On The Choice between Strategic Alliance and Merger in the Airline Sector: The Role of Strategic Effects

by

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Abstract: We consider a market with three competitors, two of which decide to cooperate. Firms first choose capacity under demand uncertainty then compete in quantities after the uncertainty has been resolved. We specify *strategic alliance* (SA) as an agreement where two airlines jointly choose capacity and divide it among themselves. Contrary to the full merger case, after demand is revealed the alliance members market their capacity shares independently. Our main result is that *the profit of the cooperating firms is greater under SA than under full merger*.

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Key words: Strategic alliance, capacity, airline industry.

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1. Introduction

In recent years, increased cooperation among airlines has been a major trend in the air transport sector. Full mergers, code-sharing agreements and block-seat sales are examples of the variety of cooperation forms that have been used by airlines. The need for cooperation arises mostly from the desire of major airlines to a) offer a global service, b) increase service quality, c) exploit size economies, and d) gain market power.[3]

In this paper we admit from the outset that, for some or all of the above reasons, airlines desire to cooperate and examine if there is an economic reason for them to prefer forming a *strategic alliance* (SA) rather than to proceed with a full merger. By SA we mean situations of partial cooperation, where firms cooperate on some decisions but act as competitors on others. SA formation is usually attributed to i) regulations preventing foreign airlines for providing domestic services or owning national carriers, and ii) the fact that "the investment required to develop an efficient global service network is perhaps prohibitively large, even for major airlines."[4] While considering the above factors as being very important, we show that strategic reasons may also enhance the desirability of SA. Interestingly, the effect underlined in this paper could also explain the strategy by Air France and KLM in trying to maintain some independence despite their recent merger.[5] Lufthansa has also recently adopted such a strategy following its acquisition of Swiss.

We consider a market with three competitors, two of which decide to cooperate. The general structure of the model is analogous to Barla and Constantatos (2000 and 2005). Firms first choose capacity then compete in quantities. Capacity being a longer run decision it is taken under uncertainty over the state of demand while the seat sales decision is taken after the demand state has been revealed. In this paper, we specify SA as an agreement where two airlines jointly choose capacity and divide it among themselves according to some rule. Contrary to the full merger case, after demand is

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[3] According to Oum *et al.* (2000) cooperation allows i) expansion of seamless service networks (*i.e.,* avoid changing airline); ii) traffic feed between partners; iii) cost efficiency (economies of scale, scope and traffic density); iv) increased service quality; v) marketing advantages (pooling of frequent flyer programs, CRS display)

[4] Oum *et al.* (2000).

[5] This strategy has been coined "one group, two airlines".

revealed the alliance members market their capacity shares independently. Our main result is that *the profit of the cooperating firms is greater under SA than under full merger*.

As is well known, a two-firm merger in a Cournot triopoly, while successful at raising the price, it turns out to be detrimental for the profit of the merged firms. By internalizing part of the effect a firm's quantity decision has on rival profits, the merged entity sets its quantity more prudently, thus yielding market share to the outside firm who now acts more aggressively.[6]

When instead of merger the cooperating firms form a SA then the above effect disappears, since *for given capacity choices* the allied airlines will act as aggressively as the outside firm. This change in attitude, while of no importance in states where the cooperating firms are capacity constrained, becomes important in low demand states where capacity is not binding. In those states, the SA members will market their capacity more aggressively. This implies that in the capacity stage, the SA's reaction function is located outwardly relative to the reaction function of the merged entity. Equilibrium capacity of the cooperating firms is, therefore, higher under SA than under merger and the opposite holds true for the outside rival.

While the cooperating airlines do better by forming a SA than merging, they still make less profit compared to acting separately. The latter conclusion can be easily reversed when joining forces allows for synergies and cost reductions.[7] If SA and merger confer similar cost reductions, the former becomes the first best solution in terms of profit maximization. It also dominates the merger in terms of social welfare.

The existing literature on airline strategic alliances is limited but growing. Park (1997) and Oum, Park and Zhang (2000) analyze the effect of airline alliances on traffic levels, fares, and welfare, distinguishing between *complementary* and *parallel* alliances. The former refer to cases where firms link up their existing networks to build a larger one, while the latter to collaboration between firms competing on the same routes. It is

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[6] See Salant *et al.* (1983) and Tirole (1989). While the merger succeeds to increase price, the market share losses of the participating firms are sufficiently large to counterweight any such benefits. In strategic terms, the merged firms adopt a soft attitude ("*fat cat*") while competition takes place in strategic complements.
[7] As a matter of fact, the cooperating firms also make less profit than their independent rival. Sufficient cost reductions from cooperation reverse this result as well.

shown that complementary alliances are likely to increase welfare while parallel alliances to decrease it.

Brueckner (2001) distinguishes two types of markets, the *inter-hub* and the *interline* markets, where a passenger needs to use two companies in order to complete his trip, even in the pre-alliance situation. It shows that an alliance tends to reduce (increase) fares in the interline (inter-hub) and suggests that the positive effects of alliances may outweigh any negative impacts.

Flores-Fillol and Moner-Collonques (2004) examines whether airlines that employ the same hub have an incentive to create a complementary alliance. It concludes that complementary alliances are profitable only for a sufficient degree of product differentiation, but may nevertheless be formed as prisoner's dilemma outcome even when product differentiation is not enough. In a situation where the allied airlines and their rival can choose whether to be the leader in a price game with product differentiation, Lin (2004) shows that the leader's identity is parameter-dependent. Chen and Ross (2003) studies an alliance where an incumbent accepts to provide access to its facilities to a newcomer. It shows that, even if the alliance increases total market surplus above the pre-alliance level, it may be socially detrimental by forestalling a more substantial form of entry. Lin (2005) also shows that a strategic alliance may deter entry by acting as a commitment device.

In all the above papers no comparison is made between SA and full merger. Considering alliance as a joint venture for an intermediate product, Morash (2000) shows how contractual terms about transfer prices and profit sharing may serve as an appropriate commitment device yielding the alliance Stackelberg-like leadership advantages over the outside firms. Forming a strategic alliance may therefore be superior to full merger. Zhang and Zhang (2005) develops a two stage model of competition between two alliances each formed by two partners linked by demand complementarities. In the first stage, alliance partners decide on the degree of internalization by a partner of its impact on the other partner's profit. In the second stage, alliances are competing in quantities. In this setting, internalizing demand complementarities has not only a direct positive impact but also improves the alliance strategic position by making it "tougher". They therefore find that partners have an interest to opt for complete cooperation.

Section 2 presents the model, section 3 and 4 present the main results and section 5 concludes.

2. The Model

Let us have two cities A and B. The air-transport market between them (market AB) is currently served by three airlines. Airlines 1 and 2 contemplate either forming a strategic alliance or merging in which case the emerging company, airline M, competes against airline 3. The SA differs from merger in that the partners join forces only in deciding the choice of total capacity and its allocation between them. Once individual capacities are decided, the two partners become rivals in selling AB tickets.

The three carriers are players in a three-stage game. At stage 1, firms 1 and 2 decide on the nature of their relationship: merger or SA. At stage 2, firms make their capacity choice. Whether merger or SA, firms 1 and 2 make their capacity decisions jointly. Stages 1 and 2 are played under demand uncertainty. At stage 3, the demand state is revealed and firms compete in quantities, with potentially binding capacity constraints.

To keep the analysis tractable a) we assume the demand on AB to be $P = \alpha - Q$, where P is price, Q is total quantity and the parameter α follows a uniform distribution on the support $[0,1]$; b) we rule out any product differentiation among airlines.[13]

On the cost side, we assume that the capacity costs supported in stage 2 are the only cost element. Hence, the marginal cost associated with serving an extra passenger in stage 3 is zero up to capacity. This is consistent with the observation that, in the airline industry, most of the operating costs are associated with offering a seat rather than serving a passenger.[14]

Concerning the capacity cost, we introduce a very simple structure that allows us to focus on demand and strategic considerations. We assume that: i) all airlines face similar cost; ii) the per unit capacity cost (i.e. the cost of offering one seat) is independent

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[13] This is done in order to isolate the effects under study from those due to product differentiation.
[14] In other words, once a seat has been added to capacity, its cost is the same whether a passenger flies on it or not. The analysis could easily be extended to include a positive marginal cost in stage 3.

of the number of seats carried on a route and equal to c, $0 < c \leq \frac{1}{2}$. We restrict c to values below ½ in order to rule out the trivial case where the market AB is never served in equilibrium.[15]

3. The Case of Merger

Airlines 1 and 2 form a single entity M that chooses total capacity as well as quantity. The subgame examined in this section is a two-stage duopoly between symmetric airlines, M and 3. A superscript M indicates equilibrium values in this subgame.

Lemma 1: When airlines 1 and 2 merge, $K_M^M = K_3^M = \left(1 - \sqrt{2c}\right)/3$, while $\Pi_M^M = \Pi_3^M = (1/27)\left(1 - 6c + 4\sqrt{2} \cdot c^{3/2}\right)$.

 Proof: Let us assume that both players have already chosen capacities with $K_i \leq K_j$, $i, j = M, 3$ $i \neq j$. Define $\alpha_{1M} = 3K_i$, $\alpha_{2M} = K_i + 2K_j$. There are three possibilities according to the realization of α. First, when $\alpha \in (0, \alpha_{1M}]$ the demand is very low none of the firms is constrained. The Cournot solution is $q_i = q_j = \alpha/3$, $P = \alpha/3$. Second, when $\alpha \in (\alpha_{1M}, \alpha_{2M}]$ (intermediate demand states) firm i is constrained while its rival is not. The Cournot solution is $q_i = K_i$, $q_j = (\alpha - K_i)/2$, and $P = (\alpha - K_i)/2$. Third, when $\alpha \in (\alpha_{2M}, 1]$ (high demand states) both firms are constrained with $q_i = K_i$, $q_j = K_j$, and $P = \alpha - K_i - K_j$. Hence, at the first stage firm i maximizes

$$E(\Pi_i) = \int_0^{\alpha_{1M}} \frac{\alpha^2}{9} d\alpha + \int_{\alpha_{1M}}^{\alpha_{2M}} \left(\frac{\alpha - K_i}{2}\right) K_i d\alpha + \int_{\alpha_{2M}}^1 \left(\alpha - K_i - K_j\right) K_i d\alpha - cK_i \quad (2)$$

while its rival maximizes:

$$E(\Pi_j) = \int_0^{\alpha_{1M}} \frac{\alpha^2}{9} d\alpha + \int_{\alpha_{1M}}^{\alpha_{2M}} \left(\frac{\alpha - K_i}{2}\right)^2 d\alpha + \int_{\alpha_{2M}}^1 \left(\alpha - K_i - K_j\right) K_j d\alpha - cK_j. \quad (3)$$

It is straightforward to show (proof available by the authors) that the only equilibrium involves the symmetric capacity choices and profits described in the lemma, QED.

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[15] Obviously, if c>½ capacity costs in the AB exceed the maximum expected revenue from that market.

There is no much to comment on the merger case. Each of the merged firms 1,2, collects half the duopoly profit. Since the two firms act in a fully coordinated manner, the way they split capacity, hence profits, is irrelevant for the market outcome.

4. The Case of Strategic Alliance

In this section, firms 1 and 2 form a strategic alliance defined as an agreement where partners a) jointly choose capacity in order to maximize total expected profit, b) share this capacity equally among themselves,[16] c) market their capacity share independently. This implies that market structure in the third stage is triopoly, potentially an asymmetric one. A superscript A indicates equilibrium values in this subgame.

Lemma 2: When airlines 1 and 2 form a strategic alliance, unless c is too small (i.e.,

$\forall c > 0.0006$), $K_A^A = \frac{1}{4}\left(2 - 2c^{1/4} \cdot \sqrt{\sqrt{2} + 2.5\sqrt{c}} + \sqrt{2c}\right)$, $K_3^A = \frac{1}{8}\left(2 + 2c^{1/4} \cdot \sqrt{\sqrt{2} + 2.5\sqrt{c}} - 5\sqrt{2c}\right)$,

while $\Pi_A^A = \frac{1}{24}\left[1 - 3c + \sqrt{2} \cdot c^{3/2} + \left(\sqrt{2c} - 1\right)\sqrt{2\sqrt{2} + 5\sqrt{c}} \cdot c^{3/4}\right]$, and

$\Pi_3^A = \frac{1}{48}\left[1 - 3c + 22\sqrt{2} \cdot c^{3/2} - \left(3\sqrt{2c} + 1\right)\sqrt{2\sqrt{2} + 5\sqrt{c}} \cdot c^{3/4} + 3\sqrt{2c}\right]$.

Proof: Since we have assumed a 50% capacity-sharing rule among alliance members, $K_1 = K_2 = K_A/2$. We need to examine two cases according to whether $K_A \leq 2K_3$ or $K_A > 2K_3$. We only present the former since it turns out to be the only equilibrium. Therefore, as α increases, each alliance partner becomes capacity constrained before the outside firm. Define $\alpha_{1A} = 2K_A$, $\alpha_{2A} = K_A + 2K_3$, which divide the realizations of α into three zones analogous to those in the merger case. At the first stage, the alliance chooses its capacity maximizing[17]

$$E(\Pi_A) = \int_0^{\alpha_{1A}} 2 \cdot \frac{\alpha^2}{16} d\alpha + \int_{\alpha_{1A}}^{\alpha_{2A}} \left(\frac{\alpha - K_A}{2}\right)K_A d\alpha + \int_{\alpha_{2A}}^1 (\alpha - K_A - K_3)K_A d\alpha - cK_A \qquad (4)$$

while the outside firm maximizes

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[16] This division could be viewed as the result of a Nash bargaining outcome where the two airlines have identical bargaining power.

[17] Expressions (4) and (5) are analogous to expressions (2) and (3).

$$E(\Pi_3) = \int_0^{\alpha_{1A}} \frac{\alpha^2}{16} d\alpha + \int_{\alpha_{1A}}^{\alpha_{2A}} \left(\frac{\alpha - K_A}{2}\right)^2 d\alpha + \int_{\alpha_{2A}}^1 (\alpha - K_A - K_3) K_3 d\alpha - cK_3 \qquad (5)$$

Solving the system of first order conditions and substituting optimal capacities into the profit functions yields the expression in the lemma. Notice that $\forall c \leq 0.0006$ the second order conditions for the maximization of (5) are not met, which creates a discontinuity in the reaction function of firm 3. We simply ignore this case since it has no special interest, QED.

   With the two lemmata at hand, we proceed to show

Proposition 1: *A strategic alliance is preferable to merger as a means for the participating firms to collaborate, while the outside firm prefers that its competitors merge;* i.e., $\forall c \in (0.0006, 0.5]$, $\Pi_A^A \geq \Pi_M^M$ *and* $\Pi_3^A \leq \Pi_3^M$.

Proof: First we compute the $\Pi_A^A - \Pi_M^M$ difference for all the admissible values of c. The results are reported in figure 1, which shows that $\forall c \in (0.0006, 0.5]$, $\Pi_A^A \geq \Pi_M^M$. Similarly, figure 2 reports the $\Pi_3^A - \Pi_3^M$ difference, which is positive $\forall c \in (0.0006, 0.5]$, QED.

   The intuition behind the results in proposition 1 is straightforward. Merging makes the last stage reaction of the joining partners softer, thus yielding market shares to the outside firm. To see this clearly let first $K_A = K_M = K_{12}$, so $\alpha_{1M} = \alpha_{1A} = \alpha_1$, and compare profits in demand states where neither the alliance, nor the merged firm is capacity constrained. From the first integrals in (2) and (4) it is obvious that the alliance performs better in terms of partner's profits. This happens since $\forall \alpha \in [0, \alpha_1]$ capacity choices are irrelevant and the allied partners behave like unconstrained Cournot triopolists. We find, therefore, the well know result of Salant, *et al.* (1893): when firms compete in strategic substitutes a merger reduces the total profit of the participating firms. Hence, preferring alliance to merger has a first strategic effect related to third stage outcome and stemming from low demand states.

   Now assume also that whether merger or alliance the outsider's capacity is fixed at $K_3 = \overline{K}_3$. It is easy to show that $\left(\frac{\partial E(\Pi_A)}{\partial E(K_A)} - \frac{\partial E(\Pi_M)}{\partial E(K_M)}\right)\Big|_{K_{12}, \overline{K}_3} = \frac{1}{4} K_{12}^2 > 0$. In other words, preferring alliance to merger increases the cooperating firms' marginal profit due to

capacity and pushes their second stage reaction function outwards. This implies that $K_A^A > K_M^M$ and $K_3^A < K_3^M$. Figure 3 reports the $K_A^A - K_M^M$ difference and shows that it is positive for all the admissible values of c. This means that the alliance's total capacity exceeds that of the merged firm, therefore, whenever constrained, the alliance partners have in total a larger market share than their merger counterpart. This holds true independently of whether the outside firm is capacity constrained. These results also easily explain why social welfare is always higher under the alliance than the merger (see Figure 4).

5. Conclusion

We have shown that, in the presence of demand uncertainty airline alliance dominates merger in terms of profits as a form of cooperation. Strategic alliance is therefore not necessarily a second best solution justified by regulation limiting airline mergers. In the model presented here, had the two firms remained independent they would have obtained higher profits This is due to the fact that, in order to keep matters simple we have ruled out any cost synergies. Obviously, by allowing for sufficient cost synergies one can find situations where cooperating yields higher profits than remaining independent. Since the intuition developed in this paper is unaffected by the presence of such synergies, the superiority of alliance over merger is robust when the two forms of cooperation provide similar cost reductions. Obviously, it remains to be verified whether a strategic alliance allows the same type of cost synergies than a full merger. [18] In terms of policy implications, our results suggest that, for similar cost savings, SA should be favored over full merger by the competition authorities.

We have presented the analysis in the framework of a parallel alliance (the collaborating airlines were supposed to initially operate on AB). Note however that the

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[18] Note that it is not clear that the merger necessarily performs better in that respect than the SA. Indeed, suppose that economies of aircraft size are the main source of cost saving associated with cooperation between airlines (i.e. the per-unit capacity cost is decreasing with the level of capacity). In this case, the strategic advantage of the SA could very well be reinforced, since the alliance chooses more capacity than the merged entity, and most important, it creates an asymmetry with the rival. Also, consider, for instance, that the three airlines are somewhat differentiated, and the uncertainty that they face contains an idiosyncratic component. If airline 1's idiosyncratic uncertainty is not perfectly correlated with that of firm 2, forming a strategic alliance allows the two airlines to reduce the cost of holding excess capacity, like in Barla and Constantatos (2000).

same type of strategic effect should favor SA over merger in the case of a complementary alliance. Indeed, suppose that airline 1 and 2 connect a third city H to cities A and B, respectively. For some reason (e.g. regulatory constraint), they cannot serve AB directly but if they collaborate they can offer AB passengers to fly through H. In choosing whether to merge or to form a SA, the strategic effect identified in our analysis remains present.[19] We can therefore conclude that, when cooperation is called for by either cost synergies or regulatory constraints, in the presence of outside rivals SA is profit superior to merger.

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[19] Obviously, airlines would also have to consider the impact of their decision on the other markets namely AH and BH. However, since the SA makes the collaborating airlines more aggressive in terms of capacity choice, the SA should also be superior to the merger in improving their competitive positions into these other markets.

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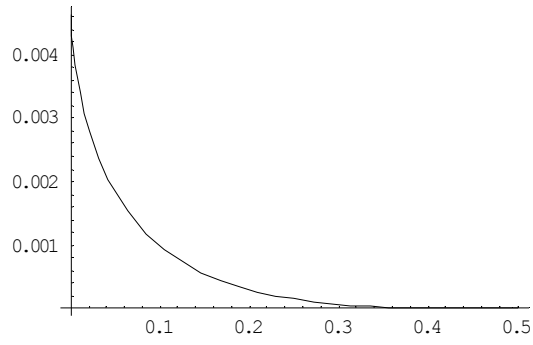
Figures

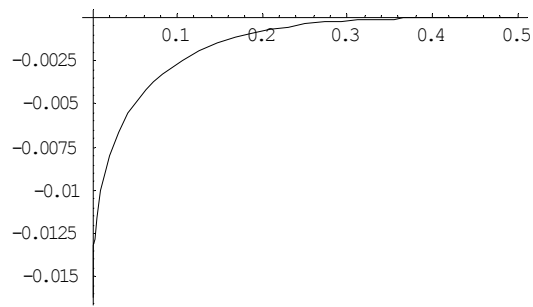**Figure 1.** The $\Pi_A^A - \Pi_M^M$ difference for all admissible values of c.

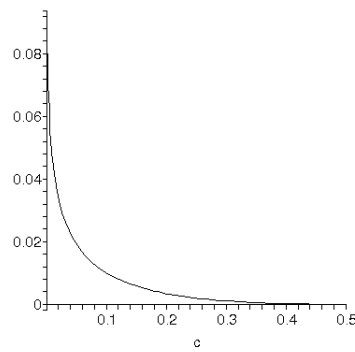**Figure 2.** The $\Pi_3^A - \Pi_3^M$ difference for all admissible values of c.

Figure 3. The $K_A^A - K_M^M$ difference for all admissible values of c.
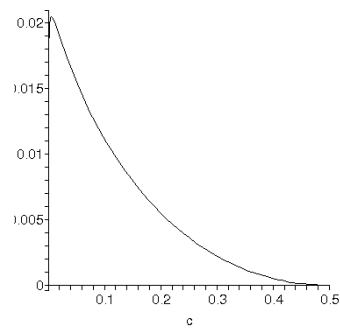
Figure 4. Difference (alliance-merger) in total surplus for all admissible values of c.