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Trade-off between Welfare and Competitiveness?**

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VERTICAL CONTRACTS BETWEEN AIRPORTS AND AIRLINES: IS THERE A
TRADE-OFF BETWEEN WELFARE AND COMPETITIVENESS?

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ABSTRACT

Airports and airlines have been increasingly establishing vertical contracts, which have a wide variety of forms. These contracts have important implications for policy issues, namely for regulation and price discrimination legislation. In this paper we develop a model to analyse the effects of three types of vertical contracts, in what regards welfare, pro-competitiveness and the scope for regulation. We find that two types of contracts are anti-competitive, and that in all of them consumers are better-off, though in one of them within conditions regarding operational efficiency. We also conclude that regulation may (or may not) improve welfare depending on the type of contract and that price capping has different effects according to the facility the price of which is capped. Moreover, we find that these agreement's effects exhibit a trade-off between pro-competitiveness and welfare and between price discrimination and welfare.

JEL code: R48, L93

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1. Introduction

When one airline has an important market share in an airport, both partners may be interested in establishing agreements concerning the use of the airport's facilities, which includes the fees and charges airlines pay. These agreements create a situation of price discrimination that favours the airlines that sign them, while those that stay out of the agreement pay higher fees and charges. On the other hand, vertical contracts may lead airlines to acquire market power in the upstream (airport) market, whenever they allow airlines to operate, for example, terminals, and so control the downstream market through the access to the input. Price discrimination and control, even if partial, of the input market, may be anti-competitive. But vertical contracts and collusions may also benefit consumers and be welfare-enhancing, as they may eliminate the so-called double marginalisation. Thus vertical contracts' effects often exhibit a trade-off between competitiveness and welfare.

The purpose of this paper is to analyse this trade-off, by examining three main types of vertical contracts between airports and airlines, and to find out which types of contracts and of clauses lead to results that make consumers better (worse)-off and which ones are pro (anti) competitive. Furthermore, this paper analyses the effects of airports regulation under vertical contracts. In fact, the issue of de-regulation is currently on the agenda of national authorities concerned with air transport and competition¹, it is also important to analyse how vertical agreements may change the scope for regulation. Indeed, vertical contracts lead to deep changes in the upstream market, where the airport sells its facilities to airlines, but these effects spill over downstream markets, where airlines sell flights to passengers. Such changes may lead politicians to question issues like the effects of regulation under these contracts, what prices should be regulated and what effects should be expected.

Using a model that considers the downstream and the upstream markets and so allows for a two-stage game, we analyse the effects of three types of vertical contracts in what regards three main issues: (i) welfare and consumer surplus, (ii) pro-competitiveness, or the effects on other airlines that remain as outsiders and (ii) the effects of regulation.

¹ The United Kingdom has been a pioneer in these issues. See, for example, the Competition Commission (2008) and the Civil Aviation Authority (2008) documents.

Vertical agreements between an airport and one or more airlines are common. In Europe, they have not been disclosed, as they involve clauses that may go against articles 81 and 82 of the European Union Treaty, and so the European Commission has investigated and condemned some of these agreements². In the United States (US) agreements between airports and the so-called “signatory airlines” are common and frequently fully disclosed. In Australia, these agreements can also be found in major airports, like in Sydney and in Melbourne. In Section 3 we take a closer look at the existing vertical contracts and at the clauses they involve.

As we show in Section 3, there is a wide variety of vertical contracts between airports and airlines, so that it is convenient, for our purposes, to establish a typology. Starkie (2008) considers three main types of agreements: (i) the European case (which we call the first case), where contracts are relatively new and focus on negotiated charges for the use of the airport facilities; (ii) the Australian case, (our second case) where agreements lie in long term leases on terminals; and (iii) the US case (our third case), with “majority in interest clauses” for signatory airlines.

We use Starkie (2008)’s three types of vertical contracts to develop three models for vertical restraints. Results differ much according to the type of contract and depend on the clauses (restraints) they include. Thus, in the first case, contracts are anti-competitive but welfare-enhancing. However, price regulation restores competitiveness and increases consumer surplus, even when allowing for the contract to persist. In the second case, vertical restraints are anti-competitive but may increase welfare, depending on airlines’ efficiency in terminal operations. Price cap regulation may only restore competitiveness if is applied to the price airlines charge for leased terminals but not if it regulates airports’ charges. In the third case vertical contracts are pro-competitive and also increase welfare, though only concession revenues may support the agreements. Additionally, in this case regulation is only useful if there are few airlines in the market. If markets are competitive enough, price cap regulation makes consumers worse-off.

² Examples are the cases of the Zaventem/Brussels National Airport in favour of the national flag carrier Sabena, of the Finnish airports of Helsinki, Vaasa, Turku, Pori and Tampere for a discount of 60% on landing fares on domestic flights of domestic airlines, of the Portuguese Airport Authority, ANA, which offered discounts of 50% on charges for domestic flights of domestic airlines and of Brussels Charleroi airport, which offered lower charges to Ryanair.

Vertical relations have scarcely been dealt with in air transport studies (Oum and Fu, 2008). According to the same authors, the effects of vertical agreements are two-sided, and need further investigation. In this sense, this paper adds to literature as it is intended to fill this gap. Formal models on this issue were seldom developed, and conclusions on the sign of effects were never made clear. Mostly, and as far as we are aware, the effects of these vertical restraints on competitiveness and on welfare were never analysed. Vertical collusion between airports and airlines was analysed elsewhere (Barbot, 2008), considering the effects of a vertical merger (collusion) in the competition between two airports and between the airlines that use it. In this work, the role and the effects of other airlines (outsiders) were not assessed, as it is developed under the hypothesis that only one airline operates in each airport. The present paper does not focus on the issue of airport competition but rather of airline competition in a single airport and of market foreclosure³ in the event of a vertical agreement. The issue is of great importance within the context of air transport policy. In fact, it is unclear if these arrangements are pro-competitive and welfare-enhancing, and it seems that policy makers hesitate when facing cases of vertical agreements as well as on regulation practices in presence of these contracts. As an example, Oum and Fu (2008) refer that the US Federal Aviation Administration (FAA) has shown concern towards exclusive deals between airports and airlines.

Also, the paper adds to general literature of vertical merger as it considers two types of agreements that are common in air transport but were not analysed neither for other industries nor within a theoretical framework.

The paper is organised as follows. Section 2 provides a brief literature review on the effects of vertical restraints. Section 3 specifies some forms of vertical contracts. Section 4 develops the models and results. Finally, in Section 5 some concluding remarks are presented.

2. The effects of vertical restraints: Literature

³ We use foreclosure as the use of market power by one firm in one market to restrict output in another market, but excluding rival from this last market.

We shall first relate to vertical contracts in Air Transport literature. Starkie (2008) analyses the reasons and possible effects of vertical agreements between airports and airlines. Following this author, in Europe contracts are novel and result of air transport liberalisation. Before liberalisation, flag airlines were public entities that operated in public airports where they had a dominant position. There was no need of contracts as the vertical relation was between two public entities. With liberalisation these entities were often privatised, new airlines (in particular, low cost carriers) entered the market and many airlines started operating routes that were former preserved territories. Thus, air transport markets became more competitive but also more risky, which lead to the need of establishing vertical contracts. However, vertical contracts have a long duration and airlines will bear sunk costs, which will reduce their mobility in switching to other airports and so also airport competition will hampered. (Starkie, 2008). Thus vertical contracts are a novelty and tend to increase in number, which stresses the need to analyse their effects.

Oum and Fu (2008) suggest that both airports and airlines have incentives for vertical agreements, the former by being able to exclusively supply a dominant airline and so increase their market share towards other competing airports, and the latter by securing its operational needs as well as by getting competitive benefits over other airlines. Barbot (2008) shows that, however, that these benefits do not always exist and that they may be reaped out if other competing airports and airlines also engage in agreements.

Basso and Zhang (2007) focus on congestion delays with airport rivalry. In these authors' model there are two competing airports. A multistage game is used to determine capacities and fares, using congestion costs. Results regard the comparison between a monopoly and a duopoly facility, and a central planner one, in prices and congestion delays.

Basso (2008) analyses, as an extension, the case of two-part tariffs imposed by an airport, which, according to the author, leads to the same solution of joint profit maximisation by airports and airlines. With a two-part tariff the airport charges a price per flight plus a fixed fee. Though airlines behave as horizontal colluders, the maximisation of joint profits allows the airport to capture part of the airlines' extra profits by means of the fixed fee. Basso (2008)'s paper differs substantially from the

present one. In fact, this author considers an agreement with all airlines while I consider a contract with one (or more) airlines, but always leaving other airlines remain outside the agreement. This difference is important because, as will be shown in the paper, the existence of outsiders does not allow the airport to capture airlines' profits, but rather, it creates market power both in the downstream and upstream markets for one airline. Put in other words, in Basso (2008)'s paper there are no outsiders in the joint profit maximisation and pro-competitive effects cannot be examined, but only welfare effects. Besides, this author uses a Cournot setting in the downstream market, while I develop my paper with the Stackelberg model, though this does not make much difference to results, as will be shown below.

In what regards general Industrial Organisation literature on vertical relations, Tirole and Rey (2006) provide a wide survey on vertical restraints and merger. This literature is extensive and so we limit its review to the analysis of situations that are similar to our cases, in what regards the issues we focus, namely, the effects on market foreclosure and on welfare.

The debate on the effects of vertical restrictions on market foreclosure inside Industrial Organisation literature is also extensive. Ordober et al. (1990) provide a review of the critics addressed to the foreclosure result. These critics advocate that the excluded firms may have incentives to stay in the market. However, those incentives are based on the existence of other suppliers, which is not the case of this paper. Part of the criticism relies on the possibility of outsiders engaging in vertical contracts with other input suppliers, or simply buying the input from them at "market" prices. Another part claims that the upstream firm may not be interested in foreclosing the downstream market as it may lose buyers.

Ordober et al. (1990) give an example which is worth referring here: if the integrated downstream firm has a share of 10% the input supplier would lose 90% of the market. Our objection is that, in the case we are analysing, there is an airline with a larger market share. Airports would never establish contracts with airlines that are marginal in terms of market share. That is one of the reasons why we have chosen the Stackelberg model in the downstream market as it fits better real situations. In fact, the European cases mentioned in the Introduction of this paper involve contracts of airports and flag

(dominant) airlines. In the Charleroi case, Ryanair agreed “to base between two and four aircrafts at Charleroi and to operate at least three rotations per aircraft leaving Charleroi over a 15-year period” (European Commission, 2004). This means that, if the contracting airline was not a leader of the airport’s market share, the agreement planned that it would be. In fact, in 2002, the first year of the agreement, 94% of passengers departing from Charleroi were carried by Ryanair (European Commission, 2004). To engage in an agreement, it is necessary that one airline has a large market share. If it were not so, the validity of the criticism is a matter of time. If the airline is able to quickly fill the market (in the case, the slots) left by the foreclosed rivals, the argument is no longer valid. The same objection applies to a criticism referring to the fact that foreclosed rivals might well participate in the bidding for a contract with the upstream firm. Even if they were willing to, the airport would not probably be interested with in agreements with airlines that are marginal in terms of market share.

Effects of vertical mergers on consumer surplus have long been recognised as positive (Comanor, 1967). A merger of two successive monopolies increases consumer surplus, which was often expressed by the idea that successive monopolies are worse than a single monopoly. By eliminating double marginalisation vertical merger allows for lower downstream (consumer) prices. Outside the context of two vertically-related monopolies, there is a long literature considering two oligopolies or one oligopoly and competition, either in the upstream or in the downstream markets, and using Cournot or Bertrand competition. Results on welfare differ according to the models’ hypotheses. But none of these works deals with the simple case of an upstream monopolist and downstream imperfect competition and homogeneous goods⁴ which is depicted in this paper.

3. Types of agreements between airlines and airports

Literature on vertical merger shows that results depend crucially on the number of firms in each market and on the type of contract. In order to support the models developed in the next section and to set the limits within which their results are valid, it is necessary to review the types of agreements that airports and airlines are (or were) engaged in.

⁴ Comanor and Frech (1985) use an upstream monopolist but with two types of consumers, thus introducing product differentiation.

Contracts between airports and airlines have several forms, and clauses vary from case to case.

In Europe, these agreements have only been disclosed whenever they were investigated by the European Commission or by national authorities but they clearly aim at negotiating aeronautical fares. The Charleroi-Ryanair agreement is a good example of these contracts. The agreement involved a discount of 50% in landing charges (over the price charged to other airlines), and a discounted price for ground handling, by means of which Ryanair payed only about 10% of the price set for other companies (European Commission, 2004). In the Belgium, Finnish and Portuguese airports contracts, as referred above, the core of agreements was a discounted fare for flag airlines in domestic flights. This type of agreements is the base of our first case. Other types of agreements in Europe are not numerous. In Munich Airport, Terminal 2 is operated by a company that belongs to the airport and to Lufthansa and used exclusively by this airline and its partners. In Copenhagen airport, a discounted rate is offered to airlines that surpass a certain threshold of passenger numbers.

In the US, it is quite usual that some airlines (the so-called signatory airlines) sign contracts with airports. In general, these contracts establish that signatory airlines pay a lower price for the use of the airport's facilities, terminals and runways, (frequently, a price that approaches the operating cost), and a rent that intends to pay part of the airport investment. Such is the case of Atlanta International Airport Agreement⁵. We use the Atlanta agreement as the base for our third case.

Other clauses are sometimes added. The "Airline and Tampa Airport Use and Lease Agreement" establishes that signatory airlines pay fees and charges based on the airport's costs of providing facilities. They include not only the payment of investments,

⁵ "Under the Airport Use Agreements, the Signatory Airlines agree to pay landing fees to allow the City to recover certain operating and maintenance expenses as well as debt service plus 20% coverage on General Revenue Bonds issued to finance approved airfield capital improvements. The City has also entered into agreements that extend to 2010 with the principal passenger airlines serving Hartsfield-Jackson (the "Contracting Airlines") relating to their use and lease of the central passenger terminal complex (the "CPTC Leases"). The CPTC Leases provide for the calculation of terminal rentals and charges to allow the City to recover certain operating and maintenance expenses as well as debt service plus 20% coverage on General Revenue Bonds issued to finance approved terminal projects" (City of Atlanta Department of Aviation, 2007).

by means of specific rebates of debt service coverage but also sharing of the net remaining revenue. A similar agreement exists in Orlando International Airport.

In Dallas Fort Worth signatory airlines have a Use Agreement with the Airport Board. It is residual in the sense that all airport's revenues that exceed the airport's total costs (debt service, coverage, operation and maintenance costs) are returned to signatory Airlines. The Use Agreement allows signatory airlines to sublet their space to other airlines, whenever the former lease terminal space on an exclusive basis, as well as to be handled in it by signatory airlines. This contract approaches our second case.

Other airports, like Chicago O'Hare, have individual contracts with each signatory airline. Still, other agreements have been signed in Australia (for instance, at Sydney and at Melbourne⁶).

4. The model

4.1. General framework

The basic model assumes quantity leadership in the downstream market, where airlines sell tickets for flights to passengers, and, in the upstream market, where the airport sells its facilities (terminals, runways) to airlines, a situation of a single seller and a few buyers.

The application of Stackelberg quantity leadership to the downstream market seems more realistic. Table 1 shows a high concentration of airlines' flights in the 100 largest airports in the world, for 2005, with a mean for the first carrier's share of 38%, and of 56% for the two largest carriers. Most of these high shares belong to flag carriers, in Europe and Asia, or to carriers that established their bases at particular airports in the US. These airlines may be considered as quantity leaders because, as first comers, they chose their quantities (as well as the best timetables) and left the remaining slots for other carriers. Thus it seems that the Stackelberg behaviour is more appropriate than the Cournot model to assess the effects of vertical contracts. Table 2 exhibits the same

⁶ But terms of these agreements are not disclosed and were not known to the author.

concentration in some European secondary airports in 2004, where the dominance of low cost carriers is clear.

Insert Table 1

Insert Table 2

The downstream market consists of a route operated by $n+1$ airlines, one leader and n followers. I assume that flights are identical, with neither horizontal nor vertical differentiation. Demand for flights has a simple expression, $p = a-bq$, where p is the price and q the quantity. For simplicity, it is assumed that the only cost airlines bear is the airport aeronautical fare, P , per passenger, while the airport has a constant marginal operational cost, c , per passenger, and a fixed cost, F .

The game is played in two stages. In the first stage the airport chooses the aeronautical fare, P , and in the second stage airlines choose their quantities.

4.2. Basic model with no agreement

In the basic model, in the second stage airlines compete in quantities in the usual Stackelberg fashion. Each one of the followers (or airline i) maximises its profits, $\pi_i = (p(q_i + (n-1)q_j + q_D) - P)q_i$, where q_D is the quantity of the leader and q_j is the quantity of any of the other followers. As costs are identical, $q_j = q_i$, and the best reply functions (BRFs) will depend only on q_D . Using the followers' BRFs the leader maximises its profit, $\pi_D = (p(q_D + nq_i(q_D)) - P)q_D$ and find its quantity, $q_D(P)$ while the followers will determine their quantity, $q_i(P)$, depending on the leader's.

In the first stage the airport maximises its profits, $\pi_A = (P(q_D + nq_i(q_D)) - c)(nq_i(q_D) + q_D) - F$, with its derived demand function, $q(P) = q_D(P) + q_i(P)$, finding solutions for all variables. Results are in Appendix 1.

4.3. First case: vertical merger

In this case the leader airline and the airport negotiate the fare, P_l that the leader will pay for using the airport facilities. The other n airlines will pay a fare P , as before, with

$P > P_I$. The negotiation aims at both partners obtaining the highest joint profits so that the solution for this case is the same of a vertical merger.

This merged firm maximises, in both markets (in q_D and P), its joint profits, $\pi_C = (p(q_D + nq_i(q_D)) - c)q_D + (P - c)nq_i(q_D) - F$, using the followers' BRFs. Results for all variables are in Appendix 1.

The price P_I will be obtained by negotiation, depending on the bargaining power of each partner, but this price is not relevant for our analysis.

Proposition 1: *An agreement between one airport and the leader carrier established to negotiate a lower fare for the airline: (a) is anti-competitive, as the other airlines are driven out of the market; (b) if the demand function in the downstream market is linear, it increases welfare and consumers' surplus.*

Proof:

(a) The merger forecloses the downstream market by making $P = p$. If making $P < p$ were a profit maximising solution for the merger, it would face competition and have $\pi_C = (p(q^*_D + nq_i(q^*_D)) - c)q^*_D + (P - c)nq_i(q^*_D) - F$. With $p = P$, it will be a monopoly in the downstream market and have a maximum profit of $\pi_F = (p_F(q^*_F) - c)q^*_F - F$. It is necessary to show that: $\pi_F > \pi_C$. Let $\pi_M = (p_M(q^*_M) - P)q^*_M - F$ be a monopolist's profit in the downstream market with unitary cost P . Then, $\pi_M + (P - c)nq_i(q^*_D)$ is always higher than π_C . If $\pi_F > \pi_M + (P - c)nq_i(q^*_D)$, $\pi_F > \pi_C$. This happens if $(p_F(q^*_F) - c)q^*_F > p_M(q^*_M)q_M - Pq_M + Pnq^*_i - cnq^*_i + cq_M - cq_M = (p_M(q^*_M) - c)q_M + (P - c)(nq^*_i - q^*_M)$. But, as $(nq^*_i - q^*_M) < 0$, if $(p_F(q^*_F) - c)q^*_F > (p_M(q^*_M) - c)q^*_M$, the above inequality holds. Note that $(p_M(q^*_M) - c)q^*_M$ is the profit of a monopolist in the downstream market with cost c (or the profit of the merger). But if it is so, the monopolist will never have chosen q^*_M because q_F originates the highest profit in this case. So, the inequality $(p_F(q^*_F) - c)q^*_F > (p(q^*_D + nq_i(q^*_D)) - c)q^*_D + (P - c)nq_i(q^*_D)$ is true and means that the merged firm prefers to make $P = p$, and so make the outsiders' profits equal to zero and become a monopolist in the downstream market. The agreement is anti competitive.

(b) If demand in the downstream market is linear, the sum of the n airlines' BRFs will have the form: $q_i = A - Bq_D$, with $B < 1$. Then the whole quantity, q , is $q = A + (1-B)q_D$, an increasing function of q_D . But q_D is higher (and so does q) when $q_i = 0$ than when $q_i > 0$. Then the merger provides a higher quantity than the pre-merger situation. The higher quantity leads to a lower price and a to a higher consumer surplus.

The profit of a downstream monopolist with marginal cost P is higher than the sum of all firms' profits in the pre merger situation. Besides, the sum of this monopolist's and the initial airport's profits is lower than the merger's profit (a monopolist with marginal cost c), so that the sum of all profits and thus welfare will be higher with the merger.

Joint profit maximisation, by eliminating double marginalisation, offsets the downstream monopoly effect and consumer surplus and welfare will be higher.

Re-doing the model with a Cournot game in the downstream market, the airport colluding with one of them leads to the same result. So there is no need of quantity leader. Stackelberg model was used as it seems to depict better real situations. A contract between the airport and two or more airlines would also not change results, provided that there were some outsiders left out of the agreement. In this situation the merged airlines would act as colluders in the downstream market.

Corollary 1: *If a regulator sets a price P_R , $p > P > P_R > c$, in the upstream market, (a) the leader and the airport may, under certain conditions, be interested in signing the agreement (b) with the agreement, the outsiders will remain in the market and (c) if demand in the downstream market is linear regulation increases consumers surplus.*

Proof:

(a) The leader and the airport may agree in negotiating a lower price, P_N ($P_N < P_R$). The merger profit would be $\pi_F = (p(q^*_F + nq_i(q^*_F)) - c)q^*_F + (P_R - c)nq_i(q^*_F) - F$. The merger is now a Stackelberg leader with cost c . A lower cost yields a larger quantity and a higher profit margin. The outsiders' quantity q_i increases as the followers' cost (P_R) is smaller, but also decreases because the leader's quantity is higher. The difference between the merger's profit will be higher than the sum of profits of the leader and the airport under regulation if $(p(q^*_F + nq_i(q^*_F)) - c)q^*_F + (P_R - c)nq_i(q^*_F) > (p(q^*_D + nq_i(q^*_D)) - c)q^*_D + (P_R -$

$c)(nq_i (q^*_D)+ q^*_D))$. If the gains in the downstream market outweigh the losses in the upstream market, which depends on price elasticities, the agreement will be interesting for both partners.

(b) Now the merged firm cannot set $P=p$. With any price P_R , $p > P > P_R > c$, the outsiders will make profits and remain in the market.

(c) Then regulation is pro-competitive but does not eliminate incentives for contracts of this type. However, and it can be easily computed from the expressions in Appendix 1, downstream quantities increase for any $P_R < P$. Then, downstream prices fall, and so consumer surplus is higher.

This case corresponds to the situations referred above of European airports discriminating prices amongst airlines (Finish and Portuguese airports, or the Charleroi agreement). Our conclusions show that, if there are no capacity constraints⁷, there is no reason to condemn these agreements if aeronautical fares are regulated. If they are not, the regulator will face the trade-off between an increase in welfare and a loss in competitiveness.

4.4. Second case: Airlines in the upstream market

Starkie (2008) describes the Australian case as one in which one or more airlines lease and operate terminals. The same is true for the agreement in Dallas Forth Worth. All airlines that remain outside this agreement use the terminal facilities provided by those (the signatory airlines) that explore them. Part of the upstream market services are now supplied by one airline.

In order to model this situation we divide the airports' facilities in two items: terminals, with a constant marginal cost of t , and runways, with constant marginal cost of r . Suppose then that the dominant airline now fully operates the terminal, using its facilities and selling them to other airlines at a price P_I , while the airport operates the

⁷ Constraints on capacity might limit the outsiders' quantity.

runway for all airlines at a price P_2 . Previous to the agreement $c=t+r$, but afterwards the airline may have a higher (or lower) efficiency in the terminal operation.

The dominant airline's profits will be $\pi_D = (p(q_D+nq_i(q_D))-t-P_2)q_D + (P_1-t)nq_i(q_D)$, and each of the followers' profits will be $\pi_i = (p(q_i+(n-1)q_j+q_D) - P_1 - P_2)q_i$. As in the basic model, outsiders have a BRF, derived from their profit maximisation. The leader maximises its profit using the followers' BRFs, and from there results the derived demand for the airport's facilities, now with two firms exploring them. In the upstream market the leader and the airport compete in prices P_1 and P_2 for complementary goods (the terminal and the runway). The airports' profits are now originated only by the revenues of the runway facilities: $\pi_A = (P_2(q_D+nq_i(q_D))-r)(q_D+nq_i(q_D))-F$. Solutions for the upstream prices yield solutions for all other variables and are presented in Appendix 1.

Proposition 2: *With a linear demand function in the downstream market, a contract between the leader airline and the airport, stating that the airline operates and sells part of the airports' facilities, (a) is anti-competitive and (b) decreases consumers' surplus and welfare, unless the leader airline is able to increase the efficiency in the facilities it operates.*

Proof:

The proof uses the expressions of Appendix 1.

(a) The profit maximising solution for the leader is to set $q_D = \frac{a-t-r}{4b}$ and $q_i=0$. Then $n=0$. In the first stage (upstream market), the best solution for the leader and for the airport is to set $P_1 = p-P_2$, resulting zero profits for the followers, which are driven out of the market.

With this contract the leader can, by itself, foreclosure the market by setting $P_1 = p-P_2$. In the first stage, the leader and the airport compete in the upstream market, with BRFs $P_1(P_2)$ and $P_2(P_1)$ that are negatively sloped, as goods (terminal and runway) are complements. Setting a higher P_1 will lead to a lower P_2 , which causes a fall in the leader's costs. Moreover, if $P_1 = p-P_2$, the leader will have monopoly profits in the downstream market. The two benefits outweigh the losses derived from not selling the

terminal facilities to the other airlines, under the assumptions of Proposition 2 (linear demands). If demands are not linear, the result depends on the balance between gains from being a monopolist and gains from selling the terminal facilities, or on downstream and upstream demand elasticities.

(b) Consumers' surplus is lower after the agreement than before it if:

$$\frac{(a-t-r)^2}{32b} < (2n+1)^2 \frac{(a-c)^2}{32b(n+1)^2}.$$

If $c=t+r$, this inequality holds for any $n>0$ ⁸. Then, if there are no efficiency improvements, consumers' surplus decreases. It can only be higher if the leader improves enough the terminal operations efficiency, or if:

$$\frac{a-(t+r)}{a-c} > \frac{2n+1}{1+n}.$$

This ratio depends positively on n , which means that the more

airlines in the market before the agreement, the higher should the ratio be, or the more should the leader increase terminal operations efficiency in order to improve consumers' surplus.

Comparing welfare after and before the agreement, the former should be lower if:

$$7 \frac{(a-t-r)^2}{32b} - F < (2n+1)^2 \frac{(a-c)^2(6n+7)}{32b(n+1)^2} - F.$$

It also happens that this inequality holds for any $n>0$, or that, when $c=t+r$, welfare is lower after the agreement.

Proposition 2 provides interesting policy insights, as it shows that this type of contracts should only be allowed under the condition of airlines improving the efficiency of terminal operations.

Corollary 2: If the leader airline does not improve efficiency in the airport facilities it operates, an agreement set under the conditions of Proposition 2, may only be interesting for both partners if the leader airline pays a rent to the airport that

⁸ Notice that n is the number of followers in the market before the agreement.

compensates it for its losses. There is an interval of values in which values for this rent exist.

Proof:

The airport loses profits with the contract, as it now only sells part of its facilities. Suppose that $c=t+r$, and make $k=a-c=a-(t+r)$. The rent, R , should be higher than the airport's losses:

$$R > k \frac{n}{8b(n+1)}.$$

On the other hand, the rent should be lower than the leader's gains with the agreement:

$$R < k \frac{n}{16b(n+1)}.$$

It is possible that such a value of R exists for any $n>0$. Then, there are incentives for the agreement provided that the negotiated rent lies between those two limits.

Corollary 3: *In the case of an agreement in the conditions of Proposition 2, if the regulator price caps P_1 all airlines will stay in the market but if only P_2 is regulated then regulation cannot prevent the agreement from being anti-competitive and the monopoly in the downstream market will persist.*

Proof:

Let P_1^* and P_2^* be the upstream market prices under the agreement. If the regulator sets any price cap for the terminal facilities, P_1^R , $t < P_1^R < P_1^*$, the leader cannot by itself be a monopoly in the downstream market, by eliminating its competitors. This result can only be achieved if the airport would set P_2 such that $P_2 = p - P_1^R$. In the upstream market, the airport's BRF is $P_2(P_1)$, and is negatively sloped. As P_1 falls with regulation, the airport increases P_2 . The airport may push up P_2 up to the limit $P_2 = p - P_1^R$, which would eliminate the followers, or keep it below that value. The first alternative leads to a monopoly in the downstream market, a smaller number of passengers and less market power for the airport. The second alternative keeps competition in the downstream market, with more demand and more market power for the airport. The airport would never give up demand and accept a downstream monopoly that would lead to a fall in P_2 . It will prefer to set $P_2 < p - P_1^R$.

If P_2 is regulated, it must be set below the initial price, $P_2^R < P_2^*$. In the upstream market the leader alone determines P_1 . As its BRF is negatively sloped, it may charge a higher P_1 and eliminate the followers in the downstream market. As shown in Proposition 2, the leader prefers this solution.

Then, the regulation of airports where these types of agreements exist should focus on the price of the facilities that one (or more) airline operates, and not on those under the operation of the airport.

3.5. Third case: price discrimination

This case depicts many of the agreements between an airport and the so-called signatory airlines in the US, which are established in a way that airlines pay the airport the variable costs of its facilities plus a part of the fixed costs. As shown in Section 3 they sometimes contain a clause that allows the airlines a share in the airports' revenues. In our model, we shall disregard this clause and so assume that the dominant airline pays exactly the cost c for using the airport facilities, as well a part, k , of the airport's annual fixed costs, in the total amount of kF , which is agreed between the two partners. The other airlines pay a price, P , for the use of the airport's facilities.

Let q_D^C be the leader's quantity after the agreement. The dominant airline's profits are now: $\pi_D = (p(q_D^C + nq_i(q_D^C)) - c)q_D^C - kF$, and the airport's profits: $\pi_A = (P(nq_i(q_D^C)) - c)nq_i - (1-k)F$. An outsider airline will have profits of $\pi_i = (p(q_D^C + nq_i(q_D^C)) - P)q_i(q_D^C)$.

Proposition 3: *An agreement between an airport and an airline, by which the airline pays the cost of using the airport's facilities plus a fixed rent, does not foreclose the downstream market. Moreover, if the demand function in the downstream market is linear consumer surplus and welfare will be higher with the agreement.*

Proof:

The leader cannot control the downstream market as all the airport's facilities are directly sold to the outsiders by the airport, which determines P . From the expression of the airport's profits, $\pi_A = (P(nq_i(q_D)) - c)nq_i - (1-k)F$, it is clear that it will never make

$P=p$, or it would lose all revenues, except kF , which only covers part of the fixed costs and is not relevant for the determination of P .

Using the expressions of Appendix 1 it is easy to show that the difference in consumer surplus after and before the agreement is $\frac{1}{8}(3n^2 + 7n + 3)\frac{(a-c)^2}{(n+2)^2 b}$. This expression is always positive. This difference increases with n , meaning that the higher the number of airlines in the downstream market, the more consumers benefit with the agreement. A similar positive difference is obtained for welfare:

$$\frac{1}{16}(2n^4 + 15n^2 + 35n^2 + 30n + 6)\frac{(a-c)^2}{(n+2)^2(n+1)^2 b}, \text{ which is always positive.}$$

Then, under the conditions of Proposition 3, this kind of agreement is not anti-competitive and leads to a higher welfare. However, these contracts are price discriminatory as the signatory airlines pay only the cost of the facilities while the other airlines pay a full price P that includes a profit margin. As Rey and Tirole (2006) point out, anti-discrimination legislation may have a perverse effect of decreasing welfare by restoring the monopoly power of the input supplier.

If the demand in the downstream market is not linear, it is true that q_D will always be higher, as the leader's costs are now lower ($c < P$). This rise will cause a fall in q_i . But the airport's demand is smaller now, as the leader is out of this market, and P will fall, which will cause a rise in q_i . The final result in q_i and in the total quantity will depend on the outsiders' best reply function, and on price elasticity in the upstream market, which depends on the downstream demand function. If the total quantity rises, consumer surplus will increase.

Now we analyse the conditions of the agreement. It is easy to see that the leader's profits are higher as its costs are lower after the agreement. As for the airport, it loses part of its revenues (those from the leader's use of its facilities), has a smaller demand and charges a lower price. So, the rent airlines pay to the airport, kF , must, at least, compensate it for its losses.

$$kF > (P(q_D + nq_i(q_D)) - c)(nq_i(q_D) + q_D) - (P(nq_i(q_D^C)) - c)nq_i(q_D^C).$$

The leader will only pay a rent kF that does not diminish its profits:

$$kF < (p(q_D^C + nq_i(q_D^C)) - c)q_D^C - (p(q_D + nq_i(q_D)) - P)q_D$$

Corollary 4: *With a linear demand function in the downstream market, there is not a value for the rent the leader airline pays to the airport that is interesting for both parties.*

Proof:

The rent should have an upper limit equal to the leader's gains with the agreement and a lower limit, equal to the airport's losses:

$$kF < \frac{1}{4}(2n+3)\frac{(a-c)^2}{(n+2)^2b} \text{ and } kF > \frac{1}{4}(n+1)\frac{(a-c)^2}{(n+2)b}$$

From the expressions in Appendix 1 it is easy to show that the extra profits the leader earns with the agreement are smaller than the profits the airport loses for any $n > 0.618$. Then there is no value of kF that matches the above conditions, or, put in other words, that makes the agreement interesting for both partners. Thus, or it is a public airport and is not interested in profits, but only in attracting more traffic, or it can pay the losses with concession revenues⁹. These revenues not only increase the airport's profits but also have effects on all the model's variables. Namely, they induce the airport to lower aeronautical charges in order to get more passengers, and consequently induce airlines to lower their fares.

Corollary 5: *If, under the agreement, a regulator sets a price cap $P_R < P^*$, where P^* is the equilibrium price with the agreement, and if the downstream market demand function is linear, regulation will only lead to a higher consumer surplus if there is a single airline behaving as follower in the downstream market.*

Proof:

The price cap not only affects the equilibrium quantities of the airport and of the airlines that remain outside the agreement (non-signatory airlines), but also the leader's

⁹ Re-doing the model with concession revenues, and even in the simplest option (considering that each passenger spends a fixed amount in concession activities) yields too complex results to be analysed.

quantity, through the followers' BRFs. Suppose P^* is the upstream equilibrium price for the airport's (runway) facilities, with the agreement and before regulation. The regulator sets a price P_R , $c < P_R < P^*$. With a smaller input price, q_i will be higher, as the followers have a lower cost, but, as q_D is lower, with linear demand functions in the downstream market, the whole quantity, q , is smaller for $n > 1$. In fact, and as can be seen in Appendix 1, the difference between the two quantities (after and before regulation) is equal to $-\frac{1}{2}(n^2 - 2)\frac{P - P_R}{b(1 + n)}$, which is negative for any $n > 1.4$. For any $n \geq 2$,

downstream quantities will be lower, and prices higher, leading to a lower consumers' surplus. Consumers will only be better-off if there is a single follower, or in the case of a duopoly.

With more than one follower there is no point for regulation. Moreover, the agreement is pro-competitive, but regulation only changes the relative quantities of the airlines, by increasing q_i and decreasing q_D . If the market is competitive enough (or if it has more than one follower), the agreement is more efficient without regulation.

5. Concluding remarks: Some policy issues

This paper is intended to answer to questions that are currently of great importance for designing appropriate policies for the air transport industry, namely how vertical relations between airports and airlines affect competition and welfare, what is the scope for price discrimination legislation, and how regulation performs when there are vertical restraints.

According to findings of Industrial Organisation literature, pro-competitiveness and welfare effects depend on market structures and on the clauses included in vertical contracts. We concluded that price negotiation (or vertical merger) and the operation of terminals or other airport facilities by airlines are anti-competitive.

The first case typically exhibits the trade-off between competitiveness and welfare (as the merger increases consumers' surplus and welfare), leaving politicians a decision on allowing or not agreements, which means making (or not making) passengers or other airlines (with implications on other variables, like employment) better-off. However,

regulation may balance the trade-off, by leaving consumers better-off and by giving room for the merger but not for market foreclosure. Additionally, and as the agreement improves consumers' surplus but price discriminates amongst airlines, politics should review the scope for price discrimination legislation.

The second form of vertical contract only increases consumers' surplus and welfare if there are enough improvements in terminal operations by the airlines. The lesson that can be learnt (though within the restrictive model framework of this paper) is that these arrangements should be allowed under the condition of airlines achieving a higher efficiency in terminals operations. Welfare-enhancing regulation should focus on this point, and pro-competitiveness regulation should focus on capping the price signatory airlines charge to others, but not the price the airport charges all airlines.

The third form of contract is pro-competitive and increases welfare. So, it seems that there is nothing wrong with these contracts. The only problem that there is no incentives for airports signing them, except if they are public and have other aims than mere profits, or if they can compensate losses with higher expenses in concession activities' goods and services. Moreover, it seems that regulation cannot add much, unless the market has few firms. This third form of vertical contract is also price discriminating, which adds another reason for questioning the point for not allowing this practice.

Finally, we should point out that anti-competitive results may not happen in a way that all airlines kept outside agreements are driven out of the market. Additional market imperfections, like slots' grandfathering rights hold by these airlines, or the leader's lack of capacity to supply the whole demand in the downstream market may prevent this result. Thus results should be understood as a tendency, or an increase in the contracting airline's share, which does not withdraw the validity of the outcomes for policy purposes.

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APPENDIX 1

1. Basic model

Downstream demand function: $p = a - bq$.

CS = Consumers' surplus

W = Welfare = consumers' surplus + sum of profits of all airlines + airport's profits

Results:

$$P = \frac{1}{2}(a + c); p = \frac{3a + 2n(ac) + c}{4(1 + n)}$$
$$q_D = \frac{a - c}{4b}; q_i = \frac{a - c}{2b(1 + n)}; q = \frac{(a - c)(2n + 1)}{4b(n + 1)}$$
$$\pi_D = \frac{(a - c)^2}{16b(1 + n)}; \pi_i = \frac{(a - c)^2}{16b(1 + n)^2}; \pi_A = \frac{(a - c)^2(2n + 1)}{8b(1 + n)} - F$$
$$CS = \frac{(a - c)^2(2n + 1)^2}{32b(1 + n)^2}; W = \frac{(a - c)^2(2n + 1)(6n + 7)}{32b(1 + n)^2} - F$$

2. First case

Results:

$$P = p = \frac{1}{2}(a + c)$$
$$q_D = q = \frac{a - c}{2b}; q_i = 0$$
$$\pi_F = \frac{(a - c)^2}{4b} - F; CS = \frac{(a - c)^2}{8b}; W = \frac{3(a - c)^2}{8b} - F$$

Regulation :

$$q_D = \frac{(a - c)}{2b}; q_i = \frac{a - c - 2P_R}{2b(1 + n)}; q = \frac{a - c + 2n(a - P_R)}{2b(1 + n)}$$

3. Second case

Results:

$$P_2 = \frac{a+r-t}{2}; p = \frac{3a+t+r}{4}$$
$$q_D = q = \frac{a-t-r}{4b}; q_i = 0$$
$$\pi_D = \frac{(a-t-r)^2}{16b} - F; \pi_A = \frac{(a-t-r)^2}{8b}$$
$$CS = \frac{(a-t-r)^2}{32b}; W = \frac{7(a-t-r)^2}{32b} - F$$

4. Third case

$$P = \frac{a+2cn+3c}{2(n+2)}; p = \frac{3an+4a+4cn^2+9cn+4c}{4(1+n)(n+2)}$$
$$q_D = \frac{(3n+4)(a-c)}{4b(n+2)}; q_i = \frac{a-c}{4b(1+n)}; q = \frac{(a-c)(4n^2+9n+4)}{4b(n+1)(n+2)}$$
$$\pi_D = \frac{(a-c)^2(3n+4)^2}{16b(1+n)(n+2)^2} - kF; \pi_i = \frac{(a-c)^2}{16b(1+n)^2}; \pi_A = \frac{(a-c)^2 n}{8b(1+n)(n+2)} - (1-k)F$$
$$CS = \frac{(a-c)^2(4n^2+9n+4)^2}{32b(1+n)^2(n+2)^2}; W = \frac{(a-c)^2(4n^2+15n+12)(4n^2+9n+4)}{32b(1+n)^2(n+2)^2} - F$$

Regulation:

$$q_D = \frac{a-c+n(P_R-c)}{2b}; q_i = \frac{a+c(n+1)-P_R(n+2)}{2b(1+n)}; q = \frac{a(n+2)-cn(1+n)+P_R(n^2-2)}{2b(n+1)}$$