When to regulate airport charges:
A simple rule

by
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Abstract

This paper analyzes a profit-maximizing private airport with market power in providing aeronautical services. Our model implies that airports with ample capacity may voluntarily abstain from abusing their market power if non-aeronautical revenues are airports' main source of income. In this case, a price regulation that is confined to the aviation business will be unnecessary from a welfare point of view.

Keywords: airport pricing; airport regulation; dual-till; locational rent; non-aeronautical revenue

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1   Introduction

Airports usually face some form of price regulation. This is due to the fact that airports are regarded to possess persistent market power in the aviation business, which comprises the provision of landing, take-off, gangway and parking capacity for aircraft and passengers. In order to avoid that privatized airports can abuse this market power and increase prices to achieve excessive returns, raises in the charges for aeronautical activities normally have to be approved *ex-ante* by regulatory authorities. On the contrary, charges for non-aeronautical services, that are often provided by commercial operators – such as retail, car parking or food & beverage – are usually not subject to price regulation. That is because even in the presence of some market power in the non-aviation business, airports could be disciplined by potential competition.

In the course of the commercialization and privatization of airports all around the world (Graham, 2008; Gillen, 2011), the non-aviation business has become increasingly important to airports within the last two decades. In the late 1980s, non-aeronautical revenues only averaged out at 30% of total airport revenues (Behnke, 2000). Nowadays, commercial revenues of airports worldwide account for almost half of all airport revenues – and at many airports already represent the main source of income (Graham, 2009; ACI, 2011). Considering this fact, it appears questionable whether airports actually have an incentive to take advantage of their market power in the aviation business: High aeronautical charges allow for high profits in the aviation business. However, lower charges would increase the number of flights and passengers – and, hence, increase the demand for and the revenue from non-aeronautical services.

A number of studies have investigated the effects of non-aeronautical revenues on airport pricing and the need to regulate aeronautical charges. Starkie (2001) finds that airports are unlikely to abuse their market power whenever complementary non-aeronautical activities exist: Since these activities gain superior locational rents owing to their superior location, increases in traffic volumes at an airport will often produce significant increases in their profitability. However, the profitability of those commercial activities would be negatively affected when aeronautical charges are set too high.

In contrast, Zhang and Zhang (2003) as well as Oum et al. (2004) show that although an unregulated profit-maximizing airport has an incentive to suppress aeronautical charges, it would not set them at a socially optimal level, so that a price regulation may be necessary. Kratzsch and Sieg (2011) demonstrate that a regulation of aeronautical charges may become needless from a welfare point of view if non-aeronautical revenues exceed a critical, but empirically unknown threshold.

In this study, we show analytically that profit-maximizing airports with ample capacity and market power in the aviation business may not have an incentive to abuse their market power if non-aeronautical revenues are an airport's main source of income. In this case, airports may voluntarily accept aviation losses resulting from landing fees below the cost-covering level if the induced rise in traffic generates sufficiently high non-aeronautical revenues, so that non-aviation profits overcompensate aviation losses. If so, a price regulation that focuses on the aviation business will be unnecessary in terms of social welfare.

2 The model

Based on the analysis of Sieg (2010), we consider a profit-maximizing private airport that possesses market power in providing aeronautical services. The airport is served by an airline (hereafter also referred to as "air carrier") that is a monopolistic supplier of air transport to consumers.[1] In order to be allowed to land on the airport and to use the airport facilities, the airline has to pay a landing fee. Furthermore, we assume that there is ample capacity for both aeronautical and non-aeronautical activities, i.e., the airport is prepared to handle additional traffic without facing congestion.

The demand for tickets is represented by

$$X = D - \alpha P_c, \tag{1}$$

where $\alpha > 0$ is the slope of the linear demand curve and $D > 0$ the ordinate intercept. Ticket demand is equivalent to the number of passengers and

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[1]The model could be easily extended to an N-airline-oligopoly, as in Kratzsch and Sieg (2011). To simplify matters, and because there would be no change in the qualitative results of this study, we only consider an airline monopoly.

higher the lower the ticket price P_c demanded by the air carrier. Assuming that the air carrier uses identical aircraft, and that all aircraft have the same load factor, X can be measured by the number of flights.

Following Kratzsch and Sieg (2011), we assume that airport revenues consist of aeronautical and non-aeronautical revenues: Besides the income from aeronautical activities, P_aX, where $P_a > 0$ is the landing fee charged to the airline, the airport generates income from commercial activities, SX. Commercial revenues may comprise direct income from shops, restaurants, car parks, etc. if these facilities are run by the airport itself or concession income if they are run by commercial operators. For simplicity, we assume that one commercial product is offered at the airport and each passenger buys one unit of this good. Alternatively, the commercial product could be consumed in the airport's competitive hinterland where it is offered at a price that equals marginal costs, assumed to be $MC = 0$, and passengers are free to choose where to consume the commercial good. Consequently, the airport possesses no market power in the non-aviation business: The airport is not able to set the price of the commercial product and, thus, does not earn a non-aeronautical monopoly rent. However, by offering the commercial good to consumers, or by renting property to a commercial operator that undertakes the provision of the commercial product, the airport earns an exogenous locational rent, $S > 0$. This rent arises because passengers may find it more convenient to consume the commercial product at the airport (instead of in the hinterland) and, hence, airport users are prepared to pay a premium for retailing or property activities at the airport (Forsyth, 2004; Starkie, 2008). As a result, non-aeronautical revenues amount to SX.

The airport's costs consist of fixed costs, $\underline{F} < F < \bar{F}$, where $\underline{F} = 4D^2 - (D - \alpha S)^2/16\alpha$ and $\bar{F} = (D + \alpha S)^2/8\alpha$. These costs include capital costs, such as depreciation of capital and a normal rate of return on capital. Fixed costs are important for airports, therefore they cannot be low. Very high fixed costs result in non-profitable airports which are either closed or subsidized by governments. As usual in the literature on airport regulation, we further assume that the airport's costs are perfectly attributable to both aeronautical and non-aeronautical activities: A share $1/2 < \lambda \leq 1$ in the airport's costs can be assigned to aeronautical activities whereas the remaining share $1 - \lambda$ is related to commercial activities. The lower threshold for λ

is chosen in order to account for the fact that, in reality, non-aeronautical activities tend to generate higher profit margins than aeronautical activities (Oum et al., 2004; ACI, 2011) because airports' fixed costs are mainly related to the aviation business. Hence, the airport maximizes its profit

$$(P_a + S) \cdot X - F \tag{2}$$

by charging an optimal landing fee P_a to the airline.

The airline maximizes its profit by demanding an optimal ticket price P_c from the passengers. For simplicity, we assume that the only cost accruing to the airline when operating a flight is the landing fee. Thus, the air carrier maximizes

$$(P_c - c) \cdot X(P_c), \tag{3}$$

where the constant total cost per flight c corresponds to the landing fee paid to the airport, i.e., $c = P_a$.

The timing of events is as follows. The airport has to determine the landing fee in advance for the forthcoming flight period. Within that flight period, the airline decides what ticket price to charge. Therefore, the game is a sequential game: The airport is the first mover and the airline the second mover, and the resulting prices and quantities are determined by backward induction.

3   No price regulation

In the absence of price regulation, the airline determines a ticket price that maximizes its profit. The optimal ticket price demanded from the passengers equals

$$P_c^* = \frac{D + \alpha c}{2\alpha}, \tag{4}$$

and the resulting demand for tickets adds up to

$$X^* = \frac{D - \alpha c}{2}. \tag{5}$$

The airport anticipates the price decision of the airline and the derived ticket demand. Profit maximization by the airport results in an optimal landing fee charged to the air carrier,

$$P_a^* = \frac{D - \alpha S}{2\alpha}. \tag{6}$$

Hence, the airport earns a positive profit

$$\Pi_a^* = \frac{(D + \alpha S)^2}{8\alpha} - F \tag{7}$$

because, by assumption regarding the airport's costs, $F < \bar{F}$ applies.

4 Price regulation

Subject to price regulation, the airport's aeronautical charges have to be approved *ex-ante* by a regulatory authority in order to prevent the airport from abusing its market power in the aviation business. The regulator is assumed to have complete information on the airport's cost structure and to pursue welfare maximization.

Social welfare W is defined as the sum of the air carrier's profit $(P_c - P_a)X$, the airport's profit $(P_a + S)X - F$ and consumer surplus $\int_0^X P_c(Y)dY - (P_c + S)X$. Hence, social welfare equals consumer's gross surplus less the airport's costs,

$$W = \int_0^X P_c(Y)dY - F, \tag{8}$$

because landing fees are expenses for the airline but aeronautical revenues for the airport, and ticket revenues as well as non-aeronautical revenues are expenses for consumers.

The regulator maximizes social welfare while regarding the fact that the airport is not allowed to earn profits from providing aeronautical services. However, with the approved landing fee, the airport should be able to achieve cost recovery in the aviation business. Commercial activities are not considered by the regulatory authority, the airport is allowed to make profits in the non-aviation business and, hence, even an overall profit.[2] Thus, the regulator's problem can be formulated as follows:

$$\max_{P_a} W$$

$$s.t. \quad \Pi_a^{Av} = P_a^{reg}X - \lambda F = 0.$$

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[2]In airport economics, this regulatory approach is called dual-till, whereas the so-called single-till approach would use non-aeronautical revenues to cover deficits in the aviation business. The single-till approach, however, appears undesirable in terms of productive efficiency (Oum et al., 2004; Assaf and Gillen, 2012).

The regulatory authority will only approve aeronautical charges that do not exceed the lowermost landing fee that ensures cost recovery in the aviation business. Consequently, the regulator will approve a positive landing fee

$$P_a^* \leq P_a^{reg} = \frac{D - \sqrt{D^2 - 8\alpha\lambda F}}{2\alpha}, \tag{9}$$

where P_a^* follows from the airport's profit maximization under the constraint $P_a \leq P_a^{reg}$. The approved landing fee results in at least

$$X^{reg} = \frac{D + \sqrt{D^2 - 8\alpha\lambda F}}{4} \tag{10}$$

flights operated at the airport. Comparing the regulated landing fee to the profit-maximizing landing fee in the absence of regulation, reveals the important role of an airport's revenue structure.

Proposition 1. *A profit-maximizing private airport with ample capacity for aviation and non-aviation activities, and a medium level of airport costs, will voluntarily abstain from abusing its market power in the aviation business if non-aeronautical revenues are the airport's main source of income, i.e., $S > P_a^*$.*

  Proof. Because

$$P_a^* = \frac{D - \alpha S}{2\alpha} \text{ and } P_a^{reg} = \frac{D - \sqrt{D^2 - 8\alpha\lambda F}}{2\alpha},$$

it follows that

$$P_a^* < P_a^{reg} \iff \alpha S > \sqrt{D^2 - 8\alpha\lambda F} \iff S > \frac{2\sqrt{D^2 - 8\alpha\lambda F}}{D - \alpha S} P_a^*. \tag{11}$$

Because $\lambda > 1/2$ and

$$F > \underline{F} = \frac{4D^2 - (D - \alpha S)^2}{16\alpha},$$

it follows that

$$\frac{4D^2 - (D - \alpha S)^2}{32\alpha\lambda} < F.$$

Therefore

$$4(D^2 - 8\alpha\lambda F) < (D - \alpha S)^2 \text{ , i.e., } \frac{2\sqrt{D^2 - 8\alpha\lambda F}}{D - \alpha S} < 1.$$

Using the assumption $S > P_a^*$, it follows from equation (11) that $P_a^* < P_a^{reg}$, as stated in the proposition.   □

If non-aeronautical revenues amount to more than 50% of all airport revenues, a price regulation that focuses on the aviation business will be unnecessary from a welfare point of view. The profit-maximizing airport will voluntarily abstain from taking advantage of its market power in the aviation business. Moreover, the airport will even accept aviation losses by charging a landing fee that lies below the cost-covering level for the aviation business, $P_a^* < P_a^{reg}$. This is due to the fact that a landing fee below the cost-covering level attracts additional traffic, $X(P_a^*) - X(P_a^{reg}) = (\alpha S - \sqrt{D^2 - 8\alpha\lambda F})/4 > 0$, which in turn increases non-aeronautical revenues. As a result, profits by providing non-aeronautical services, $\Pi_a^{Non-Av} = 2(D\alpha S + (\alpha S)^2)/8\alpha - (1 - \lambda)F > 0$, overcompensate aviation losses, $\Pi_a^{Av} = (D^2 - (\alpha S)^2)/8\alpha - \lambda F < 0$, and the airport earns a positive overall profit $\Pi_a^* > 0$.

5   Concluding Remarks

The worldwide trend towards airport commercialization and privatization has increased the importance of commercial revenues in the airport business. Within the last two decades, the share of non-aeronautical revenues in airports' total income has increased continuously from about 30% to almost 50%. At many airports, commercial revenues already represent the main source of income.

We have shown analytically that this development can have implications for the need to regulate airport charges. If non-aeronautical revenues are an airport's main source of income, a profit-maximizing airport may voluntarily abstain from taking advantage of its market power in the aviation business: As long as there is ample capacity for aeronautical and non-aeronautical activities, and airport costs are neither too high nor too low, the profit-maximizing landing fee in the absence of regulation will lie below the landing fee that would ensure cost recovery in the aviation business. Hence, a price regulation that is confined to the aviation business will be unnecessary in this case and could be replaced by a form of *ex-post* or light-handed regulation, as it is in effect at major airports in Australia since 2002. Recent empirical evidence shows that private airports facing light-handed regulation are more

efficient than fully and partially private airports facing some form of *ex-ante* price regulation (Assaf and Gillen, 2012). In addition, light-handed regulation proves to be able to deter airports effectively from abusing their market power – even if airports are local monopolies and possess persistent market power, as it is the case in Australia (Productivity Commission, 2011; Littlechild, 2012).

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