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State Aids granted by regional airports: a two-sided market analysis

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Abstract

A lot of cases had arise in the past decade about agreements between regional airports and low-cost carriers. These agreements are challenged on the basis of the State Aids European control as they rise concerns not only about competition distortions between airlines but also about fiscal competition risks among Member States or local governments. Such phenomena could be expected as regional airports are characterized by significant overcapacities and overlapping inducing a substitutability for airlines. Surprisingly, the new 2014 guidelines on State Aids granted to airlines open the way to transitory operating aid schemes, an option apparently at odds with the European longstanding principles. Our purpose in this paper is to demonstrate with the help of the development of a model, that such agreements can make sense from the economic point of view provided that the relationship between the carrier and the airport is no longer analyzed as a vertical chain, inducing an assessment in terms of economic dependence, but as a two-sided market. The favorable usage terms granted to low cost carriers generate additional flows on the other side, with commercial revenues from shops or parking. Consequently, subsidizing operating costs might be rational, even for a private investor in a market economy, and might be a perennial device.

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For more than fifteen years, the European Commission has issued several decisions concerning State aids cases involving regional airports and low-cost carriers (hereafter LCCs). Some of the provisions of the agreements between airports managers and the LCCs involves rebates in airport charges and other advantages, as start-up aids to create new routes or co-funding schemes of marketing campaigns. Such schemes may lead to some discriminations between airlines and as a consequence may be qualified as State Aids according to the European competition law. The rebates and the other advantages granted may impair the level playing field in the competition between airline carriers. They may also lead to competition distortions between regional airports (Malavolti and Marty, 2010). This last risk is all the more significant that the LCCs can easily arbitrate between competing infrastructures that they can see as substitutable considering the utility functions of their passengers. These ones may accept more time consuming transfers to a destination than affairs customers or might be indifferent between alternative locations for holidays, even if these ones are very distant from each other. In other words, the LCC trade-offs may take place between close airports, as many European regional infrastructures are characterized by numerous overlaps in their catchment areas, as the last ECA report stresses, but also between very distant ones. The potential tax competition issue cannot be

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only conceived in the framework of a Hotelling-type model. The competitive pressure for regional airport managers is aggravated by their over-capacities. Attracting and maintaining airline routes is an imperative need for several airports and may lead some of them to accept unbalanced contractual terms. If an airport obtains the opening of a new route by a LCCs based on the closure of an existing one from another competing infrastructure, a tax competition type race might be initiated. As in the same time the development of the LCCs is main growth driver in the EU airlines market, the European Commission cannot refuse all the agreements on the basis they may induce competition distortions. In order to cope with an increasing number of litigations, often initiated by historical operators (flag-carriers) or competing infrastructures, the Commission issued in 2005 new aviation guidelines. If the 1994 guidelines were adopted in the context of the liberalisation of the European market for air transport services, the 2005 ones also addressed the issues of the public financing of airports and of the start-up aids for airline services operated from regional airports. However, these guidelines do not deal with the issue of operating aids, the most distortive ones and at the theoretical point of view the more inconsistent with the EU competition law. It was necessary to adjust the EU DG Competition monitoring framework to the new specificities of the market, characterized by the emergence of the low-cost/ low-fare model and the more and more sensitive issue of the overcapacities of regional airports throughout the EU. The new 2014 guidelines both contribute to broader Commission's policy objectives (sustainable and more inclusive growth strategy) and participate to its modernisation strategy of State Aids control. This one is based on the implementation of a more economic approach that privileges an effect-based assessment of the State aids on a more formal, legal-based, evaluation procedure. In this framework, the decision of the grantor might be considered as free of aids despite the public origin of the funds if it meets the requirements for being qualified of 'market economy operator principle' (MEOP) compliant decision. No State aids has to be notified to the EU Commission as soon as a private investor may take the same decision in terms of risks and expected financial returns. The purpose of this communication is to shed a specific light to the agreements between LCCs and regional airport managers by analysing their compliance with the MEOP according to a two-sided market model. Our objective is to demonstrate that even long-term operating aids may be optimal in economic terms. In other words, the paper purpose is to show that a private investor may accept to commit into this kind of arrangement. The two-sided structure is based on the duality of the airport revenue sources. On a first side, the airport benefits from aeronautical services revenue flows. On a second side, the airport also receives payments from non-aeronautical activities as commercial rents from shops or parking revenues. The revenues produced by these activities are closely dependent from the number of passengers using the airport. It can make sense to consider that the customers of the LCCs are first of all the airports and not the passengers if the airport is supposed to 'buy' traffic from the LCCs to maximize the number of passengers and consequently its commercial revenues. The airport acts like a platform that can accept to renounce to a part of its aeronautical revenues expecting that the increase of non-aeronautical ones will compensate this 'investment'. As a consequence, the tax rebates and the other aids schemes may also be accepted by a private market investor who wants to maximize its aggregated revenues on the two sides of the market. In the same way, such rebates (operating aids) may be rational not only on a transitory basis but can also be rational as a perennial scheme. By taking the issue to the extreme, we might also assume that negative tariffs on the aeronautical side might be sustainable for a private investors as soon as the cross elasticities between the two sides are sufficient to generate a sufficient amount of revenues to compensate this loss. In practice, these kind of arrangements take the form of commercial revenues sharing schemes between the regional airport and a (there dominant) LCC. Our communication aims at providing an economic rationale to the aids granted to LCCs and explore the interaction between the regulation of aeronautical fees and the competition law based control of State Aids. In a nutshell, the aeronautical taxes are regulated according a price-cap scheme. In other words, the purpose of the ex-ante regulation is to avoid that the manager of the infrastructure would abuse of its 'monopoly' position to charge tariffs exceeding its complete costs. It is a matter of optimal regulation of an essential facility. Avoiding that the owner of the natural monopoly would be in position to extract all the airlines surpluses supposes to make its tariffs cost-oriented and to impose non-discriminatory conditions among the different users. If such a model is well-fitted in a major-airport, especially in congested hub, things are radically different for regional airports that do not enjoy any dominant position in their negotiations with airline carriers. The issue at stake is not the monopoly one, but the monopsony. If we suppose that the tariff is optimally set, it allows the airport to cover its complete costs. As soon as a tax rebate is granted the airport will fail to cover its costs, the issue of State aids is at stake. Our research hypothesis is the following: if the ex-ante regulation would privilege a floor model and not a cap one, it may allow to limit fiscal competition risks (by making mandatory to cover a given part of the

airport whole costs) and to limit the amount of the public aid granted (and consequently its distortive effects both for public finance and for competition). The institutional framework: the European guidelines on state aid to airport and airlines. The main purpose of the European competition policy is to complete the internal market and to guarantee a level playing field for all the economic operators, e.g. to prevent any competition distortion. The old ordoliberal conception of a complete competition framework is at stake. The competition policy has to prevent any impairment to the market process both coming from public or private economic powers. The competition process must remain undistorted. The control of State Aids finds its meaning within this logic. Discretionary and specific subsidies granted to an economic operator distort competition between private firms and may constitute an obstacle in the completion of a common market of free and fair competition. This last type of distortions may be significant as regional airports are excessively numerous and close from each other in the EU territory and as the negotiations between them and the LCCs are intrinsically biased. Indeed, we have seen in our introduction that a LCC may realise some trade-offs between different airports without fearing an excessive impact in terms of demand, especially because of the relative importance of its leisure passengers compared to a flag company operating from or toward a congested hub. In the same time, its switching costs are all the more reasonable given that a LCC commonly outsources its airport services and given that the airports themselves often fund start-up investments. So, the choice of the LCC is characterised by the low level of both sunk costs and switching costs. On the contrary the airport is in position of contractual hostage as it has already invested in specific assets (the infrastructure). Not only, the airport must generate or maintain route to limit its overcapacities but also it has to face political and general interest related pressure to ensure its public service missions as connectivity. As a consequence, controlling State Aids aims at preventing competition distortions between firms and collectively suboptimal dynamics of tax competition between regional airports (Marty, 2005). Even if the article of the European Treatises relating to State Aids control are the same since the Treaty of Rome, their enforcement has significantly evolved during the last ten years. The main change driver is the implementation of the so-called effects-based approach (Crocioni, 2006). This one helps to avoid a per-se prohibition of some devices (as operating aids, as we will see) by promoting a unique criteria based on the market failure correction. A State Aid is compatible with the Treaty if it address a market failure, if it is necessary to correct it (e.g. it doesn't exist any less distortive solution), and if it is strictly proportionated to this purpose. A State measure might be also accepted and won't be seen as a State Aid if it is compliant, as we have noticed, with the MEOP. Whatever the origin of the resources involved, public or private, an investment, that a private investor might decide, is compliant with the Treaty, as this one is neutral between public and private ownerships. The 2014 guidelines specifically address the issue of regional airports. Despite the concerns of overcapacities, the European Commission opens the door to airport infrastructure aids, hoping that these last defined according to a threshold of 3 million passengers may reach a financial equilibrium after a ten years transitional period. For the smallest ones, characterised by annual traffic below 700000 passengers, the Commission accepts not just only start-up aids but also operating ones. The objectives of the Commission is to take into account the new economic model of regional airports and LCCs and to contribute to territorial cohesion and development. For instance, the criteria are more flexible for remote regions. In a nutshell, one of the main novelty of the 2014 guidelines compared to the 2005 ones, is the acceptance by the Commission of operating aids (European Commission, 2005). If these ones are undoubtedly the most distortive, they might make sense as our model will show in a context of a privatization trend of regional airports and of an European airline market in which the LCCs have already catch up the market share of flag-carriers with 44%, after a decade of annual growth rates from four to five times higher. However, it is impossible to rely on a unique model to describe the relationships between airline carriers and airports. The situations of the 500 European airports is particularly contrasted (European Commission, 2014a and 2014b). The main hubs are characterized by congestions and raises some issues related to barriers to entry (the slot is here an essential facility). Remote region airports benefit from a monopoly situation and from the specific regulation of economic services of general interests (EISG). The crucial issue is the situation of the regional airports, which are characterized by the overcapacities that we have already stressed. The airports that count less than one million passengers each year represent 60% of the European infrastructures but only 4% of the European traffic. The 2014 report of the European Court of Advisors shows that even the traffic has increased of 60% between 2001 and 2010, 48% of the EU airports failed to equilibrate their accounts. Increasing the number of passengers appears as a necessity to reach financial equilibrium. According to the ECA (2014), only the more than five million PAX airports (passengers by year) operate profitably. The airports between five and one million, commonly operate above their shutdown threshold but below their breakeven point. In other words, if they succeed to fund their operating

costs, they failed to fund all their structure ones. The situation is logically worse for the regional airports below one million PAX. The new 2014 guidelines have to cope with this issue by relaxing the rules on start-up and operating aids without inducing excessive distortions. The Commission, who has issued one hundred decisions based on the 2005 guidelines (European Commission, 2014b), aims at simplifying its regulation and incorporating these new business model according to an effects-based approach. A first dimension is related to the EISG issues. The new guidelines defines a 'de minimis' rule allowing the airport to not notify the agreement on an ex-ante basis, if the annual traffic is inferior to 200000 passengers. The second issue is significantly more important. It deals with start-up aids. Such agreements will be validated by the Commission if the airport demonstrates a positive net effect, taking into account externalities and relying on robust traffic forecasts. The allowed intensity of the State Aids is decreasing according to the size of the airport. If an airport is characterized by a traffic between 3 and 5 million of PAX, the cap is set at 25%, but between 1 and 3, it can reach 50% and may be rise at 75% for the airports under this threshold. The third dimension is the most crucial for our purpose. It deals with operating aids. If the 2014 guidelines opens the room for operating aids, we have to put into relief that these ones may be only granted for a transitional period of 10 years. This one is seen as sufficient to adjust their economic model to the new market situation. As the Commission underlines in its February 2014 memo: 'this will give them time, for example, to gradually increase airport charges for airlines, rationalise their activities, differentiate their business model or attract new airlines and customers to fill idle capacity'. The intensity of the aid must also be decreasing during this period. Only the airports with up to 700'000 passengers per year can implement non transitional schemes. A first issue at stake is linked to the transitional nature of the device. Our model will show that if we adopt a two-sided market perspective, the rebates on aeronautical taxes might be perennial even for a private investor. A second issue is related to the intensity of the aids. These ones are capped to 50% of an assessed funding gap (the part of the operating costs not covered by revenues) on a 10 year period. For the smallest airports, this cap is set at 80%. If the new guidelines undoubtedly relax the competition policy control on the agreements between regional airports and LCCs, we aim at showing that the assessment of the necessity and of the proportionality of the State aids is closely dependent from the market model chosen. A two-sided perspective may justify perennial rebate schemes but may also provide some insight about the proportionality assessment and establish a connection between regulatory and competition law based issues by highlighting the links between the airport taxes regulation model and State Aids intensity.

1. The model

1.1. Economics of small airports

Let us consider the situation of a small airport which activity is highly dependant of a unique Low Cost Company (hereafter LCC).

The airport is a platform on which two main activities are handled. The first one, which corresponds to the core services, is the aeronautical activity. Airlines buy services such as the ground handling of their passengers and their luggage, or the ground handling of their aircraft, (parking and maintenance included). The second activity which is called "commercial activity" corresponds to the parkings, to the rent of space for shops, inside the terminals, services for the car renters... Although very diversified, these two activities are related since they are based on the passengers present at the airport. According to the ATRS report, in 2005, the commercial activity drives between 45% and 80% of the revenues. It represented 48% of the turnover of ADP (Aéroports de Paris) in 2011. The same trend is observed for small airports: according to the the french civil aviation authority report (2012), the commercial revenues stand for 35% up to 76% of the turnover.

Our model takes into account these two activities and their interaction. More precisely, in our model, the airport sets an aeronautical tax a for the services delivered to the company. This tax is proportional to the activity brought by the airline at the airport. The airport decides simultaneously the level of the rent r to be paid by atomistic shops to access to space (inside or outside the airport). The demand of these shops is characterized by two arguments: $S(r, N)$ which is the total number of space asked, is depending negatively on the price of each space r (continuous, differentiable) and depends positively of the number of passengers present at the airport, N . These passengers correspond to the passengers flown by the airline, who represent would-be buyers for shops. Furthermore, we assume that the shop demand is 0 if the rent is higher than some value \bar{r} and symmetrically, that there is a maximum demand \bar{S} correspond-

ing to a zero rent. These assumptions are made to find solutions in the set of variables definition. The LCC will decide how much activity to bring to the airport. It faces a demand for travel expressed by passengers and denoted $N(p)$. This demand is decreasing with the price of the ticket p , differentiable and continuous. It is equal to \bar{N} at maximum for a price p equal to zero. This maximum demand is defined in order to take into account that the small airports will often not break-even and even if the demand is maximum, it might be difficult without external help to recoup the costs. In the European Court of Advisors report (2014), the Court shows that small airports, characterized by a total demand of less than 100000 passengers per year, undergo a 130€ loss per passenger on average. The cost structure of the airport is another important ingredient of our model. Indeed, we consider the situation of small airports, which have serious difficulty to break-even and face important fixed cost, relative to their activity. We assume that variable costs correspond essentially to the processing of the passengers. $CV(N)$ is thus increasing with N . Along with these variable costs, there exist fixed costs CF to install the capacity (terminal, runways, parking) both for the aeronautical and non-aeronautical activity.

The airport profit is thus written as follows, when there is no state aid:

$$\Pi_{\text{airport}} = aN(p) - CV(N(p)) + rS(r, N) - CF$$

We then make the following assumption to focus our attention on small airports which are these which receive the aid from the region, or the State.

Assumption 1. *The profit of the airport is negative even in the most favourable case, i.e. if the airport is able to set monopoly prices both on the tax infrastructure a , denoted a^M and on the rent of the shops, r^M , while facing a maximum number of passengers \bar{N} . Technically, it writes*

$$\Pi_{\text{airport}} = \bar{a}\bar{N} - CV(\bar{N}) + \bar{r}S(\bar{r}, \bar{N}) - CF \leq 0$$

This assumption allows us to justify the intervention of a positive public aid which amounts A and is approved by a Competition Authority, in order to sustain the activity of the airport. In our model, the Competition Authority will allow a positive public aid up to a given amount denoted \bar{A} , exogenously set. Our paper will not explain how this maximum amount of aid is set but will analyse the impact of the market structure on the level of aid asked by the stakeholders¹. Provided that the aid A asked is lower than \bar{A} , the aid is accepted.

Besides, the airport is regulated because of its obvious monopoly position. The regulator sets a price cap, denoted \bar{a} . In Europe, it depends on the number of passengers at the airport and is a choice of a regulatory agency. The regulation is a dual till regulation if both aeronautical and commercial activity are considered separately and the regulation applies only on the aeronautical revenues, i.e. $aN(p)$. On the contrary, when the regulation area includes the commercial revenues, the regulation is said to be single till. The latter type of regulation, recommended by ICAO (document 9082), indeed considers that part of the commercial revenues can help cover the investment costs. The price cap is then a priori stricter (lower) in the single till situation. That is mainly the reason why large airports generally advocate for a dual till regulation since, according to them, it enables to better cover the real costs of their investments. They also claim that the commercial and the aeronautical activities are so different that they internally separate two business units, one for each activity. The economic literature has tackled the issue of regulation area, with different results. A first set of papers (Starkie, 2001 ; Starkie and Yarrow, 2008) analyse the impact of the choice of regulation area on airport long term decisions. The papers show, focusing on a rate of return analysis, that incentives to invest are lowered if the airport cannot keep enough resources. They thus advocate for a dual till regulation. However, a more recent literature (Frohlich, 2011; Malina and al., 2011; Malavolti, 2014) considers the airport as a platform which makes passengers and shops to meet. This two-sided market analysis leads to a modification of both the price structure and the incentives of the platform: the aeronautical activity is subsidized for the positive externality exerted on commercial profits. This work recommends single till regulation in order to internalize the externalities existing between the two activities. What is observed though, is that big airports tend to be dual-till regulated, whereas small airports are regulated according to the single till principle. This is the case of ADP, Frankfurt airport, Copenhagen

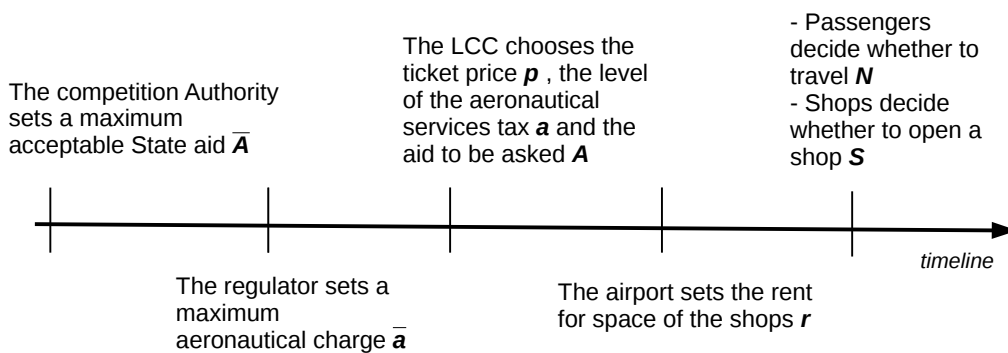
¹ To analyse the optimal level of state aid, we would need to model the objective function of the Competition Authority and perform a welfare analysis. This is left for future research.

airport for instance. Besides, Perrot (2014) suggested that big airports have to deal with congestion issues: if regulated by single till, the airports increase their aeronautical activity in order to make more profit on the commercial side. However, this mechanically increases the congestion of the platform since more passengers travel. In our model, the price cap \bar{a} is decided by the regulator and exogenously given to the airport. The airport is authorized to set any a provided that it is under the given price cap \bar{a} .

The airport has only one customer: a LCC which operates all the flights from and to the infrastructure. To represent this economic dependency, the LCC is supposed to be a monopsony. The LCC will decide how much traffic to bring to the infrastructure (number of passengers) depending on the price of the ticket p . It will face the demand of passengers for travelling N at price p . However, it will also decide the price to pay for the aeronautical services a and the rent of the shops location r because it has market power over the airport. Of course, the LCC will have to make sure that the airport is willing to handle the passengers and the shops, i.e. is willing to participate to the activity. Several examples of contracts sharing commercial profits between airports and airlines indeed exist in the real world: in France, Ryanair for instance accepts to settle in a given airport only if it can get a share of the parking revenues of the infrastructure. Tampa airport shares the concessions revenues with several airlines operating traffic at its infrastructure.

1.2. Role of the market structure in the equilibrium state aid

The timeline of our model is the following The game is solved backward and we look for subgame Nash equilib-



rium².

² We could have modelled the relationship between the LCC and the airport as a Nash-bargaining solution, with all the weight of negotiation in the hands of the LCC. This situation is more interesting to analyse situations of competing airports to attract airlines. We instead focus on an already settled LCC which wants to improve its profit by exploiting its monopsonic position.

The airport decides first of the rents r to be paid by the shops. The maximization program is the following:

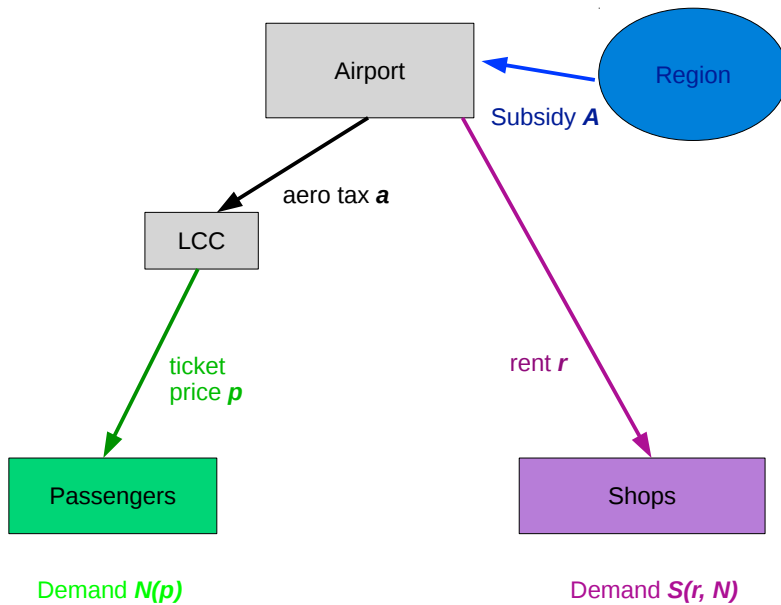
$$\underset{\{r\}}{\text{Max}} \Pi_{\text{ccial}} = rS(r, N)$$

The couple solution (r^*, S^*) satisfies the following equation

$$S^*(r^*, N) + r^*S'(r^*, N) = 0$$

where r^* is the rent which maximizes the commercial profit of the infrastructure. This profit is parametrized by the number of passengers N , since shops demand is positively impacted by the passengers present at the airport. We define $S'(r, N) = \frac{\partial S}{\partial r}$. This equation shows that the price r is determined by the airport as a monopoly, taking into account the negative impact of the price r on the quantity S . Typically, r^* is strictly higher than the marginal cost of producing the service to the shops, which we have assumed in our model to be equal to zero for sake of simplicity. This price is higher the lower the sensitivity of the demand S to a modification of the price r .

Furthermore, we consider a situation in which the airport is a platform which makes passengers and shops meet. The airport plays the role of a catalyst for both activity, as defined by Evans and Schmalensee (2007). This model has been firstly developed for the credit cards market by Rochet and Tirole (2003, 2006) and largely used to analyse the role of platforms and intermediaries. This model relies on the assumption that the number of participants on one side of the market influences the profits realized on the other side of the market.



The two-sided market methodology is relevant for our model since the demand of the shops is function of the number of passengers at the airport. These passengers are brought in by the airline. Hence, the airline will take the positive externality exerted by the passengers on the shops when deciding which level of aeronautical tax to pay and which rent to set for shops locations. Compared with a situation in which the airline only focus on the aeronautical activity, the aeronautical tax should be lower to bring more passengers to the airport and the rent paid by the shops should be higher: shops subsidize the aeronautical activity to reach more customers and increase their profits. The

LCC is assumed to be a monopsony. It then will decide the price of the ticket p to be paid by the passengers, the aeronautical tax a it will pay to the infrastructure, and A the amount of State aid to cover the profit loss. Obviously, the LCC has to take into account the profit of the airport in order to ensure the infrastructure is willing to participate to the deal. The maximization program is then the following:

$$\begin{aligned} \underset{\{p,a,A\}}{\text{Max}} \quad & \Pi_{\text{LCC}} = pN(p) - aN(p) - C(N(p)) \\ \text{s.t.} \quad & \Pi_{\text{airport}} = aN(p) - CV(N(p)) - CF + A + r^*(N(p))S^*(r^*(N(p)), N(p)) \geq 0 \quad (1) \\ & a \leq \bar{a} \quad (2), \\ & 0 \leq A \leq \bar{A} \quad (3), \end{aligned}$$

$pN(p)$ represents the LCC revenues received for the selling of N tickets at price p . $aN(p)$ is the total aeronautical charges paid by the LCC to the airport for the handling of N passengers. $C(N(p))$, increasing, convex, is the variable cost of flying N passengers. We normalize to zero all the other (fixed) costs. The first constraint represent the passengers demand for travelling. (1) stands for the participation constraint of the infrastructure. The airport profit integrates the revenues and costs from the two different activities, i.e. commercial and aeronautical. The commercial activity has already been optimized by the airport, given the demand N brought by the LCC. The aeronautical activity has to be optimized by the LCC, according to its program. However, the aeronautical tax, chosen by the LCC has to satisfy the price cap \bar{a} set by the regulator. (2) gives this constraint. Finally, the airport will receive a positive aid from the region A which is positive at minimum (the region cannot be subsidized by the airport) and may reach a maximum, set by the Competition Authority \bar{A} .

Lemma 2. *The airport is making no profit at equilibrium. Moreover, the maximum State aid available will be optimally picked by the LCC.*

$$\begin{aligned} \Pi_{\text{airport}} &= 0 \\ A^* &= \bar{A} \end{aligned}$$

PROOF. Let us consider the triplet solution of the LCC maximization program (p^*, a^*, A^*) . Let us consider $\tilde{a} < a^*$, constraint (1) is still satisfied, i.e. (1) > 0 evaluated at (p^*, \tilde{a}, A^*) . Then this solution is profitable since the profit of the LCC is increased while the constraint is still satisfied ((1) > 0). Thus, constraint (1) cannot be unbinding at equilibrium. Let us now suppose that $A^* < \bar{A}$. The triplet solution (p^*, a^*, A^*) satisfies (1). Moreover, the airport participation constraint is relaxed at (p^*, a^*, \bar{A}) with respect to evaluated at (p^*, a^*, A^*) . Then it is always possible to find $\tilde{a} < a^*$ such that we replicate the level of the airport profit of solution (p^*, a^*, A^*) with triplet $(p^*, \tilde{a}, \bar{A})$. However, in that case, the profit of the LCC is higher: $\Pi_{\text{LCC}}(p^*, \tilde{a}, \bar{A}) > \Pi_{\text{LCC}}(p^*, a^*, A^*)$.

The State aid A transfer does not directly impact the profit of the LCC. However, it clearly helps satisfying the participation constraint of the airport. Profit of the airport is higher, the higher the State aid. The LCC has thus an interest to ask for the highest amount of aid available, i.e. \bar{A} . The aeronautical charges paid by the LCC decrease its profit. Thus, for a given ticket price and State aid transfer, the airline would like to pay less aeronautical charges. This justifies that the airport participation constraint is binding. Furthermore, this participation constraint is better fulfilled the higher the State aid.

Hence, we solve the problem integrating the two binding constraints to the objective function. For simplicity, we will consider that the LCC decides the number of passengers to fly N (instead of the price p). Indeed, the two maximization problems are equivalent since $N(p)$ is assumed to be monotonically decreasing in p . After some manipulations, the program rewrites:

$$\begin{aligned} \underset{\{N,a\}}{\text{Max}} \quad & \Pi_{\text{LCC}} = pN - CV(N) - CF + \bar{A} + r^*(N)S^*(r^*(N), N) - C(N) \\ & aN = CV(N) + CF - \bar{A} - r^*(N)S^*(r^*(N), N) \quad (1) \\ & a \leq \bar{a} \quad (2), \end{aligned}$$

Proposition 3. *The aeronautical charge can become a subsidy given by the airport to the airline if the commercial profit of the airport is sufficient. It typically depends on the demand for shops and on the potential demand of passengers for travelling which have to be sufficiently high.*

The two instruments, the price cap and the State aid, are substitutes : the higher the level of the regional aid, the lower the price cap, everything equals.

PROOF. The LCC profit is decreasing with the aeronautical tax a , which suggests a corner solution given by the remaining constraints. What appears first is the fact that the price cap \bar{a} given in constraint (2) will never be reached. Nevertheless if \bar{a} is very low, and the commercial profit of the airport is low as well, then the constraint may be saturated. If the commercial profit is sufficient, i.e. if the shape of the demand for space is such that the willingness to pay and the sensitivity with respect to the number of passengers welcomed in the airport is high and the demand for passengers is sensitive to the price of the ticket, then the aeronautical charge becomes a subsidy.

The profit of the airline is such that it takes into account the externality exerted by the aeronautical activity on the commercial activity. Hence, the airline attracts more passengers in order to benefit from the commercial profit of the airport which it extracts. At equilibrium, the number of passengers will thus be higher than without considering the externality. It will be possible at the expense of a lower ticket price.

Moreover, the airline will extract the regional aid from the airport in order to decrease its cost and be able to attract even more passengers at the airport. Hence, the aeronautical charge and the regional aid become substitutes to increase the airline profit.

If the commercial activity is very active and profitable, because of a high willingness to pay of the shops for additional passengers, the aeronautical charge paid by the airline to the airport can become a subsidy given by the airport to the airline to increase the number of passengers at the infrastructure.

2. Conclusion

The development of LCCs is one of the main results of the air transport liberalisation initiated by the EU. It participates to its objectives in terms of social and territorial cohesion (inclusiveness, connectivity). The LCCs might also play an important role for the development of EU regional airports that are characterized by their high density but also by huge overcapacities phenomena. In this context, airports are incentivized to contract with LCCs to develop new routes both for achieving their commitments towards local governments and for covering at least a part of their costs. However, the LCC may play at a monopsony, arbitrating among several alternative locations without incurring significant switching costs and without risking losing significant traffic. As a consequence, the negotiation may be unbalanced without the two potential partners and the LCC might extract an excessive rent. In addition, such contractual hold-up may induce a tax competition race among regional airports with suboptimal results in terms of social welfare.

In this context, the 2005 guidelines tend to control the start-up aids granted to LCCs. The prolific case law induced by the enforcement of these guidelines testifies of the necessity to cope with an alternative economic rationale of the arrangements between LCCs and regional airports. The cases of operating aids and of cofounding schemes of marketing campaigns highlight that other dimensions, and long-term ones, are at stake. If the new 2014 guidelines admit such operating aids, they define some limits both in terms of duration and in terms of intensity. Making such schemes possible is already a real progress in terms of state aids control. On the principle such aids are prohibited as they are the more distortive. However, the implementation of an effects-based approach (allowed by the more economic perspective), leads the Commission to adopt a more pragmatic view. This one is grounded on the analysis of the new economic model of LCCs and regional airports that leads to consider such supports, even perennial, as rational at the economic sense.

Indeed the airport combines aeronautical and non-aeronautical revenues. Its economic model is a two-sided one (Rochet and Tirole, 2003; Frohlich, 2011; Malina and al., 2011; Malavolti, 2014). Accepting some rebates for aeronautical revenues (airport tax rebates) may be rational as soon as it leads to maximize the revenues from non-aeronautical services (parkings, shops). As it is the case for electronic platform as Google, the airport might not charge any price on the LCCs (see Malavolti and Marty, 2013) and at the extreme may remunerate the LCCs for bringing customers and consequently additional revenues on the second side of the market. The contractual arrangements by which commercial revenues are shared in some airports with the LCC constitute a striking example of such a logic. A lot of arrangements can be seen as compliant with the market investor principle, as a two-sided perspective demonstrates that even a private manager would rationally take the same decision.

As a consequence the current model may be at odds with the new economic model of regional airports that might imply perennial operating aids. However if our model justifies this kind of arrangements, it also illustrates a second

issue that will provide further research perspectives. Indeed, the conventional way to grant supports to the LCC is to allow some rebates on airport taxes. However these ones are regulated, in other to make them cost-oriented. If this characteristic is coherent for a congested hub that might abuse form its dominant position, things are radically different for a regional airport. If the tax level is set to allow it to cover its whole cost, any rebate will lead it to operating losses. In other words, it leads to establish a link between the ex-ante regulation (capping the taxes) and the ex-post control of State aids, e.g. the competition policy. The more important the rebate, the more important the Aid.

However, the modernisation of EU State Aids control regime is based to a strict limitation of the aid at what is necessary to correct a market failure. In the same time, the cost of public funds and the risk of making suboptimal investment choices or to maintaining lame ducks (excessive duplication of capacities or bottomless pit infrastructures) lead to recommend to limit the financial disequilibria of such infrastructures. Consequently, we might propose to substitute to a price-cap regulatory regime (inefficient as soon as the infrastructure is unable to exploit a market power) a floor-type one. This one would both allow to limit the rents extracted by the LCC and the deficit of the infrastructure. A floor model might limit the intensity of the State Aids and by the way limit the market distortions both among airline carriers and competing infrastructures.

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