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# Price-cap regulation of airports: single-till versus dual-till

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Berlin, 7th September 2004

## **Abstract**

This paper takes up the debate whether price-cap regulation of airports should take the form of single-till or dual-till regulation. The contribution is to model single- and dual-till regulation, evaluate their welfare implications, and compare them to Ramsey prices. We show that the single-till dominates the dual-till regulation at non-congested airports with regard to welfare maximization. However, none of them provides an airport with the incentives to implement Ramsey prices. A perfect price-cap regulation, which achieves this goal, is also presented.

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## **Zusammenfassung**

Eine übliche Form der Flughafen-Regulierung ist die Price-Cap-Regulierung. Hierbei ist zwischen einer Single-Till- und einer Dual-Till-Regulierung zu unterscheiden. In dieser Arbeit analysieren wir, welche der beiden Regulierungsvarianten aus Sicht eines Wohlfahrtsmaximierers vorteilhaft ist. Dazu wird ein Vergleich der Regulierungsergebnisse mit denen von Ramsey-Preisen vorgenommen. Es zeigt sich, dass bei nicht kapazitätsbeschränkten Flughäfen die Single-Till-Regulierung zu besseren Wohlfahrtsergebnissen führt als die Dual-Till-Regulierung. Dennoch, keine der beiden Regulierungsformen kann das Ramsey-Ergebnis erreichen. Aus diesem Grund wird zusätzlich eine perfekte Price-Cap-Regulierung vorgestellt, die zu einer Implementierung des Ramsey-Ergebnisses führt.

# 1 Introduction

Until recently most airports were owned and managed by public authorities. Nonetheless, a growing number of airports in Europe as well as Australia and New Zealand became fully or partially privatized during the last twenty years. Furthermore, many airports in South-America, Africa, and Asia are under review for being privatized [8]. Airport privatization is almost always accompanied by some form of price regulation. This is basically due to the fact that airports are supposed to exhibit market power. However, Starkie claims that there would be a lack of incentives for airports to exploit it [9]. His conclusion is based on demand complementarities between aeronautical and commercial airport activities in combination with location rents. Aeronautical activities of the airport include the provision of take-off, landing, and parking capacity for aircraft. Commercial activities include, e.g., retailing and car parking. Roughly outlined, Starkie argues that increased airport charges do not only reduce the demand for flights, but, also, the demand for commercial services. This in turn reduces location rents and therefore the returns to the tenant, i.e., the airport itself. Following this reasoning the airport might not want to raise aeronautical charges so that airport regulation might be unnecessary.

In reality there is no fully liberalized airport market in the world, and airport policy makers are basically considering modifications of the regulatory regimes. An example on which we will focus in this paper is given by the debate about the single-till and the dual-till approach. It addresses the problem of the ‘right’ integration of aeronautical and commercial activities into airport price regulation. The single-till approach is characterized by an inclusion of commercial revenues into the price-cap formula. The dual-till approach, in contrast, tries

to separate the aeronautical from the commercial activities, such that only the former ones determine the price-cap formula. In Australia, the United Kingdom, and Germany the question was raised whether price-cap regulation could be improved by switching from a single-till to a dual-till approach, see [2], [3], [7], [4].

Beesley was one of the first economists to attack the single-till approach [1]. He claims that regulation should concentrate on activities which are characterized by a natural monopoly, and therefore not be affected by the commercial activities. On the other hand, he doubts that it is possible to isolate the aeronautical activities from other airport activities. For this reason he generally rejects the application of a price-cap regulation mechanism to airports. Starkie, in contrast, is in favor of a dual-till price-cap regulation, [9]. He argues that, for non-capacity constrained airports, commercial airport activities should not be regulated because they could provide the airport with an incentive to reduce aeronautical charges. For capacity constrained airports, on the other hand, a dual-till regime would lead to higher aeronautical charges, which would have positive effects on the allocation of scarce slot capacity and on investment incentives. The reasoning is in line with the argument by Starkie and Yarrow [10], and similar results are presented by Oum, Zhang, and Zhang [8]. The latter provide empirical evidence that a dual-till price-cap regulation improves economic efficiency in terms of total factor productivity for large, busy airports compared to a single-till approach. Somewhat different are the conclusions of Lu and Pagliari [6]. According to them the single-till system is advantageous given that the market-clearing level of aeronautical charges is lower than the average cost of aeronautical services. This result is based on the assumption that

aeronautical charges under a single-till context are lower than under a dual-till regulation, since under the latter profits from commercial activities are used to reduce aeronautical charges. Hence, if there exists excess capacity, capacity utilization is improved. On the other hand, for a capacity constrained airport, the use of capacity is improved under a dual-till regulation. Thus, according to Lu and Pagliari for capacity restricted airports the dual-till approach is assumed to be welfare enhancing.

The objective of this paper is to contribute to the debate whether the single-till or the dual-till approach to price-cap regulation is appropriate. While the existing literature focuses on the effect of aeronautical charges on commercial airport activities, our model also takes into account the effects of commercial charges on the demand for aeronautical services. It is shown that the single-till approach dominates the dual-till approach. This result is based on the fact that the single-till system implements an optimal regulation of aeronautical charges. However, it turns out that neither the dual-till nor the single-till regulation of the aeronautical charges is able to implement Ramsey charges. Since the demand for commercial goods is always a subset of the demand for aeronautical services, the Ramsey charge for the former is lower than that for the latter. But this cannot be implemented by a regulation of aeronautical charges alone. We finally show that it is possible to implement Ramsey prices by use of a weighted-average price-cap regulation scheme.

The next section presents the model. An unregulated monopolistic airport is considered in section 3. Section 4 analyzes Ramsey prices. The evaluation of single-till and dual-till price-cap regulation schemes follows in section 5. In

section 6 an analysis of a perfect price-cap regulation approach is provided. The paper closes with some concluding remarks in section 7.

## 2 Model

The airport considered is a multi product monopolist which provides aeronautical and commercial services. The underlying assumption that airports possess market power in the markets for aeronautical and the commercial activities is in line with models used by other authors [8], [11].

The provision of airport services produces fixed costs denominated by  $F \geq 0$ . For simplicity all variable airport costs are supposed to be zero. Furthermore, airlines and commercial service providers are assumed to be in perfect competition with constant marginal costs. Then we can express consumers' willingness to pay and the retail charges as net of the constant marginal costs. It follows that the airport charges are identical to the (net) retail charges for consumers.

There is a set of individuals denoted by  $Q$  with mass one. Everyone flies at most once and buys at most one unit of a commercial good. Letting  $p_1 \geq 0$  denote the charge for a flight and  $p_2 \geq 0$  the charge for commercial services, the utility of an individual  $q \in Q$  who flies and buys is

$$V_1(q) + V_2(q) - (p_1 + p_2)$$

where  $V_1(1)$  is the willingness to pay for a flight and  $V_2(q)$  that for the commercial good. It is assumed that both  $V_1(q)$  and  $V_2(q)$  are uniformly and independently distributed over the unit interval, i.e.  $V_1(q), V_2(q) \in [0, 1]$ . Hence, in  $V_1$ - $V_2$ -space, all individuals are uniformly and independently distributed over the unit square, as shown in figure 1. It is assumed that only the passengers,

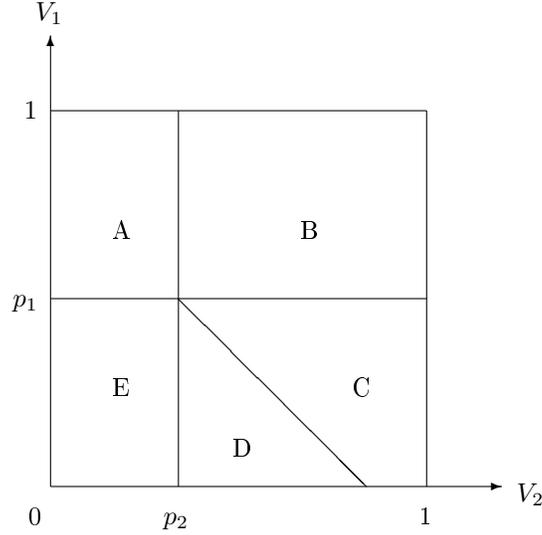


Figure 1: Passenger and consumer demand for given prices  $p_1$  and  $p_2$ .

i.e. individuals who decide to fly, can buy the commercial services. Passengers make use of commercial services if  $V_2(q) - p_2 \geq 0$ . Individuals fly if they get a positive rent from flying and buying, i.e. if  $V_1(q) - p_1 + \max\{0, V_2(q) - p_2\} \geq 0$  is satisfied.

For given charges  $p_1$  and  $p_2$ , the passenger demand  $D_1$  and the demand for commercial airport services  $D_2$  is illustrated in figure 1. We show that

$$D_1 = A + B + C.$$

For all individuals in the areas A and B the utility of a flight is at least as high as  $p_1$ , hence, these individuals decide to fly. Note that individuals located in area C also buy a flight although  $V_1(q) \leq p_1$ . This is so because  $p_1 - V_1(q) \leq V_2(q) - p_2$  and, hence, the negative rent from flying is compensated by the positive rent generated from consumption of commercial services. Only individuals located in the areas D and E do not buy a flight, since  $p_1 > V_1(q)$  holds, and the rent

generated by consumption is too small to compensate for the disutility resulting from flying. For  $p_1 + p_2 \leq 1$  one calculates:

$$D_1(p_1, p_2) = 1 - p_1 p_2 - \frac{p_1^2}{2}. \quad (1)$$

Demand for commercial services is

$$D_2 = B + C.$$

For individuals located in the areas A and E the utility for consumption is smaller than  $p_2$ , hence, they will not buy commercial services. Individuals located in area D do not consume aeronautical services simply because they do not fly. For  $p_1 + p_2 \leq 1$ :

$$D_2(p_1, p_2) = 1 - p_2 - \frac{p_1^2}{2}. \quad (2)$$

Since all variable costs are assumed to be zero, the welfare  $W$  generated from flying and consuming is simply the sum of all actual buyers' willingness to pay for the two services:

$$W := \int_{A \cup B \cup C} V_1 dV_1 dV_2 + \int_{B \cup C} V_2 dV_1 dV_2.$$

For  $p_1 + p_2 \leq 1$ :

$$W(p_1, p_2) = 1 - \frac{p_1^3}{3} - p_1^2 p_2 - \frac{p_2^2}{2}. \quad (3)$$

With  $p_1 = p_2 = 0$  welfare is at its maximum of 1.

### 3 An unregulated monopolistic airport

Which effect does the integration of commercial activities into the airports' optimization problem have on aeronautical charges? For an illustration, assume that

$p_2 = 1$ . Then nobody will demand airport commercial services, since  $V_2(q) \leq 1$ , and it follows that aeronautical demand is  $D_1 = 1 - p_1$ . Since marginal costs are zero, profit is maximized by  $p_1 = 0.5$ . Now assume to the contrary that  $p_1 = 0$ . Then everyone buys a flight, the demand for commercial services is  $D_2 = 1 - p_2$ , and the profit maximizing charge for commercial services is  $p_2 = 0.5$ . Now consider an airport which optimizes profits by simultaneous choice of aeronautical and commercial charges. Since both services are complementary we would expect one price to be reduced below 0.5, and the other to be raised above 0.5. Which charge will be raised and which one reduced? The airports' maximization problem is given by:

$$\max_{0 \leq p_1, p_2} \Pi(p_1, p_2) \quad (4)$$

with  $\Pi(p_1, p_2) := p_1 D_1(p_1, p_2) + p_2 D_2(p_1, p_2) - F$ . For  $p_1 + p_2 \leq 1$  equations (1) and (2) imply

$$\Pi(p_1, p_2) = p_1 - \frac{p_1^3}{2} + p_2 - \frac{3p_1^2 p_2}{2} - p_2^2 - F.$$

The solution for (4) is given by  $(p_1^M, p_2^M) = (2/3, 1/6)$ . It implies  $D_1(p_1^M, p_2^M) = 2/3$ ,  $D_2(p_1^M, p_2^M) = 11/18$ ,  $W(p_1^M, p_2^M) \approx 0.81$ , and  $\Pi(p_1^M, p_2^M) \approx 0.55 - F$ . This shows that a simultaneous profit maximization in fact raises the aeronautical charges and reduces the charges for commercial services. This is contrary to the hypothesis that an unregulated airport would reduce aeronautical charges in order to raise the profitability of commercial activities [9].

That a monopolist is better off by increasing aeronautical charges instead of commercial ones, mainly depends on the fact that  $D_1 > D_2$ , since  $D_2$  is a subset of  $D_1$  (except for  $p_2 = 0$  where  $D_1 = D_2$ ). Hence, raising aeronautical charges increases revenues by a larger amount than raising commercial charges.

## 4 Ramsey charges

The monopoly solution analyzed in the last section leads to a welfare loss of approximately 0.19 compared to the welfare maximum of 1. On the other hand, welfare maximizing charges,  $p_1 = p_2 = 0$ , do not cover the airport's fixed costs. Ramsey charges  $(p_1^R, p_2^R)$  are a compromise between welfare maximization and profitability. The corresponding optimization problem is

$$\max_{0 \leq p_1, p_2} W(p_1, p_2) \quad \text{s.t.} \quad \Pi(p_1, p_2) \geq 0. \quad (5)$$

The solution for (5) is plotted in figure 2 as a function of  $F \in [0, R(p_1^M, p_2^M)]$  with  $R(p_1, p_2) := p_1 D_1(p_1, p_2) + p_2 D_2(p_1, p_2)$ .<sup>1</sup> Observe that  $p_2^R = 0$  holds for fixed costs are below a critical amount  $\hat{F} \approx 0.485$ . Moreover it holds:

**Proposition 1** *Ramsey charges satisfy  $p_1^R > p_2^R$  for all  $F > 0$ .*

**Proof** For  $F \in (0, \hat{F})$  Ramsey charges for the commercial services are  $p_2^R = 0$ . Consequently,  $p_1^R > 0 = p_2^R$  must hold to cover fixed costs.

The first order conditions for (5) for  $F \in [\hat{F}, R(p_1^M, p_2^M)]$  imply:

$$p_1^R = 2 - p_2^R - \sqrt{2 - 4p_2^R + (p_2^R)^2}. \quad (6)$$

It follows that  $p_1^R > p_2^R$ . ■

Similar to the monopoly case, aeronautical Ramsey charges have to be higher than the commercial ones. The intuition is similar, too. Raising charges for aeronautical services is more profitable than raising commercial charges.

It has been pointed out that cross-subsidization between commercial and aeronautical airport operations can be welfare enhancing [11]. However, our

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<sup>1</sup>In the following it is assumed that  $\Pi(p_1^M, p_2^M) \geq 0$  is satisfied. Then Ramsey charges covering the fixed costs exist.

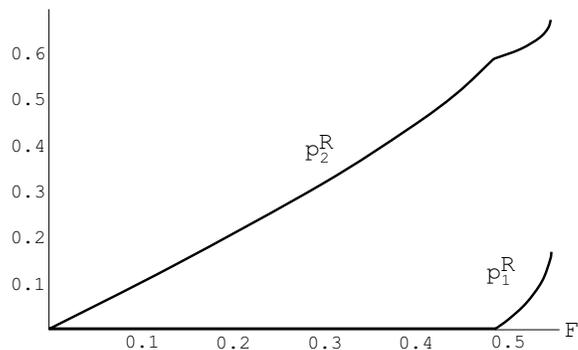


Figure 2: Ramsey charges.

result shows that the desirability of cross-subsidization strongly depends on the amount of fixed costs. If  $F \leq \hat{F}$  commercial prices should not be raised above marginal costs.

## 5 Single-till versus dual-till

We now address the comparison between single-till and dual-till price-cap regulation and their relation to Ramsey charges. Both approaches are characterized by the fact that only aeronautical charges are directly regulated, see [2], [4]. Hence, the regulator defines a price cap  $\bar{p}^a \geq 0$  with  $a \in \{s, d\}$ , which restricts aeronautical charges to satisfy  $p_1 \leq \bar{p}^a$ . The indices denote the price-cap under a single-till ( $a = s$ ) or a dual-till approach ( $a = d$ ).

Single-till takes profits from aeronautical as well as commercial activities into account when determining the price-cap. The way of calculating a single-till price-cap is ideally given by

$$\bar{p}^s = \max \left\{ 0, \frac{F - p_2 D_2(p_1, p_2)}{D_1(p_1, p_2)} \right\}. \quad (7)$$

Thus, the single-till price-cap is given by the maximum of zero and the average fixed costs per passenger minus the average profits resulting from commercial activities per passenger. Rearranging (7) shows that  $\bar{p}^s > 0$  implies  $\Pi = 0$ . A dual-till price-cap is ideally given by

$$\bar{p}^d = \frac{\alpha F}{D_1(p_1, p_2)} \quad (8)$$

where  $\alpha \in [0, 1]$  is the share of the fixed costs which are attributable to aeronautical services.<sup>2</sup> The dual-till price-cap is given by the average fixed costs attributable to aeronautical activities per passenger. Note, if the commercial activities are profitable, i.e.  $p_2 D_2 > (1 - \alpha)F$ , then it follows that  $\bar{p}^s < \bar{p}^d$ .

Our analysis of single- and dual-till regulation will be based on the assumptions that the above formulas are to be taken seriously, and that the regulator has a rational expectation of the airport's reaction to the price-cap. Formally, this amounts to a regulation game with two stages under perfect information. In the first stage the regulator determines the price-cap  $\bar{p}$ , satisfying either (7) or (8), and in the second stage the airport chooses charges  $(p_1, p_2)$  so as to maximize profit subject to the price-cap and the non-negativity constraints.

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<sup>2</sup>We assume that fixed costs are perfectly attributable to the different airport activities, although we agree with other authors that this might be difficult, see [1]. However, this is a necessary pre-condition for a dual-till approach to be workable.

Solving backwards, we obtain the airport's optimal strategy, or pair of reaction functions:

$$(p_1^r(\bar{p}), p_2^r(\bar{p})) =: \arg \max_{p_1, p_2 \geq 0} \Pi(p_1, p_2) \quad \text{s.t. } p_1 \leq \bar{p}$$

One shows that there is indeed a unique solution to the airport's problem. The price-cap is binding, i.e.  $p_1^r = \bar{p}$ , if and only if  $\bar{p} \leq 2/3$ . The non-negativity constraint on  $p_2$  is not binding, so that  $p_2^r$  is given by the first-order condition  $\partial \Pi(p_1^r, p_2^r) / \partial p_2 = 0$ .

In the first stage of the regulation game the airport sets  $\bar{p}$ . For a single-till regulation,  $\bar{p}^s$  is the maximum of zero and the solution to

$$\bar{p} = \frac{F - p_2^r(\bar{p}) D_2(p_1^r(\bar{p}), p_2^r(\bar{p}))}{D_1(p_1^r(\bar{p}), p_2^r(\bar{p}))}. \quad (9)$$

For a dual-till regulation,  $\bar{p}^d$  is the solution to

$$\bar{p} = \frac{\alpha F}{D_1(p_1^r(\bar{p}), p_2^r(\bar{p}))}. \quad (10)$$

Note that the solutions for (9) and (10) are unique and that they constitute the unique subgame perfect Nash-equilibrium of the regulation game.

Under the single-till approach the Nash-equilibrium depends on  $F$  only, while under the dual-till approach it depends on  $F$  and  $\alpha$ . The figures 3 and 4 show the charges implied by the Nash-equilibria with varying amounts of  $F$  respectively  $\alpha F$ . Under dual-till regulation the airport is allowed to charge monopoly prices if  $\alpha F \gtrsim 0.44$  holds. Under the single-till approach monopoly prices are only allowed for  $F = R(p_1^M, p_2^M)$ . However, which regulation scheme should be preferred? The following proposition and corollary show that single-till regulation (weakly) dominates the dual-till regulation from a welfare perspective.

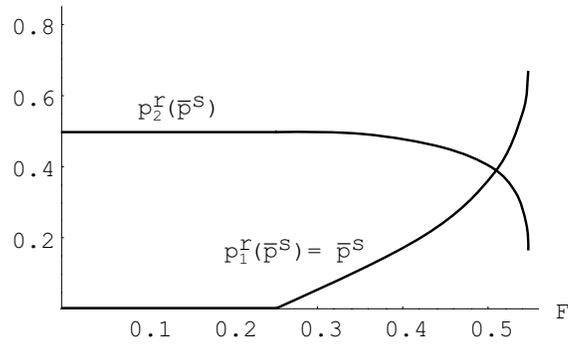


Figure 3: Charges implied by subgame perfect Nash-equilibria under a single-till regulation for varying amounts of  $F$ .

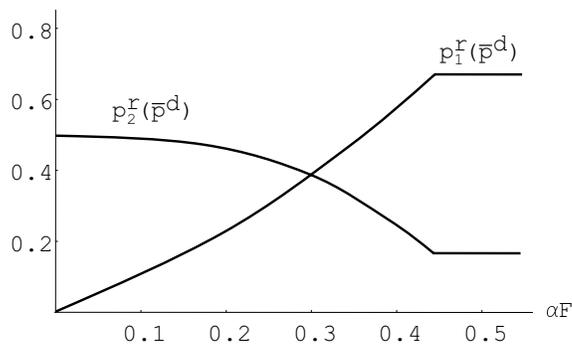


Figure 4: Charges implied by subgame perfect Nash-equilibria under a dual-till regulation for varying amounts of  $\alpha F$ .

**Proposition 2** *The welfare maximizing price-cap for the aeronautical charges, subject to a zero-profit condition, is equivalent to single-till regulation.*

**Proof** The welfare maximizing regulation of airport charges is the solution to

$$\max_{\bar{p} \geq 0} W(p_1, p_2) \quad \text{s.t.} \quad \Pi(p_1, p_2) \geq 0 \quad \text{and} \quad (p_1, p_2) = (p_1^r(\bar{p}), p_2^r(\bar{p})).$$

At the solution it holds either  $\Pi(p_1, p_2) = 0$  or  $\bar{p} = 0$ . Hence, the solution must be equivalent to the single-till price-cap. ■

**Corollary 1** *Single-till regulation strictly dominates dual-till regulation if  $F \in (0, R(p_1^M, p_2^M))$  and  $(1 - \alpha)F \neq p_2^s D_2(p_1^s, p_2^s)$ .*

**Proof** The conditions imply that  $\bar{p}^d \neq \bar{p}^s$ . ■

To provide an intuition for proposition 2, one can calculate that  $\partial W(\bar{p}, p_2(\bar{p}))/\partial \bar{p} \leq 0$  for  $\bar{p} \leq 2/3$ . Thus, in order to maximize welfare the regulator should try to implement the lowest possible price-cap for aeronautical charges, i.e., the one for which either  $\Pi = 0$  or  $\bar{p} = 0$ . However, this is the one also implemented by a single-till regulation. A particular advantage of the single-till approach in comparison to the dual-till follows from the fact that it allows complete control of the overall profitability of the airport.

Note, however, that even the single-till approach cannot implement the Ramsey charges, since it regulates only the aeronautical charges. That is, we have  $(p_1^r(\bar{p}^s), p_2^r(\bar{p}^s)) \neq (p_1^R, p_2^R)$  for all  $F < R(p_1^M, p_2^M)$ . For this reason, the following section proposes a perfect price-cap regulation scheme which will implement Ramsey charges.

## 6 A perfect price-cap regulation

To implement Ramsey charges the aeronautical as well as commercial charges have to be integrated into the price-cap formula. Suppose that airport charges are restricted by a cap  $\bar{p}$  on average prices with weights  $(w_1, w_2)$  so as to satisfy

$$w_1 p_1 + w_2 p_2 \leq \bar{p}. \quad (11)$$

Then a price-cap  $\bar{p}$  and price-weights  $(w_1, w_2)$  exist which guarantee that a profit maximizing airport will reproduce  $(p_1^R, p_2^R)$ .

**Proposition 3** *A price-cap of*

$$\bar{p} = \begin{cases} F & \text{for } F \geq \hat{F} \\ p_1^R & \text{for } F < \hat{F} \end{cases}$$

*in combination with price weights given by*

$$(w_1, w_2) = \begin{cases} (D_1(p_1^R, p_2^R), D_2(p_1^R, p_2^R)) & \text{for } F \geq \hat{F} \\ (1, 1) & \text{for } F < \hat{F} \end{cases}$$

*guarantees that the airport sets  $(p_1, p_2) = (p_1^R, p_2^R)$ .*

**Proof** Assume  $F \geq \hat{F}$ . Since  $W = W - \Pi + \Pi$ , the Lagrangean for the Ramsey problem (5) can be expressed as

$$\mathcal{L} = W(p_1, p_2) - \Pi(p_1, p_2) + (1 + \lambda)\Pi(p_1, p_2). \quad (12)$$

Since  $W - \Pi$  is equivalent to an indirect utility function, rearranging the first order condition for (12), after inserting  $\partial(W - \Pi)/\partial p_j = -D_j$  given by Roy's identity, produces the following characterization of the Ramsey charges:

$$-\frac{1}{D_j(p_1^R, p_2^R)} \sum_{i=1}^2 p_i^R \frac{\partial D_i}{\partial p_j} = \frac{\lambda^R}{1 + \lambda^R}. \quad (13)$$

Consider now the optimization problem of a monopolistic airport subject to constraint (11). The respective Lagrangean is

$$\mathcal{L} = \Pi(p_1, p_2) + \mu(\bar{p} - w_1 p_1 - w_2 p_2). \quad (14)$$

Rearranging the first order condition for (14) generates

$$-\frac{1}{w_j} \sum_{i=1}^2 p_i^* \frac{\partial D_i}{\partial p_j} = 1 - \mu^*. \quad (15)$$

For  $w_j = D_j(p_1^R, p_2^R)$  and  $\bar{p} = F$  it follows  $\mu^* = 1/(1 + \lambda^R)$ . Hence, the conditions (13) and (15) are equivalent and therefore  $(p_1^*, p_2^*) = (p_1^R, p_2^R)$ .<sup>3</sup>

For  $F < \hat{F}$  the Ramsey price for commercial services  $p_2^R = 0$  reflects a boundary solution, and the former result does not hold. However, for  $w_1 = w_2 = 1$  the first order conditions of (14) imply  $p_2^* = 0$ . Moreover, with  $\bar{p} = p_1^R$ , the Ramsey solution will be reproduced for  $F < \hat{F}$ . ■

Why do price weights  $w_1 = w_2 = 1$  provide the airport with no incentives to set  $p_2 > 0$ ? The intuition behind this result is, again, based on the complementarities between the demands for aeronautical and commercial services. With equal price weights an increase of  $p_2$  has to be compensated by a similar decrease of  $p_1$ , due to the price-cap restriction. However, this would reduce profits.

## 7 Conclusions

Airport privatization has always been accompanied by some form of price-regulation. Our paper focuses on the current debate whether a price-cap regulation of monopolistic airports should take the form of a single-till or a dual-till regulation.

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<sup>3</sup>The argument follows Laffont and Tirole [5].

In order to address this issue we modelled the market interdependency between aeronautical and commercial airport activities and their impact on monopolistic airport charges. In particular, the demand for commercial services is always a subset of the demand for flights. We showed that this has an important implication: An unregulated monopolistic airport would tend to reduce charges for commercial services in order to raise the charges for flights.

Since first-best charges would imply losses for a non-congested airport with low marginal costs we also considered Ramsey charges. It turned out that, consistently with monopolistic charges, Ramsey charges for aeronautical services are higher than the respective charges for commercial services. Our analysis shows that any cross-subsidization of aeronautical services by profits generated from commercial activities is only welfare enhancing if fixed costs are fairly large.

Furthermore, we point out that the single-till dominates a dual-till regulation from a welfare point of view. This result is due to the fact that a single-till regulation is equivalent to an optimal price-cap regulation for aeronautical charges. However, even the single-till approach does not provide the monopolist with incentives to implement Ramsey charges. For a broad range of fixed costs, the aeronautical charges implied by a single-till and a dual-till regulation are lower than the charges for commercial services. This strongly thwarts the idea of Ramsey charges. It is shown that Ramsey charges can be implemented by use of a weighted average price-cap regulation scheme.

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