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Mutual influence across routes using a common airport: The case of the domestic market in Japan

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ABSTRACT

This paper empirically investigates the mutual influence of traffic volumes across routes serving the same airport. Regression analysis using the data on Japan's domestic air transport market reveals that an increase in passengers on a given route has a positive effect on the number of passengers on other routes that share an endpoint airport with the given route. This result implies that a change in policy for an airport is likely to influence routes that do *not* serve that airport as well as the routes that do.

1. Introduction

National and local governments implement various airport policies, such as airport pricing to deal with flight delays at a congested airport and subsidies to stimulate demand for a local airport. While these policies may resolve the problems faced by a given airport through affecting market outcomes on the routes serving the airport, they may also influence the other routes on an airline network which do not serve that airport. For example, a reduction in landing fees at Haneda Airport is likely to increase traffic volumes on routes to or from the airport—for example, the route between it and New Chitose Airport, thereby increasing the number of users of New Chitose Airport. This may accordingly affect traffic volumes on other routes serving New Chitose Airport—for example, the New Chitose–Fukuoka route—if an increase in an airport's users affects the routes serving the airport through, for example, economies of scale and airport congestion.

This paper empirically investigates whether an increase in the number of passengers on a given route has a positive or negative effect on the number of passengers on other routes serving one of the endpoint airports of the given route. This paper estimates a simple regression model using the data on Japan's domestic air transport market. The estimation results reveal that the number of passengers on a route positively affects the number of passengers on other routes using the same airport. It is therefore suggested that a change in policy for an airport which increases the traffic on routes serving the airport also increases traffic on other routes which do not serve the airport because of the following reason. The policy change first increases the traffic on routes serving the airport. Each route has two endpoint airports, so the increase in passengers on a route serving the given airport positively influences traffic volumes on routes serving the other endpoint airport of the route which do not serving the given airport.

This article also provides some information about the source of the positive influence across routes using the same airport. One might think that the influence can be explained by a change in the number of transit passengers. However, the result is robust to restricting the sample to airports where almost all passengers are non-transit passengers. That is, the positive influence across routes exists even at airports where transit usage is very rare. Hence, there might be other sources of positive influence apart from a change in the number of transit passengers.

In the literature on airport policy, such as airport pricing (e.g., Basso, 2008; Brueckner, 2002; Zhang and Zhang, 2003) and subsidy (Barbot, 2006), the focus tends to be on the effect of an airport policy on the routes serving the airport. The policy's influence on other routes which do not serve the airport is usually abstracted from the model in order to make the model simple and to obtain clear conclusions.

Previous studies on airline networks, however, point out that airline routes do not exist independently and that routes which share an airport as an endpoint affect each other. A demand or

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supply shock on a route may spill over to other routes serving the same airport through, for example, economies of traffic density (Brueckner and Spiller, 1994; Caves et al., 1984), 'demand side network effects' regarding departure times (Encaoua et al., 1996) or flight frequencies (Brueckner, 2004; Kawasaki, 2008), and airport congestion (Mayer and Sinai, 2003). These examples include both the positive and negative effects that an increase in traffic on a route has on the traffic volumes on routes serving the same airport. This paper estimates a net effect based on a simple empirical model and finds a significantly positive net effect. This result suggests that a policy change for an airport which increases the number of passengers on routes serving the airport has positive influences on the number of passengers on other routes which do not serve the airport.

The remainder of this paper is organized as follows. Section 2 explains the data used in the following analysis. It first describes the characteristics of Japan's domestic air transport market and then conducts a preliminary analysis using these characteristics. Section 3 introduces a regression model and the method for estimating it. Section 4 describes the estimation results and discusses several robustness checks. Section 5 provides some concluding remarks.

2. Data

This section introduces the data used in the following analyses and explains the characteristics of Japan's domestic air transport market. This section then conducts a descriptive analysis prior to the regression analysis in Section 3. The results of the preliminary analysis support the hypothesis that an increase in traffic on a route increases traffic on other routes to or from one of the endpoint airports of the given route.

This study employs the publicly available data on Japan's domestic air transport market from the Annual Report on Air Transport Statistics (*Koku Yuso Tokei Nempo*; in Japanese). The annual report provides the monthly data for the number of passengers on each route, where a route is defined as a pair of airports and is not distinguished by the direction of transport. The monthly data are aggregated to yearly because the data on populations and incomes, which are introduced below, are yearly. Although the annual report provides the data on an airline–route basis until 2010, it provides only data aggregated on a route basis for 2011 and onward. Hence, the following analysis is based on the data aggregated on a route basis. The data period is from 2000 to 2012. The analysis uses the data after 2000 because the deregulation of Japan's domestic air transport market was completed in 2000 and the market structure before deregulation was likely different from that after it.

Table 1 shows the summary statistics of the dataset. Panel A is for the full sample and presents statistics for four variables: the number of passengers on route r in year t (Q_{rt}); the total number of passengers on routes to or from the endpoint airports of route r, excluding route r itself (Qot_{rt}); the geometric mean of the populations of the prefectures where the endpoint airports of route r are located (POP_{rt}); the geometric mean of the per-capita incomes of those prefectures (INC_{rt}). The data on population are obtained from the Population Estimates of the Statistics Bureau of the Ministry of Internal Affairs and Communications of Japan. The data on per-capita income are from the Annual Report on Prefectural Accounts published by the Cabinet Office of Japan, which has thus far published the data through 2010. The values of per-capita income are deflated by the overall CPI index to constant 2010 JPY.

Unique aspects of Japan's domestic air transport market are that the number of routes serving Haneda Airport covers a large part of the total number of routes of the market and that traffic volumes on routes serving Haneda Airport are on average much larger than those on other routes. These characteristics are shown by Panels B and C in Table 1, which present the summary statistics for the subsample with the routes serving Haneda Airport and those for the subsample with the other routes, respectively. The subsample with routes serving Haneda Airport comprises about 17 per cent of the whole sample. The average number of annual passengers for routes serving Haneda Airport is about 1.2 million, which is more than eight times the average for the other routes. This may be partly because of the large values for population and income for routes serving Haneda Airport.

In the rest of this section, we conduct a preliminary analysis to investigate the hypothesis that the number of passengers on a route is influenced by the number of passengers on other routes which share an endpoint airport with the route. The preliminary analysis uses a characteristic of Japan's domestic air transport market: routes serving Haneda Airport are, on average, much larger than other routes. If the hypothesis is correct, the routes from or to an airport which is directly connected to Haneda Airport are influenced by the large number of passengers on the route between that airport and Haneda Airport. Hence, we further divide the subsample of routes that do not serve Haneda Airport, whose summary statistics are shown in Panel C of Table 1, into three groups: routes with both endpoint airports directly connected to Haneda Airport, routes with one endpoint airport connected to it, and routes with neither endpoint is connected to it. We then compare the means of the numbers of passengers in the three groups.

Table 2 shows the results of the preliminary analysis. Column 2-1 presents the means for the subsample of routes with both endpoints directly connected to Haneda. The subsample includes, for

Table 1
Summary statistics.

Variables	Unit	Observations	Mean	Std. dev.	Min	Median	Max
A: All routes							
Q_{rt}	1000 passengers	3641	325	907	0.01	66	9692
Qot_{rt}	1000 passengers	3641	18,567	18,957	5	13,905	68,005
POP_{rt}	1000 residents	3641	4039	2649	707	3298	13,230
INC_{rt}	1000 JPY	3175	2810	577	1950	2661	5180
B: Routes serving Haneda Airport							
Q_{rt}		627	1196	1884	0.03	574	9692
Qot_{rt}		627	57,614	3236	48,973	58,245	68,005
POP_{rt}		627	5772	2756	2719	4300	13,230
INC_{rt}		527	3526	371	2938	3478	5180
C: The other routes							
Q_{rt}		3014	144	259	0.01	51	1934
Qot_{rt}		3014	10,444	6978	5	10,706	33,224
POP_{rt}		3014	3679	2478	707	3074	13,230
INC_{rt}		2648	2668	500	1950	2608	5180