Analysis of Relationship among Airport, Airline, and Destination Management Organization (DMO)

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Abstract

Recently more and more regions have formed third party tourism promotion organizations, most notably Destination Management Organizations (DMOs). Such DMOs are aggressively performing promotional business, like advertisement campaigning and attractions/events in and around airports in addition to marketing or data analyses. That kind of third-party promotions could have major impact on air transport side. We try to include such DMOs into the airport and airline vertical relationships and to analyze the impact of such promotional activities. By using the model of revenue sharing under uncertainty, an airport is sharing revenue with two airlines, which are competing with each other, and also sharing revenue with DMO. We show that if DMO and airport both seek welfare maximization and coordinate with each other perfectly, then airport could fully share its revenue with DMO to enlarge the demand, as long as the revenue sharing has positive demand boosting effects, thus attaining the optimal welfare level. On the other hand, both DMO and airport are seeking profit maximization and bargain with each other about share level, the resulting share could be more diverse or evenly divided among the three, and welfare level would always be reduced significantly from the welfare maximization case based on numerical illustrations.

Keywords:
Airport Airline vertical relationship, Revenue Sharing, Destination Management Organization, DMO
JEL classifications:
C70, L14, L83, L88, L93, Z30, Z38

1. Introduction

Recently more and more regions have formed third party tourism promotion organizations. Such third-party promotions come in various forms. Sometime the national government directly intervenes and makes financial support to boost the local travel demand. Many local government (prefecture, cities/counties/town or others) are also devoting many resources in trying to attract many tourists, business or leisure, by such means as, inviting air routes, calling on cruise ship visits, and attempting various local area promotion campaigns.

Among such various activities, newly developing is setting up the specialized intermediate organization, such as Destination Management Organizations, DMOs. DMOs are aggressively performing promotional business, like advertisement campaigning and attractions/events in and around airports in addition to marketing or data-collection/analyses. That kind of third-party promotions could have major impact on air transport side.

The relationship among DMO, airport and airline is complicated and very interesting for economic analyses, since the relationship reflects conflicting/zero-sum game setting on one hand. For example, airport could charge DMO's local tour promotional booth in the airport as well as charging landing fees on airline. But on the other hand, DMO, airport and airline are among the member to collaboratively promote and increase the demand for the air routes to the airport and the surrounding local tourist destinations. These complicated aspects involving the three could be quite interesting area for micro-economic researches. To the best of our knowledge, there are very limited attempts to investigate the potential rich relationships.

Also, in the case of Japan, which have enjoyed six consecutive years of double-digit growth of international tourist arrivals (UNWTO 2018), a lot of DMOs are being set up with the technological and financial support of national and local governments. The effects of forming and participating in the airport and airline relationship could be very much relevant for the economic research.

Here we try to include such DMOs into the airport and airline vertical relationships and to analyze the impact of such promotional activities.

2. Literature Review

There are limited number of analyses of the three-party analyses, namely the analyses of tourism promotion organization, airport and airline. Tigu and Stoenescu (2017) performed conceptual and case-study analyses of the relationship focusing on transit or stopovers. Gomez-Lobo and Gonzalez (2008) surveyed the examples of using airport charges for funding general expenditures, including tourism promotion, and found that such financing could increase travel costs and adverse effect on tourism/passenger demand. Nagahawatte and O'Connell (2016) investigate Sri Lanka markets by surveying passengers for Sri Lankan airline and users of local hotels for key aspects for improvement challenges. Micro-economic analyses about the relationship among DMO, airport and airline are, to the best of our knowledge, not conducted so far.

An excellent survey of industry practice and review of recent studies in the airport and airline relationship was undertaken by Fu and Yang (2017). They show numerous interesting examples of the airport and airline arrangements for various purposes. The examples of the purposes of vertical arrangements range from increasing passenger demand, trying to internalize commercial externality, reducing airports' investment risks, enhancing service qualities, or simply responding to other airport-airline chains. They also point out that an exclusive arrangement can lead to collusive/anti-competitive natures, depending also on contract type, market structure, and bargaining power of the parties. In sum, past research reveals the conditions that support vertical arrangements and the potential for welfare enhancements that can arise from such arrangements.

In the tourism field, there are very limited analysis about the arrangement among DMO, airport and airline. Lohmann & Vianna (2016) argues about the aviation sector and non-aviation sector engagement conceptually. Numerical analysis, especially using revenue sharing, cannot be found to our best effort.

3. Model

We consider a situation where an airport and a DMO are cooperating with each other to promote tourist demand to the local area, and the airport is served by two airlines at the airport[1]. DMO is set up by the local government, local businesses, local communities and other individuals. For the sake of tractability, we assume DMO can be thought of representative organization by virtually combining the activities of local governments, local community and numerous/various local businesses, like small shops along the town streets. This kind of representative structure is illustrated in Figure 1 below.

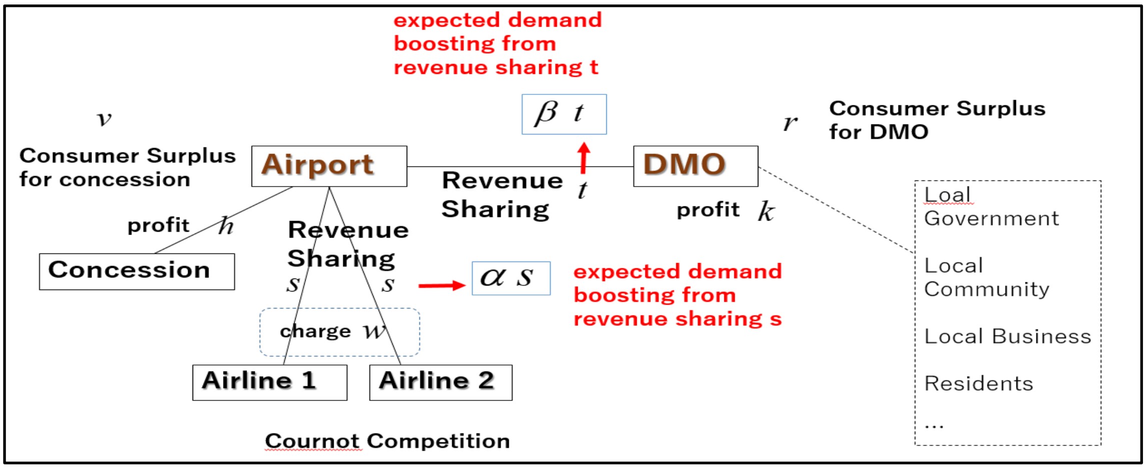

Figure 1 Revenue Sharing Relationships

[Three Stages]

1st Airport and DMO make a revenue sharing contract (possibly, bargain) to promote tourism demand using the airport and air routes

2nd Airport and two airlines arrange revenue sharing of airport's revenue

[1] We set the base of our model about a monopoly airport and two competing airlines with probabilistic linear demand function on the model of Xaio et al. (2016). Their case is not, however, involve any outside tourism promotion.

3^{rd} Two airlines compete with each other with Cournot best response mechanism.

To an inverse demand function is added with uncertainty, represented by ε, which is assumed to follow normal distribution[2], N(μ, σ²). ($\mu \geqq 0$, $\sigma > 0$)

$$P = X - bQ + \varepsilon \ , \quad \varepsilon \sim N(\mu + \ell + d, \sigma^2) \ , \quad Q = q_1 + q_2 \ , \quad \ell = \alpha s \ , \quad 0 < \alpha \ , \quad 0 \le s \le \frac{1}{2} \ ,$$

$$d = \beta t \, , \ 0 < \beta \, , \ 0 \le t \le 1$$

α and β can be seen as expected demand boosting parameter to constitute the increase (ℓ and d) of expected demand from revenue sharing, which are indicated by revenue share parameter, s and t respectively.

So, with these assumptions, we get the new settings for inverse demand function as following.
Social Welfare SW is defined as,

$$SW(w,\ s,\ t) = \int_0^Q p(y,x)dy - PQ + (v+r)Q + \{p - c - w + 2s(w+h)\}Q + (1-2s-t)(w+h)Q + \{k + t(w+h)\}Q$$

3.1 Perfectly Coordinated Social Welfare Maximization Case

If airport and DMO, both being social welfare maximizers, are perfectly coordinated for maximizing Social Welfare by setting airport charge w, and sharing rules s and t simultaneously, then this means the following maximization problem.

$$SW(Q^*(s,t,w)) = -\frac{b}{2}\{\frac{2}{3b}\{x+\mu-c-w+(w+h+\alpha)s+\beta t\}\}^2 + (x+\mu+v+r+h+k-c+\alpha s+\beta t)\{\frac{2}{3b}\{x+\mu-c-w+(w+h+\alpha)s+\beta t\}\}$$

We assume and $0 \le Q^*$ and $0 \le SW*$.

<u>Proposition 3.1 (about t)</u>

As long as the demand boosting effect exists ($0 < \beta$) in the revenue sharing between airport and DMO, the SW is maximized when t=1, which indicates airport fully shares its revenue with DMO.

<u>Proposition 3.2 (about w)</u> SW is maximized at unique point of w^*, which is indicated as follows.

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2 In the case of Xaio et al. (2016), the uncertainty is modelled by uniform distribution function. Here we choose normal distribution, since demand boosting effect is easily modelled by normal distribution.

$$w^* = \arg\max SW(s,w,t) = \frac{1}{2(1-s)}\{2hs - (x+\mu - c + \alpha s + \beta t) - 3(v+r+h+k)\} \qquad (45)$$

<u>**Proposition 3.3 (about s)**</u>

a) $s^* = 1/2$,

if for w, we have $(-h-\alpha \le w \le -h+3\alpha)$ and $(w \le w_2$ or $w_1 \le w)$ **, then always** $s^* = 1/2$.

b) $s^* = 0$,

if for w, we have, $(-h-\alpha \le w \le -h+3\alpha)$ and $(w_2 \le w \le w_1)$ **under the condition of** $D \ge 0$.

c)

$$\begin{aligned} s^* &= (3/2)(1/w+h-2\alpha)(x+\mu+v+r+h+k-c+\beta t) \\ &\quad -(1/2)[\{2(w+h)-\alpha\}(x+\mu-c-w+\beta t)/(w+h+\alpha)(w+h-\alpha)] \end{aligned}$$

if for w, we have, $w < -h-\alpha$ or $-h+3\alpha < w$.

Summarizing Proposition 3.1 ～ proposition 3, we have the results for welfare maximization values for perfectly coordinated case between airport and DMO in the following Table 1.

Table 1 Optimal Values for Parameters

Parameter	Range	s^*	w	w^*	t^*
s	$0 \le s \le 1/2$	$s^* = 1/2$	$(-h-\alpha \le w \le -h+3\alpha)$ and $(w \le w_2$ or $w_1 \le w)$		
		$s^* = 0$	$(-h-\alpha \le w \le -h+3\alpha)$ and $(w_2 \le w \le w_1)$		
		$s^* = (3/2)(1/w+h-2\alpha)(x+\mu+v+r+h+k-c+\beta t)$ $-(1/2)[\{2(w+h)-\alpha\}(x+\mu-c-w+\beta t)/(w+h+\alpha)(w+h-\alpha)]$	$w < -h-\alpha$ or $-h+3\alpha < w$		
w	$\underline{w} \le w \le \bar{w}$	$w^* = \frac{1}{2(1-s)}\{2hs-(x+\mu-c+\alpha s+\beta t)-3(v+r+h+k-e)\}$			
t	$0 \le t \le 1$	$t^* = 1$			

3.2 Nash Bargaining Case with numerical illustration

For the sake of mathematical tractability, we assume the relatively simple situation. It is then assumed that local monopoly airport has all the bargaining power with the airline. So, the airport maximizes its profit with respect to not only airport charge w but also revenue sharing level s. this is to avoid the Nash bargaining situation between airport and airlines. So, monopoly airport with all the bargaining power decides airport charge w and sharing level s by maximizing its profit by choosing w and s. Then the s and w depend on (function of t).

Nash Product for Nash bargaining between airport and DMO is defined as follows.

$$NP(t) = [\pi_{AP}(t) - \pi_{AP}(0)][\pi_{DMO}(t) - \pi_{DMO}(0)]$$

We set the parameters as follows;

b=0.75; x=-0.03; μ=-0.02; c=0.01; h=0.01; α=1; β=0.01; v=0.02; r=0.03;

k=0.

By using these parameters, we calculate the Nash Product in (62) and numerically solve the maximization problem to get $t^{NB} = \arg\max_t NP(t)$

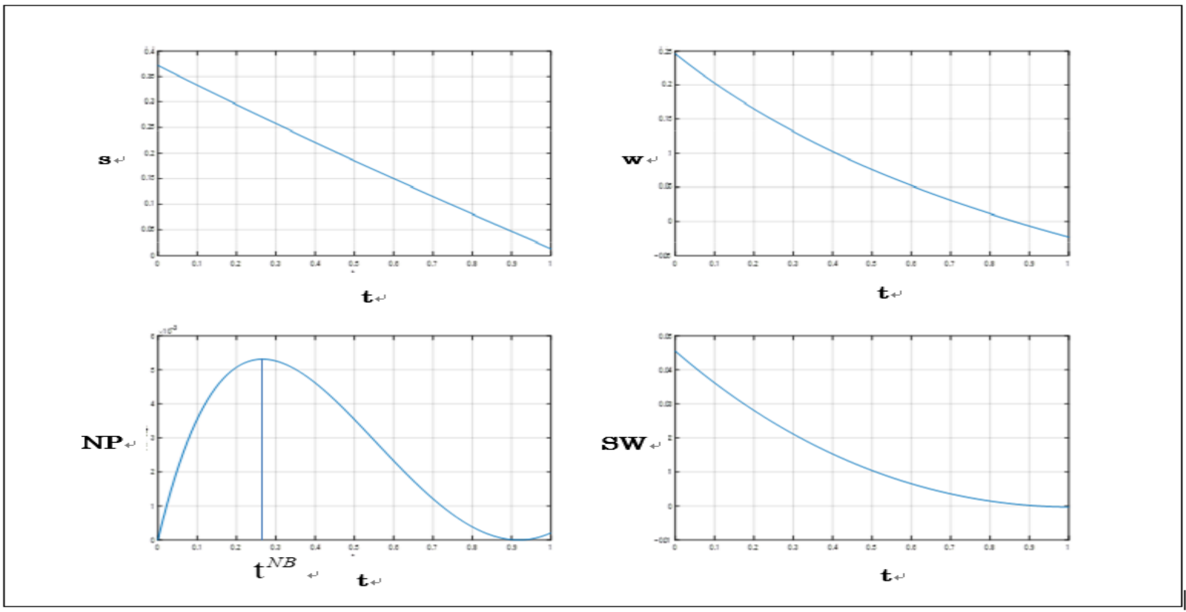

Figure 2 Nash Bargaining Solution Example

4. Concluding Remarks

Here, we try to include such DMOs into the airport and airline vertical relationships and to analyze the impact of such promotional activities. By using the model of revenue sharing under uncertainty, an airport is sharing revenue with two airlines, which are Cournot-competing with each other, and also sharing revenue with DMO.

We show that if DMO and airport both seek welfare maximization and coordinate with each other perfectly, then airport fully shares its revenue with DMO to increase demand, as long as the revenue sharing has positive demand boosting effects, thus attaining the optimal welfare level.

On the other hand, both DMO and airport are seeking profit maximizations and bargain with each other about share level, the resulting share could be more diverse, evenly divided among the three and welfare level could be reduced significantly from the welfare maximization case, based on numerical illustrations.

The one next step could be to extend our setting into more fragmented / decentralized one, such as all three (DMO, airport, and airlines) being bargaining with one another for sharing levels.

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