is to be expected that the demand elasticity with respect to seat capacity will be a significant number since, if an airport does not serve the routes that passengers want to fly at frequencies that are convenient for passengers, they will likely turn elsewhere. The term of most empirical interest is, therefore, the elasticity of supply of seat capacity, and it is to this that we now turn.

3. A CONSTANT SEARCH FOR RETURNS

Figure 1 is taken from an easyJet presentation to investment analysts in 2008[5] and shows, for the Gatwick-Malaga route, on which easyJet was in competition with BA, the fare at which a seat was offered for sale by the number of days before departure. In 2008, easyJet's entry fare was about £25, offered three months before the departure date. The fare offer increased (not quite monotonically) towards departure, at first steadily but finally more rapidly (to over £100). BA's fare offerings follow a similar pattern, but generally at a higher level, and with a more pronounced increase in the couple of weeks before departure.

This process of managing the fare yield, a so-called Low-High pricing strategy, is a process that might be expected to lead overall, for any particular service, to a (large) number of marginal purchases because there is not one product but many, each selling at a different price and at each price one might expect a purchase at or reasonably close to the margin[6]. It is a form of price discrimination[7] that is designed to maximise asset utilisation by maximising an aircraft's load factor and revenue yield, and thus, for any particular route, increasing its profitability or ROCE[8].

A profile of the returns, route-by-route, across the whole of the easyJet network in the financial year 2012 is shown in Figure 2[9]. It distinguishes routes established for more than 3 years from more recent routes and benchmarks each in relation to a 12 per cent ROCE. An overall pattern that distinguishes returns of longer-established routes from those established more recently is not immediately apparent in the data[10]. A number, perhaps around 20 per cent, of routes have returns well in excess of the 12 per cent benchmark, but the returns for about half the routes fall below this benchmark. There is a number, albeit very small, of routes with negative returns.

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5. http://corporate.easyjet.com/~/media/Files/E/Easyjet-Plc-V2/pdf/investors/presentations/analyst_and_investor_day_2008.pdf. Accessed 06.12.13

6. The purchaser at any particular offer-price is forgoing slightly different products (a seat purchased a day earlier or a day later) each offered at a small price difference.

7. See C Alves and C Barbot (2009). The paper finds that the existence of different probabilities of consuming the good and of different willingness to pay makes it possible to separate markets in time and to profitably price discriminate.

8. It is a constrained maximisation problem. Capacity supplied to the market is predetermined by the aircraft type; seats are offered at different prices (differentiated by time of booking) with the aim of maximising revenues which is achieved by maximising load factors.

9. http://corporate.easyjet.com/~/media/Files/E/Easyjet-Plc-V2/pdf/investors/results-centre/2013/2013-q1-roadshow-presentation.pdf. Accessed 14.11.13.

10. This suggests that new routes can establish themselves quickly but equally that mature routes too can be marginal. CE/SEO data (Copenhagen Economics, 2012) indicates that 15 per cent of 4 year old routes operated by LCCs were closed during the period 2002-2011 and 13 per cent of 5 year old routes, underlining the extent to which LCCs are willing to call into question well established routes in the constant search for higher returns.

An interesting and highly relevant feature of the curve shown in Figure 2 is that a large number of routes in the airlines' network are of relatively similar profitability (since the results are shown for one year, the curve may be flatter still over a two or three year period). This suggests that, if operating from a particular airport becomes more costly, routes from that airport may move many places to the right in the ranking of profitability shown in Figure 2. The flat profile implies, therefore, that small changes in relatively profitability can lead to significant changes in route structure.

The curve also illustrates the importance of assessing effects at the margin. A significant number of routes are highly profitable, and will be retained even if there are substantial changes in the relevant airport charges. These routes, because they are so profitable, serve to raise the average ROCE for routes as a whole. What matters, however, is the flatness of the curve at the margin, i.e. the part of the curve close to the ROCE level at which routes will be considered candidates for withdrawal of services.

Although the above picture reflects the whole of easyJet's route network, its basic features are likely be replicated for each of its operating bases; some routes from a particular base will perform better than others and a base's portfolio of routes might have a route-return profile that lies towards the left hand side of Figure 2, or it might have a profile more to the right, the latter signifying underperformance relative to other airports. It is also a picture based on one particular low cost carrier's data, but it is probable that it is representative of the situation faced by other low cost airlines, and indeed by airlines in general. LCCs and full-service carriers (FSCs) now compete more actively than in the past, especially in the context of the single European market (see again Figure 1), and all have to be sharply focussed on returns at the margin if they are to be successful.

4. AIRLINE REACTIONS TO AN INCREASE IN AIRPORT CHARGES

If an airport increases its charges, an airline has to assess the impact of the higher costs across its portfolio of services from that airport. To the extent that the cost increase is passed through to the passenger, the effect will be to increase, i.e. to shift upwards, the offer curves shown in Figure 1. As a result, there will be a negative impact on passenger demand and consequently on load factors: average seat yields will be reduced thus reducing operating margins. If, alternatively, the airline's initial reaction is to absorb (rather than to pass-on) the increase, this will also adversely affect operating margins and (consequently) the profitability ranking of each of the relevant routes within the overall route portfolio. If we imagine a profile for the portfolio such as that in Figure 2, the effect will be to push the ROCE of each of the affected routes downwards, making more routes at the relevant airport marginal and further weakening the performances of those already marginal. Moreover, at existing service levels, the airport itself will have become relatively more marginal to the airline in terms of its contribution to overall airline profits.

The airline might respond to this by looking to reduce the seat capacity it provides from the airport with a view to re-establishing acceptable operating margins in line with the benchmark ROCE. It can potentially reduce capacity in two, principal ways:

(a) reducing service frequencies (but holding aircraft size constant), including reducing frequency to zero (i.e. withdrawing the route), and then re-allocating capacity to other routes or reducing fleet capacity, and

(b) reducing the size of the aircraft used on particular routes (holding service frequencies constant).

In practice and particularly for LCCs, the latter response will be often be constrained by the airlines fleet mix and commitments of aircraft to other routes. Airlines with aircraft fleets made up of fairly homogeneous aircraft types cannot easily adjust the size of production unit (the size of aircraft) in order to re-establish margins; they do not have a continuous, smooth supply function, but one that is lumpy and discontinuous. Consequently, faced with such constraints on the supply side, output adjustments tend to take place by cutting route frequencies, cutting entire routes and, in some cases, by closing operating bases.

Any reduction in seat capacity made by cutting service levels (i.e. reducing flight frequencies, withdrawing routes) will in turn affect the level of passenger demand. A more infrequent service (that is, a lower quality of service) will have the effect of shifting the demand curve for a particular route downwards to the left; there will be a fall in the level of demand. This will occur irrespective of any change in the quantity demanded should the airline choose to increase fares in response to an increase in airport charges. An initial price elasticity effect, therefore, is effectively leveraged through a combination of downward adjustments in the supply of lumpy capacity, and the reaction of passengers to the resulting deterioration in the quality of service provided (see Figure 3).

5. LEVERAGING: AN ILLUSTRATION

That leverage does take place in the manner described can be illustrated by some calculations based on (a) numbers cited in the context of the UK CAA's February 2013 London-Stansted Market Power Assessment (MPA), (b) an increase in charges by Stansted Airport Limited in April 2013, and (c) the reaction of Ryanair (much the largest user of the airport) to this charges increase. For its assessment the CAA set out to calculate a charges elasticity of demand for Stansted by considering general estimates of aviation elasticities and estimates based on various approaches specific to the airport. Its conclusions were that the appropriate elasticity, which appears to correspond with the first term on the right hand side of the five-elasticities formula above, fell within a fairly wide range from -0.2 to -0.6.

Soon after these estimates were published, the airport announced increases in aeronautical charges of about 6 per cent[11]. On the basis of a charges elasticity of about -0.5 (towards the top end of the CAA's calculated range) and a then current passenger base of approximately 17.5 million we might have expected the increase in airport charges to have resulted in a loss of just over 0.5 million passengers overall or a loss for

11. This increase was announced just before the transfer of ownership of Stansted (from BAA to MAG) took effect. The increase was permissible within the then price cap set for the airport.

Ryanair, which accounted for about two-thirds of Stansted's annual passenger numbers (i.e. about 11.55 million), of 346,500.

However, Ryanair reacted to the announcement of an increase in charges saying that it would reduce its capacity at the airport by 9 per cent and that this would be done by cutting frequencies on 43 routes, removing 170 flights potentially used by 1.1mn passengers, around three times higher than implied by a price-elasticity of -0.5.12 The key point here is not the precise numbers involved but the nature of the airline reaction, (reduction in services offered at the airport) and its implications for passenger demand: if a service is withdrawn the airport will lose not only passengers who would have removed their custom on account of higher airfares, but also those who would have still been willing to fly at the new airfares but are driven away by the reduction in service availability.

6. CONCLUSIONS

In a competitive aviation environment, a number of factors can be expected to influence passenger demand for a particular airport, most notably its relative location but also including the airfares on offer from airlines using the airport and, of central interest here, the set of services offered by those airlines, characterised for example by the set of routes served and their service frequencies. When changing aeronautical charges, airports are faced with two routes by which such changes may affect passenger numbers, both indirect and each operating via decisions made by airlines.

The first effect occurs as a result of pass-through of airport charges into airfares, giving rise to a classic price elasticity of demand effect (i.e. a fall in the quantity of seats demanded). The second effect follows from this reduction in passenger demand and the consequent reduction in the profitability of marginal services at the airport. Unless all routes at the airport happened to be untypically supra-marginal, this decline in operating margins is likely to lead to a reduction in services offered. Because the airport is now less attractive to a sub-group of passengers who favoured the withdrawn services, this decline in services will lead to a fall in passenger numbers (i.e. a fall in the level of demand). Given the ability of airlines to move planes from routes served by one airport to routes served by another, the latter effect can be substantial, especially if the demand response to the initial adjustment of services triggers further service adjustments13. Thus the overall effect can be to greatly leverage the initial impact of aeronautical charges on passenger numbers.

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12. We stress at this point that the implications of this analysis for the purpose of a Market Power Assessment (MPA), which was the CAA's objective, is not direct. This is because the effect of an actual charge increase for the purposes of an MPA will depend not only on the existing level of charges but whether that level is above, at, or below what might be assessed as a competitive charge level. At the time of the increase, the competitive level of charge for Stansted remained undetermined. Furthermore, for the purpose of an MPA, an analysis such as this would have to take into account whether prices changed at or about the same time at other (substitute) airports.

13. It can also be noted that, all other things being equal, an increase in charges at one particular airport will alter its relative standing with respect to margins earned at all other airports in an airline's network.

Although this leveraging effect is more likely to bear upon airports serving LCC's, because of the homogeneous nature of their fleets14, the same issues that give rise to leveraging will not be entirely absent with respect to FSC operations. Competition in the liberalised European short-haul sector, a sector that dominates the activities of most European airports, has increased the incentive for FSCs to reduce costs by rationalising their fleets so that at some airports FSCs also operate fleets of a reasonably standard type15. Competition will have also have increased the requirement for FSCs to focus on operating margins. Consequently, we would suggest that the leveraging process we have outlined is a potent factor at airports throughout Europe and it should be taken into account in competition assessments concerning an airport's market power16. It is not sufficient to focus the assessment on a narrow view of the price elasticity of demand.

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We would like to thank Salvatore Nava for assistance with Figure 3.

14. Ryanair fleet March 2013 comprised of 305 aircraft, all B737-800s. easyJet's fleet as at September 2012 comprised of 214 aircraft split between 156 seat Airbus A319s (160) and 180 seat A320s (54).
15. For example, at London Gatwick BA have a short-haul fleet of 23 aircraft, 18 of which are 737-400s.
16. Moreover, airports need only to be served by one major airline with a homogeneous fleet to face discontinuities in demand associated with lumpiness in airline capacity.

APPENDIX

Figure 1.

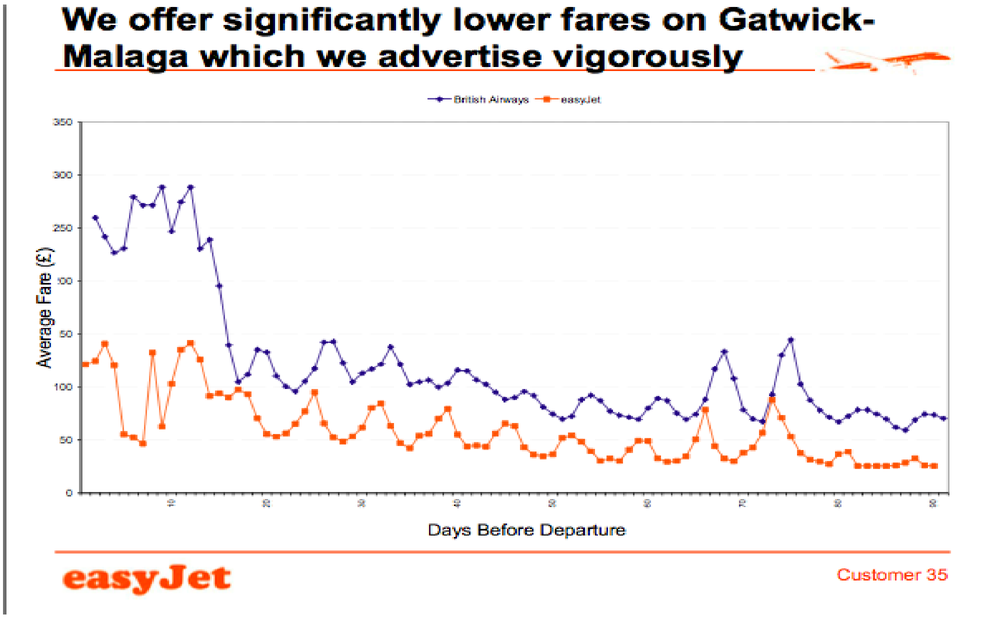


Figure 2.

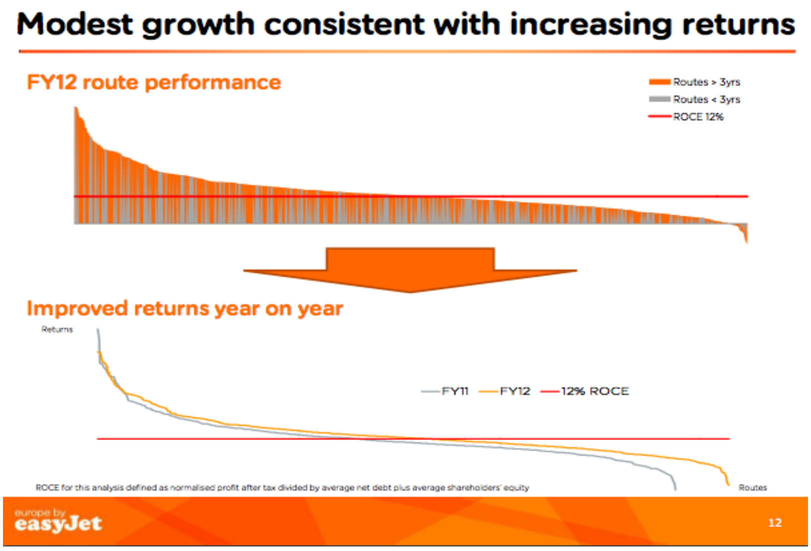
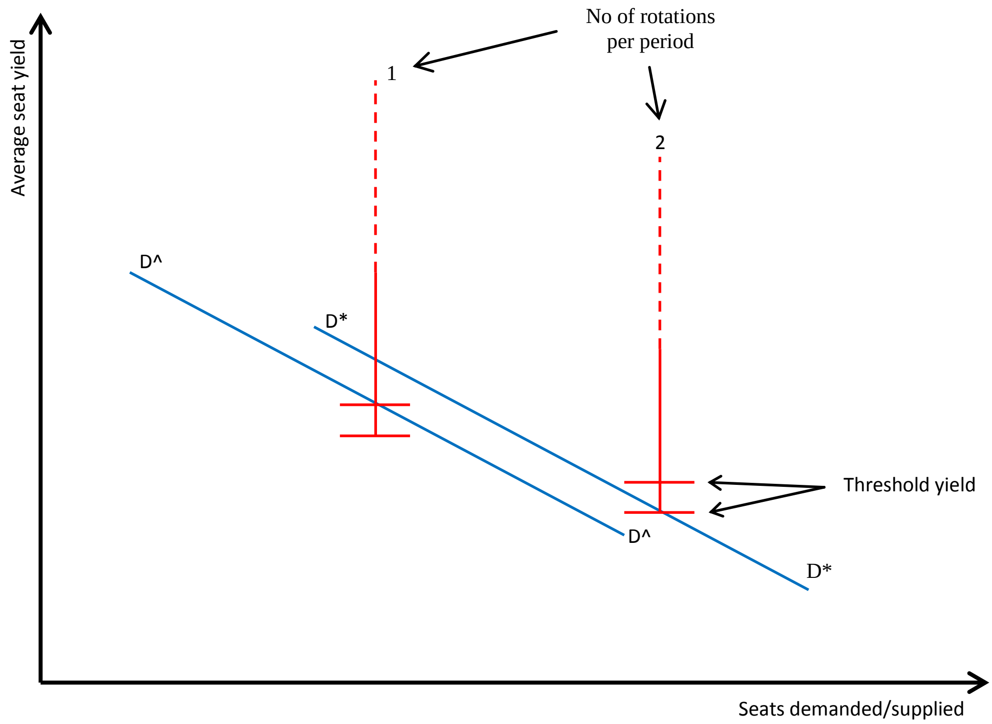


Figure 3.



The Figure illustrates schematically the discontinuities in the supply of airline seats and the marked change in passenger volumes at certain charge points. For a notional air route, it shows the relationship between the average seat yield (also a proxy for the retail price of air travel) on the vertical axis and the quantity of seats demanded/supplied on the horizontal axis. The demand curve D* is the passenger demand when there are two daily/weekly rotations (services); the curve D^ when there is only one rotation.

The solid vertical lines correspond to the fixed number of seats supplied at one and two rotations (using aircraft of a fixed size). This supply is conditional on demand being high enough for the service to achieve a yield that meets a threshold consistent with a required return on capital employed (ROC). This hurdle, or threshold yield, is indicated by the bottom bar on the vertical supply curves. The required yield is higher for one rotation because of the fixed costs of serving the route being carried by one rather than two flight rotations. As drawn, at two rotations, demand D* is only just sufficient to meet the required yield.

An increase in airport charges requires a higher hurdle yield (requiring a higher retail price), shown by the higher bar in the case of both the single and double rotation. At the newly required hurdle yield, two rotations can no longer be sustained at the existing level of demand (the demand curve D* is below the upper bar) so that the frequency of service on the route is cut to a single rotation, thus halving the supply of seats.

As drawn, the single rotation can be sustained because demand D^ is (just) sufficient to meet the hurdle yield. This is in spite of the decrease in demand due to the lower quality of service, a decrease indicated by the difference between D* and D^. But one can also imagine a case where, following an increase in airport charges, demand overall is insufficient to cover the (higher) threshold yield and the service is withdrawn completely.

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