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An Economic Analysis of Duopolistic Competition between Gulliver and Dwarf airlines : The case of Japanese Domestic Air Markets

Hideki Murakami

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Hideki MURAKAMI

Associate Professor, Kobe University, Japan

Graduate School of Business Administration

Phone & FAX: +81-78-803-6941

E-mail: hideki@rose.rokkodai.kobe-u.ac.jp

Abstract

This paper theoretically analyses the effects of an alliance by two small (dwarf) airlines on their own profit, their rival's profit, and the economic welfare. The rival is assumed to be a gigantic Gulliver. The Gulliver and the dwarves' profits will change in a different direction in the post-alliance situation. With regards to the social welfare, as long as the dwarf airline's alliance leads to the simultaneous achievement of strong economies of density, thorough product differentiation, seamlessness, and cost reduction, the social welfare would presumably be improved. The political implication is that firms' asymmetric factors (cost difference and product differentiation) should be maintained in the post alliance situation; otherwise, we cannot tell whether the dwarves' alliance will improve the social welfare or not.

Key words: high and low cost airlines, alliance, hub, duopoly, economic welfare

I Introduction

This paper models the duopolistic competition between a large incumbent airline and small airlines, and simulates the market performance that would result if the small airlines jointly competed against the large airlines instead of competing separately. This idea comes from the fact that two low-cost dwarf airlines have been independently competing with the colluded large airlines in very large markets, such as Tokyo-Sapporo (the largest market in the world in terms of the number of annual passengers) since 1998, but to date the financial status of these small airlines has been poor. Therefore, we are very interested in what would happen if the two dwarf airlines formed an alliance to increase their market power, and jointly competed with the “Gulliver” airlines. The reason why we are using the terms “Gulliver” and “dwarf” is that in Japan’s domestic air transport markets, the group of incumbents has about a 93% passenger share at Tokyo-Sapporo, and a 90% share in terms of the number of departures, and this holds true for other markets.

The Gulliver airlines to be discussed here are the typical “Flag Carriers” such as Japan Airlines and All Nippon Airways, which are characterized by their large domestic network and high input costs. The dwarf airlines are Skymark Airlines or Air Do (Hokkaido International Airlines), which are assumed to have lower input costs and to produce differentiated services.

As mentioned above, these “Dwarf” airlines have been suffering from financial deficits ever since they were founded in the late 90s, and in the year 2002, Air Do finally decided to obtain financial aid from ANA (All Nippon Airways). The “S-Curve Effect,” as well as the lack of financial strength, explains how this situation came about. Douglas and Miller (1974) proposed the “S-Curve Effect,” which implied that airlines with a small “departure share” would lose their market share more rapidly than their departure share. Air Do and Skymark Airlines have only a several percent market share in their base market, and it has been pointed out that if they had had a larger market share, they would have gained more profits than they actually earned.

The next section depicts the current network status of the Gulliver and dwarf airlines. The third and the fourth sections analyze what kind of effects the alliance by dwarves would have on the profit of their own and the Gulliver carriers, and on the economic welfare. Finally, we will refer to the political implications concerning the treatment of small airlines and their alliance on domestic air transport policy.

II The Current Status of the Network

Before discussing the main topic of this paper, it is necessary to discuss the strategic alliance in the airline industry. The strategic alliance can be observed not only in the airline industry, but also in other industries like manufacturing. The motivation for companies to agree to alliances can be explained from various aspects. One reason is that companies can attain managerial resources that they could not otherwise attain alone; these resources are something like “know-how” that has been accumulated in a specific company, or licenses or patents that are costly for other companies, or institutional barriers that internationally-operating airlines might face, like the 5th freedom right.

The second type of alliance is the “hub and feeder” type; for example, a trunk airline (Northwest Airlines) and a complementary feeder airline (Horizon Air) at Seattle/Tacoma Airport. In the air transport industry, the advantage of this alliance can be explained by the positive externality and amelioration of the economies of density.

The third type of alliance is the collaboration of dwarf airlines to cope with competition from a gigantic Gulliver airline. The aim of this kind of alliance is to form a market power against a monopolistic firm, as well as to utilize positive network effects such as network externality and the economies of density. This aim is presumably true for the alliance formed between America West Airlines and Continental Airlines in the US domestic markets. A sample of this case is illustrated in Figure 1.

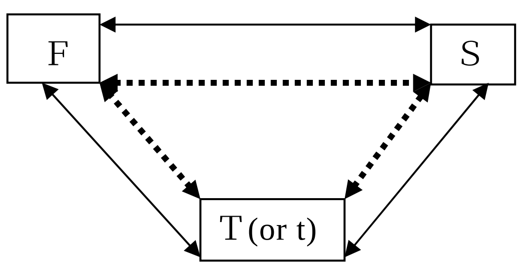

Figure. 1 The competition between “allied dwarves” vs. Gulliver

Figure 1 shows the situation;

(1) where the Gulliver (the incumbent. hereafter, referred to as Firm 1 which is at the hub airport T (Tokyo) operates between T and F (Fukuoka), T and S (Sapporo), and F and S (shown in real lines);

(2) a small airline (Firm 2) operates between F and T;

(3) another small airline (Firm 3) operates between T and S (each shown in dotted lines).

In cases in which small airlines cannot own their slots at T because of congestion, both of them are assumed to be at base ***t*** airport. T-S and T-F are assumed to be symmetrical.[1]

This situation is almost true for the competition at Haneda (Tokyo International Airport) among Skymark Airlines, Air Do, and the collusive group of incumbents (JAL, ANA, and JAS); namely, Firm 1 is the group of incumbents, Firm 2 is Skymark, and Firm 3 is Air Do. In 2001, Skymark and Air Do agreed on joint ownership and operation, joint sponsorship of tourism, through-tickets, and joint booking services at Haneda for the Fukuoka-Haneda-Sapporo market[2] (Hokkaido Shinbun, June 3rd 2001).

The next section analyzes what the market performance would be if a joint operation by Firms 2 and 3 were put into practice. In such a

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[1] They are at almost the same distance and receive the same amount of traffic.

[2] However, it turned out to be difficult to put this alliance into practice, since the ticket counters of these airlines are separately located.

case, Firms 2 and 3 might compete with Firm 1 at F-T, T-S, and furthermore at F-S by jointly setting their airfares at very low levels, so that their connecting flight (Fukuoka-Haneda-Sapporo) could compete with the direct flight (Fukuoka-Sapporo) offered by the incumbent.

III Modeling "Gulliver vs. Dwarf" competition

The benchmark case: In this case, the dwarf airlines (Firms 2 and 3) individually compete with Firm 1 at T-F and T-S. At T-F, Firm 1 and 2 compete in terms of price (namely, Bertrand type competition). Their demand-functions go as follows; for convenience, they take the linear form.

$$Q_{TF}^{1} = \alpha_1 - P_{TF}^{1} + \gamma P_{TF}^{2}$$
$$Q_{TF}^{2} = \alpha_2 - P_{TF}^{2} + \gamma P_{TF}^{1}$$

Similarly, Firms 1 and 3 compete at T-S.

$$Q_{TS}^{1} = \alpha_1 - P_{TS}^{1} + \gamma P_{TS}^{3}$$
$$Q_{TS}^{3} = \alpha_3 - P_{TS}^{3} + \gamma P_{TS}^{1}$$

Furthermore, since Firms 2 and 3 do not form an alliance in the benchmark case, Firm 1 monopolizes the non-stop route F-S.

$$Q_{FS}^{1} = \alpha_1 - P_{FS}^{1} \qquad (\alpha_1 > 0, \alpha_2 = \alpha_3 > 0, 0 < \gamma < 1)$$

Considering the competition actually conducted in the late 90s, it is natural to think that Firm 1 has stronger "brand loyalty" than the dwarf airlines, and this implies that passengers are more willing to pay for Firm 1's service than Firm 2 or 3's. The evidence is that the incumbent's group succeeded in expelling Skymark Airlines from Osaka-Sapporo and

Osaka-Fukuoka, although their airfares were higher than Skymark's (the incumbent's group was not involved in the price war), and the incumbent's group maintains higher airfares and a larger market share at Tokyo-Sapporo than the dwarf airlines. Therefore, we can assume that $\alpha_1 > \alpha_2$ (at around zero passengers, airline 1 can charge higher airfares than Firms 2 and 3).

In addition, Firm 1 has wider route networks than the dwarves, and this means that the frequent fliers of Firm 1 have more opportunities to accumulate their "mileage awards" than those of the dwarf airlines. If the frequent fliers of Firm 1 switch their airline to the dwarves, "switching costs" may arise for those customers. Furthermore, Firm 1 has more frequent departures, and if the "S-curve effect" exists, passengers who enjoy the convenience of the frequent departures offered by Firm 1 may not easily shift to the dwarves. These two facts, as well as brand loyalty, imply that even though small airlines cut their airfares, the frequent flyers on large airlines may not be tempted by this price reduction. Therefore, we assumed that γ takes small values, e.g., less than unity.

As for the cost function, we followed the previous studies such as that done by Caves et al. (1984), which estimated the translog cost function of the deregulated US domestic air transport market, and assumed that the economies of density exist. We specified the shape of the marginal cost function as a linear shape, like Park (1997) did. Each firm's marginal cost functions are as follows.

$$MC_i^1 = 1 - \theta Q_i^1 \quad \left(i = TS, TF, FS,\ 0 < \theta < 1\right)$$

$$MC_{TS}^{3} = \phi - \theta Q_{TS}^{3} \qquad MC_{TF}^{2} = \phi - \theta Q_{TF}^{2}$$

$$(0 < \phi < 1, 0 < \theta < 1)$$

ϕ is assumed to fall between zero and unity, and this means that the dwarf airline's marginal cost and also unit (average) cost are always lower than Firm 1's. In fact, the average unit cost[3] of JAL Express (JEX, a commuter in the JAL group), Air Nippon (a local and commuter company in the ANA Group), and Japan Air Commuter (the JAS group) is about 274 yen. These commuter companies use smaller airplanes and operate at lower costs than their holding companies. In contrast to this, the average unit cost of Air Do and Skymark Airlines is about 219 yen, which is less than 80% of the subsidiaries of the large airlines (only 63% of JEX, the commuter with the highest cost. This fact implies that the unit cost of Air Do and Skymark would be much lower than the large airlines'.[4] The slope of the marginal cost is defined to be the same between the Gulliver and dwarves. This assumption is possible assuming that the equipment of production in a market is the same between firms. The actual fleet configuration of Firm 1 at T-S is B747s, DC-10s, and B767s, and that of Firm 3 (Air Do) is B767. The average aircraft size is apparently different, but both Firms 1 and 3 use B767s. Highlighting a specific time-zone (early in the morning), we can observe that both Firms 1 and 3 fly B767s, so it is at least possible to assume, as one case, that θ

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[3] Total operating cost divided by total revenue per ton-kilo.

[4] Calculated from Nihon Koku Kyokai, *Koku Tokei Yoran* (Annual Statistics of Japanese Aviation Industry). According to Dresner & Windle (1995) and Windle & Dresner (1999), Southwest Airlines' unit cost is only 35% of mega carriers.

is the same among firms.

In the case of Figure 1, if Firm 1 operates non-stop flights between F and S, the passengers will not catch the "inconvenient" connecting flights (F-H-S) of Firm 1 in order to move between F and S. In addition, by definition of this benchmark case, two small airlines do not form an alliance. Therefore, passengers may not use interline-connecting flights (F-H-S) to move between F and S, as long as the connecting airfares are substantially lower than the airfare charged by Firm 1 for the non-stop flights.

The total profit function of Firm 1 is the sum of the profit function of each route:

$$\Pi^1 = \pi^1_{TS} + \pi^1_{TF} + \pi^1_{FS} \qquad \pi^1_i = P^1_i * Q^1_i - TC^1_i \quad \left(i = TS, TF, FS\right)$$

And the profit function of each dwarf airline is:

$$\pi^2_{TF} = P^2_{TF} * Q^2_{TF} - TC^2_{TF} \qquad \pi^3_{TS} = P^3_{TS} * Q^3_{TS} - TC^3_{TS}$$

The benchmark case assumes that Firm 1 and Firm 3 compete at T-S, and Firm 1 and Firm 2 compete at T-F. By assumption, Firm 2 and 3 do not cooperate. Firm 1 monopolizes the route F-S.

Brander and Zhang (1993) observed through their empirical analysis that "Cournot type" duopolistic competition is prevailing in the deregulated US air transport markets[5], and consecutive studies such as those conducted by Oum et al (1992), Zhang. (1996), and Park (1997) follow their assumption. Since this paper did not attempt to use an empirical analysis, we are free from questioning which duopolistic model

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[5] Especially evident when we used yearly data. When we used monthly data, we empirically observed the Bertrand-type competition.

is appropriate for our analysis. We chose the "Bertrand type" duopoly model for the following analysis, because we observed that the monthly nominal airfares of the two airlines[6] shown in *JIKOKU HYO* (the time table and price tariff for railways, buses, ferries and airlines, published monthly), were moving in the same direction, and this fact gave us the sense that the duopolistic behaviors in the T-S and T-F markets resulted in a "strategic complement".

Taking the first order condition of the profit functions above with regard to prices, we obtained the Bertrand-Nash equilibrium-prices, outputs, and profits for T-S and T-F, and the monopolized output, price, and profit for F-S. In addition, we calculated the consumer's surplus for each case, and finally derived the social welfare for each market. Hereafter, we call the benchmark profit (BP), and the "benchmark social welfare" (BSW).

The alliance case: To contrast it with the benchmark case, we will model the alliance case, in which Firms 2 and 3 cooperate and increase their bargaining power in order to fight with the "gigantic Gulliver" in the T-S and T-F markets. As long as the alliance offers a seamless connecting service so that the passengers do not experience too much inconvenience, we can regard the allied airlines (hereafter referred to as Firm 4) as a

[6] It is not possible to find out how many full airfares and discounted airfares were actually purchased at these prices. However, we can find out how many types of discount tickets are being issued, and how much their discount rates are. This is the only way to estimate the movement of real airfares.

workable competitor with Firm 1 in F-S. However, the demand for Firm 4's service is much smaller than for Firm 1's. Taking these assumptions into consideration, we can specify the demand function for each firm:

$$Q_{TF}^{1} = \alpha_1 - P_{TF}^{1} + \gamma P_{TF}^{4} \qquad Q_{TF}^{4} = \alpha_4 - P_{TF}^{4} + \gamma P_{TF}^{1}$$
$$Q_{TS}^{1} = \alpha_1 - P_{TS}^{1} + \gamma P_{TS}^{4} \qquad Q_{TS}^{4} = \alpha_4 - P_{TS}^{4} + \gamma P_{TS}^{1}$$
$$Q_{FS}^{1} = \alpha_1 - P_{FS}^{1} + \gamma P_{FS}^{4} \qquad Q_{FS}^{4} = \eta\alpha_4 - P_{FS}^{4} + \gamma P_{FS}^{1}$$
$$\left(0 < \eta < 1, \alpha_2 = \alpha_3 = \alpha_4\right)$$

The constraints for α's and γ are the same as those imposed in the benchmark case. The value of parameter η means that the demand function for Firm 4 is always located under the demand function for Firm 1 in F-S.

The marginal cost functions of Firm 1 are the same as in the benchmark case. However, those of Firm 4 are as follows.

$$MC_{TS}^{4} = \phi - \theta(Q_{TS}^{4} + Q_{FS}^{4})$$
$$MC_{TF}^{4} = \phi - \theta(Q_{TF}^{4} + Q_{FS}^{4})$$

Each marginal cost function contains two types of outputs. This means that the connecting-flight-passengers who move between F-S by Firm 4 squeeze into Firm 4's flights at T-F and T-S, since Firm 4 does not fly direct flights for F-S. As for these two marginal cost functions, the cost complementarities exist.

$$\frac{\partial MC_{TS}^{4}}{\partial Q_{FS}^{4}} = -\theta < 0 \quad \text{and} \quad \frac{\partial MC_{TF}^{4}}{\partial Q_{FS}^{4}} = -\theta < 0$$

The parameter constraint imposed on ϕ is the same as the benchmark case. The constraint on θ can be derived from the second order condition for the profit-maximization; the following two Hessian matrices (H^1 and H^4) should be negative-definite.

$$H^1 = \begin{pmatrix} \frac{\partial^2 \pi_{TS}^1}{\partial {Q_{TS}^1}^2} & \frac{\partial^2 \pi_{TS}^1}{\partial Q_{TS}^1 \partial Q_{TF}^1} & \frac{\partial^2 \pi_{TS}^1}{\partial Q_{TS}^1 \partial Q_{FS}^1} \\ \frac{\partial^2 \pi_{TS}^1}{\partial Q_{TF}^1 \partial Q_{TS}^1} & \frac{\partial^2 \pi_{TF}^1}{\partial {Q_{TF}^1}^2} & \frac{\partial^2 \pi_{TS}^1}{\partial Q_{TF}^1 \partial Q_{TS}^1} \\ \frac{\partial^2 \pi_{TS}^1}{\partial Q_{FS}^1 \partial Q_{TS}^1} & \frac{\partial^2 \pi_{TS}^1}{\partial Q_{FS}^1 \partial Q_{TF}^1} & \frac{\partial^2 \pi_{FS}^1}{\partial {Q_{FS}^1}^2} \end{pmatrix}$$

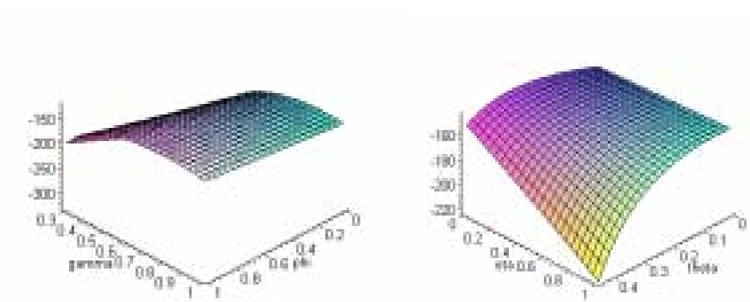
$$H^4 = \begin{pmatrix} \frac{\partial^2 \pi_{TS}^4}{\partial {Q_{TS}^4}^2} & \frac{\partial^2 \pi_{TS}^4}{\partial Q_{TS}^4 \partial Q_{TF}^4} & \frac{\partial^2 \pi_{TS}^4}{\partial Q_{TS}^4 \partial Q_{FS}^4} \\ \frac{\partial^2 \pi_{TS}^4}{\partial Q_{TF}^4 \partial Q_{TS}^4} & \frac{\partial^2 \pi_{TF}^4}{\partial {Q_{TF}^4}^2} & \frac{\partial^2 \pi_{TS}^4}{\partial Q_{TF}^4 \partial Q_{FS}^4} \\ \frac{\partial^2 \pi_{TS}^4}{\partial Q_{FS}^4 \partial Q_{TS}^4} & \frac{\partial^2 \pi_{TS}^4}{\partial Q_{FS}^2 \partial Q_{TF}^2} & \frac{\partial^2 \pi_{FS}^4}{\partial {Q_{FS}^2}^2} \end{pmatrix}$$

In addition, we need to check the condition that the prices and outputs for any airline should be non-negative. After θ meets all the conditions above, it takes the following range: $0 < \theta < 0.44475$.

The Bertrand-Nash prices and outputs can be derived from solving six equations, each of which is the first order condition which is derived by differentiating the profit function of each route with regard to price. Once we obtain the Bertrand-Nash prices and outputs, we can calculate the profits (AP), the consumer's surplus, and the social welfare (ASW) under the Bertrand-Nash equilibrium. Finally, we will compare BP and BSW with AP and ASW, respectively.

IV Comparative Analysis of Firms' Profits

This section analyses how the cooperation of the two small airlines affects the cooperating firm's profit and the rival's profit by comparing their pre-alliance and pre-alliance equilibrium-profits (namely, BP and AP). Up to this section, we have specified three parameters (α, γ, η) in the demand functions and two parameters (θ, ϕ) in the cost functions. Among these parameters, what are most affected by the cooperating behavior by the two small airlines are the degree of economies of density (θ), and the difference of the passenger's willingness to pay between the large and small firms (η): the demand for the cooperating firms will shift upwards due to the increase in the convenience of the connection at the hub airport. This implies that η will take a larger value in the post-alliance situation than in the pre-alliance situation. In addition, we can expect that the economies of scope will work more strongly for the cooperating firm in the post alliance situation than the pre-alliance situation: they can integrate the facilities and can save in operating costs by more efficient use of their fleets and human resources. Therefore, the cost difference (ϕ) will become larger in the post-alliance situation than in the pre-alliance situation. Other parameters (α_s, γ) may not drastically change between the pre-and post-alliance situations, so it is convenient to fix these parameters by giving them certain values, as long as we do not break the parameter constraints, or lose the generality. For example, considering the value of the intercept of the marginal cost function (=1), we have to set α'_s at about 3 and θ at about 0.2 so that the airlines can gain at least non-negative profits for the wide range of each parameter. What if we set $\alpha_2 = \alpha_3 = \alpha_4 = 3$? In this case, α_1 should be more than 11.4 in order for the profit of Firm1 to be positive. Considering the fact that the group of Japanese large airlines gains positive profits (but not super-normal profits), the appropriate value of α_1 will be about 13. Since the passenger's willingness to pay for the connecting flights ought to be smaller than for the direct flights, the value of η will be much smaller than unity $(\eta = 0.5)$. Then we subtract Firm 1's profit in the Alliance Case (AP) from its benchmark profit (BP), and depict the figure which shows how the balance of Firm 1's profit (AP minus BP) changes according to the change in γ and ϕ. Figure 2-1 shows this, in which the vertical axis is the balance of Firm 1's profit, and the axes show the range that γ and ϕ can take. Figure 2-2 also shows the change in the balance of Firm 1' s profit (vertical axis) according to the change in the η (left axis) and θ (right axis). In the case of Figure 2, γ is set at 0.5 and ϕ at 0.8, with other parameters equal to the case presented in Figure 2-1.

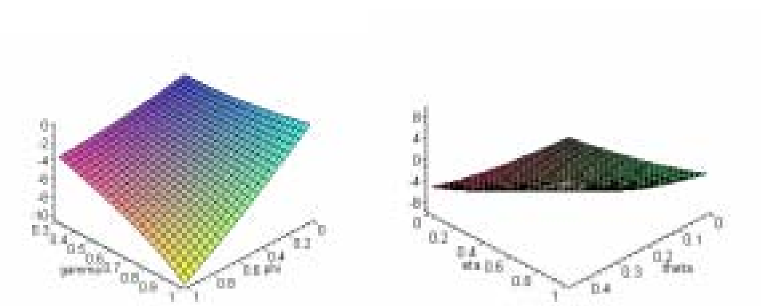


Figures 2-1 (left) and 2-2 (right): The relation between each parameter and the balance of Firm 1's profit and parameters

Looking at the vertical axes of these two pictures, the balance (AP-BP) is negative. This result does not come only from Firm 1's loss of monopolistic position at F-S. Figure 2-1 shows that though the dwarf airline lowers its cost via alliance, it does not necessarily affect its rival's balance of profit. However, if the dwarf airline promotes the product differentiation offered by the alliance, it will worsen its rival's financial condition.

Figure 2-2 shows that if the allied dwarf airline achieves and promote the seamlessness at hub T, and strengthens the degree of economies of density, it will also worsen its rival's financial condition.

Figures 3-1 and 3-2 show the case for the dwarf airlines with the definitions of parameters and axes unchanged to that in Figures 2-1 and 2-2.

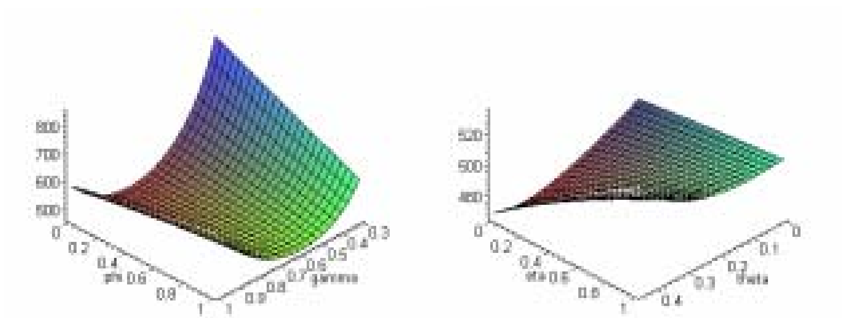


Figures 3-1 (left) and 3-2 (right): The relation between each parameter and the balance of Firm 4's profit

Whether the dwarf airlines can increase their profit in the post alliance situation depends on each parameter's change by alliance, which is different from Firm 1's case. The promotion of product differentiation, cost reduction, seamlessnes at hub T, and the economies of density will increase the balance of pre-and post-alliance profit. If the dwarf airlines can achieve all of them at a time by the alliance, then their alliance would benefit them, but if even one of them is lacking, there is the possibility that the alliance would be harmed.

V The Change of Social Welfare in the Pre- and Post- Alliance Situation

Finally, we will examine how the social welfare would change if two dwarf airlines cooperated. Both Figures 4-1 and 4-2 have the same horizontal axes as the figures in Section IV, but they have “the balance of social welfare (ASW minus BSW)” in the vertical axes.



Figures 4-1 (left) and 4-2 (light): The relation between parameters and the balance of social welfare

The most important thing is that both figures show that the social welfare would be improved by the dwarf airlines’ alliance for any possible range of each parameter. However, the shape of the graphic looks very complex compared with those in the last section. The dwarf airlines' cost reduction relative to the large airlines (i.e., smaller ϕ) has a positive effect on social welfare when their product differentiation is strong (i.e., smaller γ), but could have a negative effect when their product differentiation is weak. Similar phenomena are observed for the promotion of seamlessness at hub T (i.e., larger η) and the economies of density (i.e., larger θ). The larger η due to the alliance improves (worsens) the social welfare when the economies of density are strong (weak), and the larger θ due to the alliance improves (worsens) the social welfare when the connection at T is very smooth (inconvenient)[7]. The parameter of product differentiation (γ) shows a different trend in comparison with the other three parameters. When the dwarf airlines' costs do not necessarily differ from the large airlines', the extreme values of gamma (i.e., when the product differentiation is highly achieved or not achieved at all) improves the social welfare. When the dwarf airlines' costs do differ from the large airlines', this phenomenon holds, but substantial improvement is expected by far when the cost difference is large.

VI Conclusion

[7] Since we assume that the economies of density are the same between the group of large airlines and small airlines, the increase in the economies of density in the post alliance situation means that the total amount of traffic in the network increases due to the alliance by the two dwarf airlines.

This paper analyses, through theoretical models and their simulations, how airlines' profits and the social welfare will change if the dwarf airlines form an alliance and jointly compete with the Gulliver airline instead of independently competing in a three-point hub and spoke system. We presupposed that four parameters - the economies of traffic density in the network, the seamlessness at the hub airport, the product differentiation, and the economies of scope – would improve more in the post-alliance situation than in the pre-alliance situation. If these four assumptions are true, the dwarf airlines' post-alliance profit will become larger than their pre-alliance profit, as these four parameters become larger. However, the profit of the Gulliver airlines will presumably be smaller in the dwarves' post-alliance situation than their profit in the pre-alliance situation.

In terms of social welfare, the result is complex since the producer's surpluses of Gulliver and dwarves will change in a different direction in the post-alliance situation, so the effect of the dwarves' alliance would be offset. As long as the dwarf airline's alliance leads to the simultaneous achievement of strong economies of density, thorough product differentiation, seamlessness and cost reduction, the social welfare would presumably be improved.

The implication for public policy is that the government can admit the dwarf airline's alliance as long as the alliance meets the four conditions - strong economies of density, thorough product differentiation, seamlessness and cost reduction via economies of scope. The dwarves' alliance will create the counter market-power against the Gulliver.

However, this newly powered firm should not be a copy of the Gulliver incumbent. It is proposed that the asymmetric factors (cost difference and product differentiation) be maintained in the post alliance situation; otherwise, it is not possible to tell whether or not the dwarves' alliance would improve the social welfare.

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Discussion Paper

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