Non-Aviation Revenues, Infrastructure Improvements, and the Need for Regulating Airport Charges

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Abstract

Landing fees at airports are regulated almost all over the world since airports are assumed to abuse their market power. We find that monopolistic airports have an incentive to restrain landing fees when they generate additional non-aviation revenues and that the optimal landing fee decreases in the degree of complementarity of aviation and non-aviation. Our model implies that monopolistic airports will not have an incentive to abuse their market power as long as locational rents earned by offering commercial services or by renting property are sufficiently high. In such case, price regulation is inappropriate. However, infrastructure improvements that facilitate the accessibility of providers of commercial services in an airport's hinterland will lower locational rents and increase landing fees. If locational rents fall below a critical level, monopolistic airports will take advantage of their market power, and some form of price regulation will become appropriate.

Keywords: airport regulation; aviation and non-aviation revenues; complementarity of aviation and non-aviation; infrastructure improvements; locational rents

JEL: L93; D42; L51

1 Introduction

Privatized airports are typically regarded to have persistent monopoly power in providing aeronautical services. Hence, raises in the charges for aeronautical activities, i.e., the provision of landing, take-off, gangway and parking

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capacity for aircraft and passengers, usually have to be approved by regulatory authorities in order to minimize welfare losses. In general, regulation takes place according to principles of cost relatedness or by setting price caps.

In contrast, charges for commercial services that are often provided by franchises and other commercial operators, such as retail, car parking, banking, and catering are usually not subject to any direct form of regulation. The reason is that although airports might have some market power in the non-aviation business and might earn profits by providing commercial services or by renting property, they could be disciplined by potential competition. However, non-aviation revenues can be indirectly considered if regulators opt for applying the single-till approach while approving aeronautical charges, whereas the dual-till approach confines regulation to the monopolistic bottleneck of an airport, i.e., aviation (Czerny 2006).

As many countries moved – or are moving – towards privatization of some of their public airports (Basso 2008), the non-aviation business has become increasingly important to airports within the last two decades. On average, non-aviation revenues now account for around half of all revenues (Graham 2009). With regard to this fact, one could doubt that monopolistic airports have an incentive to abuse their market power. High charges for aeronautical activities guarantee high profits in the aviation business; however, lower charges would increase the number of landings, thereby increasing the number of passengers who can make use of the commercial services offered, as well as the derived demand for rented property.

Starkie (2001) was the first who challenged the necessity of an *ex-ante* price regulation of monopolistic airports. He argues that airports are unlikely to abuse their market power whenever complementary commercial activities exist because the profitability of those activities will be negatively affected when aeronautical charges are set too high. In contrast, Oum, Zhang and Zhang (2004) point out 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. Hence, Brueckner and Pels (2007) conclude that it is not completely clear that airports will actually abuse their market power, in which case the regulation of charges would be inappropriate.

We show that monopolistic airports have an incentive to restrain aeronautical charges (hereafter referred to as “landing fees”) when they generate additional non-aviation revenues. Landing fees are lower the higher the degree of complementarity of aviation and non-aviation at an airport. Further, our model implies that monopolistic airports will not have an incentive to abuse their market power as long as locational rents generated by offering commercial services to consumers or by renting property to franchises and other commercial operators are sufficiently high. In such case, some form of price regulation will be inappropriate.

In contrast, infrastructure improvements that facilitate the accessibility of providers of commercial services in an airport's hinterland – and thus reduce locational rents – will raise landing fees. If locational rents fall below a critical level, monopolistic airports will take advantage of their market power, and some form of price regulation will become appropriate.

This paper is organized as follows. Section 2 presents the model. In section 3 the optimal landing fees and airport profits are identified. Section 4 highlights the influence of infrastructure improvements on the optimal landing fee, and Section 5 concludes.

2 Model

Building on the analysis of Sieg (2009), we consider a non-congested, unregulated monopolistic airport that is approached by an airline.[1] The air carrier is a monopolistic supplier of air transport to consumers. In order to be allowed to land on the airport and to use the airport facilities, the carrier has to pay a landing fee.

The demand for tickets is represented by

$$x = D - \alpha p_c,$$

where $\alpha > 0$ is the slope of the linear demand curve and $D > 0$ the ordinate intercept. Ticket demand is higher the lower the ticket price p_c demanded by the carrier.

Airport revenues consist of aviation and non-aviation revenues. Besides the income originating from aeronautical activities, $p_a \cdot x$, where $p_a > 0$ is the landing fee charged from the airline, the airport generates income from commercial activities, $s \cdot \beta x$.[2] 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 franchises and other commercial operators. For simplicity, we assume that one commercial product is offered at the airport and each passenger buys a quantity of $0 < \beta \leq 1$. Hence, β can be interpreted as the degree of complementarity of aviation and non-aviation at the airport. Further, $s > 0$ is the locational rent earned by the airport by offering the commercial good to consumers or by renting property to a franchise or a commercial operator. The locational rent arises because users are prepared to pay a premium for economic activity at the preferred location, i.e., scarce airport space or land (Forsyth 2004).

[1] This is a simple version of the vertical structure approach initiated by Brueckner (2002) and used by, among others, Pels and Verhoef (2004) and Zhang and Zhang (2006) and compared to the traditional approach by Basso and Zhang (2008).

[2] The landing fee is usually a function of frequency and tickets, and non-aviation revenues are a function of passengers. We assume that tickets, non-aviation revenues and landing fees share, as a unit, a fully booked aircraft that minimizes landing fees depending on maximum take-off weight, noise (Brueckner and Girvin 2008), emissions, etc.

Since the airport competes with providers of commercial goods and services in the airport's hinterland, the locational rent s depends on the accessibility of those providers. Passengers landing at the airport could decide not to consume at the airport but to travel to hotels, shops, restaurants, etc. in the competitive hinterland where the commercial good is offered at a lower price that equals marginal costs, i.e., $s = 0$. Alternatively, passengers departing from the airport could decide not to park their cars at the airport but in the hinterland and to travel to the airport by public transport. However, in such cases, passengers would have to bear transport costs $\delta(d, t)$, where $\partial\delta/\partial d > 0$ and $\partial\delta/\partial t > 0$, i.e., transport costs are increasing in the distance to providers of commercial services in the airport's hinterland, d, and in the time t necessary to travel there. Hence, the locational rent earned by the profit-maximizing airport adds up to $s = \delta$ since otherwise no passenger would buy the commercial good at the airport.

The airport's costs consist of fixed costs that include capital costs such as depreciation and a normal rate of return on capital, $F > 0$. A share $0 < \lambda \leq 1$ in the airport's costs can be assigned to aeronautical activities whereas the remaining share $1 - \lambda$ is related to commercial activities. Consequently, the airport maximizes the profit for the forthcoming flight period

$$(p_a + s\beta) \cdot x - F$$

by charging an optimal landing fee p_a from the air carrier.

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

$$(p_c - c) \cdot x(p_c),$$

where the constant total cost per flight c corresponds to the landing fee paid to the airport, i.e., $c = p_a$. This assumption simplifies further the approach of Zhang and Zhang (2006) by assuming that all variable costs except for landing fees are zero.[3]

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 air carrier decides what ticket price to charge. Therefore, the game is a sequential game, the airport is assumed to be the first mover and the airline the second mover, and the prices and quantities discussed in the following are results of subgame perfect equilibria determined by backward induction.

[3] Because no further air carrier is landing at the airport, as we assume, no congestion externality exists. Consequently, the imposition of a congestion fee cannot improve efficiency and we do not regard delay costs for passengers or extra costs for the carrier due to congestion.

3 Optimal landing fees and airport profits

The air carrier determines a ticket price that maximizes its profit. The optimal ticket price demanded from the passengers is

$$p_c^* = \frac{D + \alpha c}{2\alpha}$$

and the resulting demand for tickets adds up to

$$x^* = \frac{D - \alpha c}{2}.$$

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

$$p_a^* = \frac{D - \alpha\beta s}{2\alpha}.$$

Hence, the airport earns a positive profit

$$\Pi^* = \frac{(D + \alpha\beta s)^2}{8\alpha} - F$$

as long as $F < \bar{F} = (D + \alpha\beta s)^2/8\alpha$.

Theorem 1 *A profit-maximizing monopolistic airport that generates income both from aeronautical and commercial activities, i.e., $\beta > 0$, has an incentive to restrain aeronautical charges. The optimal landing fee demanded from the airline, p_a^*, is lower the higher the degree of complementarity of aviation and non-aviation at the monopolistic airport, β.*

Proof: See the Appendix.

It is preferable to the airport to demand a lower landing fee than if runways were a stand-alone facility, i.e., $\beta = 0$, since the resulting rise in the volume of traffic, $\alpha\beta s/4 > 0$, increases non-aviation revenues and thus raises the airport's profit by $(\alpha\beta s)^2/8\alpha > 0$. However, that does not imply that the airport will not abuse its monopoly power and that a regulation of aeronautical charges will be inappropriate.

Theorem 2 *For a profit-maximizing monopolistic airport with fixed costs $F \leq D^2/8\alpha\lambda < \bar{F}$, the following results hold:*

1. *The optimal landing fee will be higher than the landing fee that a regulator would approve, i.e., $p_a^* > p_a^{reg}$, if the locational rent is low, i.e., $s < \sqrt{D^2 - 8\alpha\lambda F}/\alpha\beta = \hat{s}$.*

2. *The optimal landing fee will be lower than the landing fee that a regulator would approve, i.e.,* $p_a^* < p_a^{reg}$, *if the locational rent is high, i.e.,* $s > \hat{s}$.

Proof: See the Appendix.

If the locational rent earned by the airport is low, i.e., $s < \hat{s}$, the airport will have an incentive to abuse its market power in the aviation business. The optimal landing fee lies above the cost-covering level for the aviation business, traffic is lower than it was in the presence of regulation, $x(p_a^*) - x(p_a^{reg}) = (\alpha\beta s - \sqrt{D^2 - 8\alpha\lambda F})/4 < 0$, and the airport earns a positive profit by providing aeronautical services, $\Pi_{Av}^* = (D^2 - (\alpha\beta s)^2)/8\alpha - \lambda F > 0$. In this case a regulation of aeronautical charges is appropriate in order to reduce welfare-losses. In contrast, a regulation will be inappropriate if the superior location of the commercial property results in a sufficiently high locational rent, i.e., $s > \hat{s}$. Then the airport will charge a landing fee that lies below the cost-covering level for the aviation business. However, the reduced landing fee attracts additional traffic, $x(p_a^*) - x(p_a^{reg}) > 0$, which in turn increases non-aviation revenues. As a result, non-aviation profits $2(D\alpha\beta s + (\alpha\beta s)^2)/8\alpha - (1 - \lambda)F > 0$ overcompensate aviation losses, $\Pi_{Av}^* < 0$, and the airport earns a positive profit $\Pi^* > 0$.

4 The role of infrastructure improvements

Improvements in the infrastructure around the airport, such as a new motorway or a faster train connection, facilitate the access to the airport's hinterland. As a result, transport costs $\delta(d, t)$ fall because passengers will need less time t to travel to providers of commercial services in the airport's hinterland. The same holds true for the case that providers of commercial services in the airport's hinterland settle nearer to the airport which in turn reduces the distance d and hence lowers transport costs. Bearing in mind that the locational rent depends on the level of transport costs, $s = \delta$, improvements in the infrastructure will have an effect on the airport's pricing strategy.

Theorem 3 *Infrastructure improvements that facilitate the accessibility of providers of commercial services in the airport's hinterland will reduce transport costs* δ *and hence will lower the locational rent earned by the airport,* s. *Consequently, the optimal landing fee charged from the airline,* p_a^*, *will increase.*

Proof: See the Appendix.

Whenever infrastructure improvements are realized, that lower the locational rent earned by offering the commercial good to consumers or by renting property to a franchise or a commercial operator, an unregulated monopolistic airport will increase the landing fee in order to compensate for the initiated loss in the non-aviation business.[4] As long as the locational rent s does not fall below the critical level $\hat{s}$, price regulation is inappropriate since the optimal landing fee is lower than the landing fee that a regulator would approve. However, if the locational rent falls below $\hat{s}$, the airport will take advantage of its monopoly power. In order to reduce welfare losses, price regulation will become appropriate. Further, at an airport where price regulation is already appropriate before such infrastructure improvements are realized because $s < \hat{s}$, the necessity of some form of price regulation will increase.

5 Conclusion

Monopolistic airports have an incentive to restrain aeronautical charges when they generate additional non-aviation revenues. Landing fees are lower the higher the degree of complementarity of aviation and non-aviation at an airport. Furthermore, our model shows that as long as locational rents earned by offering commercial services to consumers or by renting property to franchises and other commercial operators are sufficiently high, monopolistic airports will not take advantage of their market power. In such case, price regulation is inappropriate. However, infrastructure improvements that facilitate the accessibility of providers of commercial services in an airport's hinterland – and thus reduce locational rents – will increase landing fees. Consequently, some form of price regulation will become appropriate if locational rents fall below a critical level. As a result, at airports where price regulation is appropriate and takes place, regulatory authorities will have to be very cautious with approving requested raises in aeronautical charges for the forthcoming flight period whenever such infrastructure improvements have been realized.

Appendix

Proof of Theorem 1:

The optimal landing fee in the presence of non-aviation activities, p_a^*, is lower than the fee p_a^{**} that maximizes the airport's profit in the absence of

[4]Alternatively, one could assume that the quantity of the commercial product purchased at the airport is higher the lower the good's price, i.e., $\beta = \beta(s)$, where $\beta'(s) < 0$. In such case, a profit-maximizing airport could have an incentive to reduce the landing fee after infrastructure improvements have been realized. However, it is possible to show that this will only be the case if the demand for the commercial product is price elastic, i.e., $\left|\epsilon_{\beta(s),s}\right| > 1$, which is unlikely in the short-run considered here.

non-aviation activities, i.e., $\beta = 0$:

$$p_a^* = \frac{D - \alpha\beta s}{2\alpha} < \frac{D}{2\alpha} = p_a^{**},$$

since $\alpha > 0$, $\beta > 0$ and $s > 0$.

Furthermore, the optimal landing fee falls in the quantity of the commercial product purchased at the airport:

$$\frac{\partial p_a^*}{\partial \beta} = -\frac{s}{2} < 0,$$

because $s > 0$.

Proof of Theorem 2:

A regulatory authority that confines regulation to the monopolistic bottleneck of the airport will approve a landing fee that covers the average costs which can be assigned to aeronautical activities:

$$p_a^{reg} = \frac{\lambda F}{x(p_a^{reg})},$$

where $x(p_a^{reg}) = (D - \alpha p_a^{reg})/2$. Hence, the regulator will approve a landing fee of

$$p_a^{reg} = \frac{D - \sqrt{D^2 - 8\alpha\lambda F}}{2\alpha},$$

if $F \leq D^2/8\alpha\lambda$. The optimal landing fee demanded by the profit-maximizing monopolistic airport will be higher than the regulated landing fee if

$$p_a^* - p_a^{reg} > 0,$$

$\Longleftrightarrow$

$$\frac{D - \alpha\beta s}{2\alpha} - \frac{D - \sqrt{D^2 - 8\alpha\lambda F}}{2\alpha} > 0,$$

$\Longleftrightarrow$

$$s < \frac{\sqrt{D^2 - 8\alpha\lambda F}}{\alpha\beta} = \hat{s}.$$

In contrast, the optimal landing fee demanded by airport will be lower than the regulated landing fee, if $p_a^* - p_a^{reg} < 0 \Leftrightarrow s > \hat{s}$.

Proof of Theorem 3:

The optimal landing fee charged from the airline falls in the locational rent earned by the airport:

$$\frac{\partial p_a^*}{\partial s} = -\frac{\beta}{2} < 0,$$

since $\beta > 0$.

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